The effects of practice teaching sessions in second life on the change in pre-service teachers’ teaching efficacy

Donguk Cheong*

Department of Education, The First College, Korea National University of Education, 441 Immun-gwan 7 Darak-ri Cheongwon-gun, Chungbuk 363-791, Republic of Korea

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A B S T R A C T

The purpose of this research was to investigate the effect of practice teaching in Second Life on the change of preservice teachers’ teaching efficacy, and the difference of changes between individual teaching practice and collaborative teaching practice in their teaching efficacy. Participants were placed into the individual teaching practice or collaborative teaching practice group as a part of a teaching methods and educational technology course. Both groups completed practice teaching sessions twice in Second Life and an instrument adopted for measuring of pre-service teachers’ teaching efficacy beliefs was administered after each of three stages. The researcher collected data from both groups before the first practice teaching, after the first practice teaching session, and after the second session. Results from a Repeated Measure ANOVA indicated that the practice sessions influenced changes in participants’ personal teaching efficacy but not teaching outcome expectancy. In addition, the results indicated significant difference between groups on their personal teaching efficacy after the second practice session, but not on teaching outcome expectancy. The difference between the two groups is attributed to the different methods in preparing for the practice session, practicing the teaching, and the reflection methods posed to each group of participants. This research suggests that pre-service teachers can gain valuable teaching practice in Second Life, and furthermore that collaborative practice teaching is more effective way than individual approaches to practicing teaching.

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1. Introduction

The characteristics of virtual worlds bring changes and new possibilities to educators’ learning environments. The changes and possibilities enable various approaches in pre-service teacher education methods as well as K-12 education and when combined with research on self-efficacy can be used to improve the effect of teaching and learning. Self-efficacy has been defined by Bandura as the “beliefs in one’s capacity to organize and execute the courses of action required to produce given attainments” (Bandura, 1997, p. 3). Self-efficacy is positively related to academic performance and academic persistence (Multon, Brown, & Lent, 1991). Teachers’ self-efficacy has been defined generally as a belief on their ability to influence students’ learning. Previous researchers have suggested that a teacher who has high level of teaching efficacy tends to spend more time at teaching (Riggs & Enochs, 1990), and the sense of self-efficacy is one of the variables highly correlated to student achievement (Ashton & Webb, 1986) and student motivation (Midgley, Feldlaufer, & Eccles, 1989).

Teaching experiences have the most powerful influence on the development of teachers’ sense of efficacy, and this teaching efficacy may be most malleable early in the process of learning to teach (Hoy & Spero, 2005). A teaching practicum is one way for pre-service teachers to have an opportunity to practice teaching (Mule, 2006). However, it is not always possible for pre-service teachers to have sufficient opportunities for practicing teaching prior to their work in a classroom setting. In addition, teaching practice sessions with students, though it does provide opportunities for pre-service teachers to improve their teaching abilities, exposes the students to untried teachers, which could raise an ethical concern. Unintended mistakes in practicing teaching may negatively impact to the students because in a classroom any undesirable behaviors or mistakes by pre-service teachers cannot simply be undone (Brown, 1999). Therefore, safe, easy and effective ways of increasing the amount of teaching practice for pre-service teachers are needed to develop their sense of efficacy about teaching.
Virtual worlds such as Second Life have unique characteristics to support the teaching practice. Users of the virtual worlds express their egos, characteristics, and identities through their avatars (Suler, 2002; Wood, Solomon, & Englis, 2005). As users interact in virtual worlds with others’ avatars they experience a feeling of ‘presence’ that simulates role play and connects them to the community of practice (Lin, Lin, & Huang, 2008; New Media Consortium & ELI, 2007). Dede (1995) pointed out that disinhibition, the fluidity of users’ identity, and mimesis were the main characteristics of virtual worlds, all of which can lead to possible benefits such as experimentation without real-world repercussions, and learning by doing. Pre-service teachers can use a variety of text- or voice-based communication methods in virtual spaces that can be constructed to resemble traditional classrooms. Through this technology, pre-service teachers can practice repeatedly their teaching skills without negative impact to students and also capture their performance to later engage in problem solving about and reflection upon their decisions and performance. However, much regarding the development and change of teaching efficacy during teaching practice in virtual worlds remains to be learned. One goal of this research was to examine the changes of pre-service teachers’ teaching efficacy during repeated teaching practice sessions in Second Life.

Virtual worlds can also facilitate social interaction in teaching and learning (De Lucia, Francese, Passero, & Tortora, 2009; Jamaludin, Chee, & Ho, 2009). Such interaction supports pre-service teachers’ practicing their teaching and constructing their practical knowledge of teaching (Eick & Dias, 2005) based on social context and collaboration. In the view of improving pre-service teachers’ teaching efficacy, the collaborative approach to practicing teaching (see Bullough, Young, Birrell, & Clark, 2003; Bullough et al., 2002; Eick & Dias, 2005; Jang, 2008) needs to be considered more importantly than the individual one because the four sources of self-efficacy identified by Bandura (1997) could perhaps be offered more effectively to the pre-service teachers in a collaborative environment. However, very little is known about the effect of collaborative teaching practice on the change of teaching efficacy. The second goal of the research was to examine the difference of changes between collaborative teaching practice and the individual teaching practice in pre-service teachers’ teaching efficacy during their teaching practice in Second Life.

2. The development of teaching efficacy

Efficacy beliefs, defined by Bandura, determine individuals’ initiation of behaviors, effort level and time spent in the face of obstacles, recovery from failures, and persistence in overcoming difficult situations (Bandura, 1977, 1997). According to Bandura (2006), “Perceived self-efficacy is a judgment of capability to execute a given type of performances; outcome expectations are judgment about the outcomes that are likely to flow from such performances (p. 309).” The perceived self-efficacy influences human functioning because it affects behaviors not only directly but also indirectly by impacting outcome expectations (Bandura, 2006). Teachers’ efficacy beliefs were defined as a “judgment of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated (Tschanne-Moran & Hoy, 2001, p. 783).” Thus, information affecting teaching efficacy is valuable knowledge for instructional design decisions in pre-service teacher education program.

According to Bandura (1997), individuals’ self-efficacy beliefs are constructed from four sources of information: enactive mastery experience, vicarious experience, verbal persuasion, and physiological and affective state. Mastery experience is especially influential among the four sources, and the efficacy is raised by successes and is reduced by failures (Bandura, 1997). Individuals perceive results of performances through interpreting it by themselves or by monitoring others’ reaction to them. The perceived results affect the individuals’ efficacy, which is then influential when the individuals participate in similar activities. In teacher education, actual teaching experiences are the most powerful mastery experiences that convince teachers about their teaching ability (Tschanne-Moran, Woolfolk Hoy, & Hoy, 1998). These successful and direct teaching experiences also influence pre-service teachers (Housego, 1992; Hoy & Woolfolk, 1990; Lee, 2002) and novice teachers (Mulholland & Wallace, 2001) in their efficacy development.

Vicarious experience, such as observing, enables individuals to model the observed objects’ successful performance and through mimesis improves their own performance (Bandura, 1997). In establishing pre-service teachers’ teaching efficacy, vicarious experience is important because they have limited opportunities to experience actual teaching. Observing others’ successful teaching could strengthen the pre-service teachers’ own efficacy, but observing poor teaching could weaken it. Once they are in their field placements pre-service teachers can observe their cooperating teacher’s teaching. But before these field experiences, pre-service teachers could build up their efficacy through vicarious experiences such as observing their instructors’ teaching or peers’ successful practice-teaching in courses.

Social persuasion, such as reasonable suggestions, can help individuals believe that they possess the capabilities to achieve what they want (Bandura, 1997). This belief comes from indirect experiences and is likely to activate more efforts, but is not as influential as direct experiences. For the development of pre-service teachers’ efficacy, social persuasion could offered to them in the form of encouragement, advice, feedback, and suggestions prior to the actual teaching by various sources such as course instructors, colleagues, or theories of teaching. These verbal forms of persuasion will lead pre-service teachers to greater efforts to enhance their teaching ability. It is through these connections to authentic and successful teaching experiences that social persuasion is most influential on teachers’ beliefs about their ability to teach.

The physiological and affective state of individuals, such as sweaty palms caused by emotional arousal, might be another constituent source for building one’s efficacy. According to Bandura (1997), individuals rely partly on their state of physiological arousal in judging their capabilities. Bandura (1997) believed that, because high arousal usually makes individuals’ mind weaker, individuals are more likely to expect success when they are not suffering from stressful conditions. Physiological state is a kind of direct experience and so it could be more powerful to their self-efficacy building. Pre-service teachers may have a tension or anxiety on their performance and affective state, and thus these high levels of stress may decrease pre-service teachers’ beliefs about their teaching (Lee, 2002). Therefore, teacher education programs need to scaffold pre-service teachers before their first authentic experiences of teaching practice.

Bryan and Atwater (2002) asserted that “A belief system is a structured group of beliefs with characteristics that distinguish it from knowledge systems (p. 824).” Beliefs could influence in individual’s problem solving process and actual behaviors than knowledge (Nespor, 1987). Thus, mental efforts are needed to change previous beliefs because beliefs are not easy to be changed (Bryan & Atwater, 2002). In the pre-service teacher education program, attending lectures about teaching and learning, practicum teaching experiences in classes, and student teaching in the field should be connected successively so that they build a teacher’s self-efficacy. Practicum teaching experiences provide direct experiences that, according to Rokeach (1968), modify one’s underived beliefs, which have an on-going effect on other beliefs.
and behaviors. On the other hand, derived beliefs are changed through indirect experiences such as taking lectures; derived beliefs can be changed easier than underived beliefs because they relearned from other people; however, they are also not easily continued and connected to actual behaviors. Among the four sources of efficacy identified by Bandura (1997), mastery experience and physiological state could be classified in terms of direct experience and tied to Rokeach's concept of underived beliefs, and vicarious experience and social persuasion are a type of indirect experience and tied to derived beliefs. Teaching efficacy, a kind of belief, is malleable early in learning teaching (Hoy & Spero, 2005); therefore, practicum teaching experiences in a course, a kind of direct experience which could result in successful mastery experience, could be most influential on pre-service teachers' teaching efficacy if these opportunities to practice are well-designed and are connected to their taking lectures and later student teaching in the field.

3. Practice of teaching in virtual worlds

Education programs teaching novices to become more like experts should deal carefully with the participants with whom the novices interact while practicing their professional skills. Especially in medicine and/or education, trainees should be as prepared as possible for the practice experiences in order to inflict no harm on their human subjects, and these experiences should be carefully designed to be effective and efficient. In pre-service teacher education, students should not be used merely as a tool for pre-service teachers' practice of teaching because the students need to be well educated. Thus, the laboratory-based practicum experiences (see Gurvitch & Metzler, 2009) such as teaching practice gained using teaching simulation, peer teaching, and microteaching have long been used for pre-service teacher education, even though each has limitations. Recent advanced technology such as three dimensional (3D) virtual worlds also allows us new potential way of providing pre-service teachers with laboratory-based teaching practice sessions.

3.1. Teaching practice in second life

Second Life is one of the 3D spaces in which the users are represented by customizable virtual personas called "avatars" (Bowers, Ragas & Neely, 2009; Dedè, 1995). Users represent their identities and characteristics through re-shaping their avatars and interacting with other users' avatars (Suler, 2002; Wood et al., 2005). These avatars interact with one another through a variety of text and/or voice based communication methods, and build objects to live a second life in ways similar to their real life. In addition, Second Life differs from other media in how avatars' 'presence' offers users opportunities for remote collaborative interaction, role playing, and participation in virtual communities of practice (Lin et al., 2008; New Media Consortium & ELI, 2007).

The characteristics facilitating such a social interaction in virtual worlds rather different than face-to-face collaboration were explained by Dedè (1995) as disinhibition, the fluidity of users' identity, and mimesis. Inhibition of behaviors is usually caused by social conventions, and disinhibition means the absence of such inhibition on one's behaviors. The disinhibition of users in virtual worlds brings about differences in patterns of behavior and thinking as compared to real life. These differences were conceptualized into 'benign disinhibition' or 'toxic disinhibition' (see Suler, 2004). These differences then cause cognitive and emotional dissonances (Dedè, 1995). Individuals usually try to reduce these differences because dissonances cause discomfort. Thus, in teaching and learning, such dissonances would need to be shifted into positive educational outcome through instructional design. In addition, disinhibition could lead users to fluidity of their identity (Suler, 2002). That is, users can extend their identity in virtual worlds different from their identity in real world because they can do things they could not imagine they could do before, and then enhance their self-efficacy. On the other hand, as users customize their avatar and begin to identify with it, its success and attractive life in the virtual worlds could lead users to mimesis, a desire to imitate this in real life. Thus, these characteristics of virtual worlds not only allow users to experience immersive learning activities, remote collaborative interaction, role playing, and participation in virtual communities of practice, but do so in a ways that reduces real world risks, complications, costs and ineffectiveness, while adding unique opportunities to experience success with their avatar and potentially positively influence their identity in real life.

Bandura's (1997) sources of self-efficacy suggest another reason why practicing teaching in a virtual world such as Second Life could positively influence pre-service teachers' teaching efficacy. Because pre-service teachers perform their practice through avatars their behaviors may be disinhibited and more active, due to reducing the physiological state of tension or shyness they feel in the real world, and lead to a more successful mastery experience.

3.2. Collaboration during the practice of teaching

Collaboration can have a powerful impact on the learning process because of how it diminishes the cognitive load of learners (Kirschner, Paas, & Kirschner, 2009). It also extends individuals' views and knowledge and leads to reflective learning through the multiple reviews of others' views (Kang, 1995). An advantage of collaborative learning is to reflect individuals' view and location of thinking (Holt, 1994) as well as to establish consensus (Trimbur, 1989) in the differences from others' opinions.

In pre-service teachers' teaching practice in a team, collaboration can enhance friendship and facilitate lesson design and teaching practice (Jang, 2008), offer the opportunity for discussion about teaching (Bullough et al., 2003), build practical knowledge (Eick & Dias, 2005), and provide more educative field experience (Bullough et al., 2002). The characteristics facilitating social interaction in virtual worlds also facilitate the collaboration in a team during their teaching practice sessions in Second life. Observing peers' teaching practices and their own through the avatars in virtual classroom offers pre-service teachers opportunities for vicarious experiences. Peers' suggestion, feedback, advice and/or encouragement on pre-service teachers' teaching practice in the process of discussion provide social persuasion through reviewing peers' views and sharing their prior knowledge and experiences. On the other hand, these indirect experiences, such as vicarious experiences and/or verbal persuasion, gained through collaborative teaching practice could also negatively influence novices' teaching efficacy as individuals realized how they compared to their peers in terms of teaching knowledge and skill.

Gurvitch and Metzler (2009) found that initial teaching experiences in actual school settings were very challenging to novices and as a result negatively influenced their teaching efficacy. Gurvitch and Metzler (2009) argued that 'facing repeated challenges' in classroom
teaching experiences influences in the improvement of pre-service teachers' personal teaching efficacy. In Second Life, teaching practice in a team can be performed repeatedly and more easily than in real life because team members can meet together in virtual classroom at anytime and anywhere. In addition, they can easily record their practice teaching, and share the video clip with peers, and then review peers' teaching as well as their teaching. Review and discussion with peers about the practice teaching through video clips provides pre-service teachers not only chances for vicarious experiences and social persuasion, but also chances to reflect upon and then modify their lesson plan and performance.

Instructional design is critical so that collaborative practice teaching provides opportunities to gain successful mastery experiences and the direct and indirect components of such practice fosters pre-service teachers' desire to succeed in real life and positively influences their teaching efficacy. Applying Bandura's (1997) theory about the sources of self-efficacy suggests that teacher educators' instructional design using Second Life needs to include the process of collaboration, repeated practice of teaching, and reflection of the practice in order to improve pre-service teachers' teaching efficacy.

4. The measurement of pre-service teachers' teaching efficacy

Beliefs of personal efficacy and outcome expectation are the two sub-constructs within Bandura's concept of self-efficacy (Bandura, 1997). Although the constructs of teacher efficacy have been conceptualized in various ways, most instruments intended to measure efficacy typically have considered these two constructs.

Research on the measurement of teachers' teaching efficacy was started by Rand Corporation researchers (see Tschannen-Moran et al., 1998), which developed two items, Rand item 1: "When it comes right down to it, a teacher really can't do much because most of a student's motivation and performance depends on his or her home environment" (Armor et al., 1976, p. 73) and Rand item 2: "If I really try hard, I can get through to even the most difficult or unmotivated students" (Armor et al., 1976, p. 73). Efficacy measured by Rand item 1 have been labeled as a general teaching efficacy (GTE) since the item focused on teachers' beliefs about the power of external factors compared to the influence of teachers and schools. Efficacy measured by Rand item 2 has been labeled as a personal teaching efficacy (PTE) because the item focused on more specific and individual than a belief about what teachers in general can accomplish (Tschanen-Moran et al., 1998). Since then, research on teacher efficacy has developed more reliable instruments. Gibson and Dembo (1984) developed a broader and more reliable instrument to measure teacher efficacy based on Bandura's (1977) theoretical framework. The 30-item Teacher Efficacy Scale (TES) includes two main constructs consistent with the Rand items: GTE, similar to Bandura's outcome expectancy and PTE, similar to Bandura's personal efficacy.

Riggs and Enochs (1990) developed an instrument based on Gibson and Dembo's (1984) TES to measure in-service science teachers' teaching efficacy, called Science Teaching Efficacy Belief Instrument (STEBI-A). The instrument includes two constructs consistent with the TES: personal science teaching efficacy (PSTE) and science teaching outcome expectancy (STOE). The STEBI-A was focused on elementary in-service teachers' self-efficacy beliefs using 25 items on a 5-point Likert scale from strongly agree to strongly disagree. Enochs and Riggs (1990) developed the STEBI-B to measure pre-service science teachers' self-efficacy beliefs using 23 items (13 on the PSTE and 10 on the STOE) on a 5-point Likert scale. The STEBI-B was developed by modifying the verb tenses in the items of STEBI-A to reflect future teaching of pre-service teachers and dropping two original items of STOE from the STEBI-A. Enochs and Riggs (1990) reported a Cronbach alpha coefficient of .90 for the PSTE scale and .76 for the STOE scale. The subsequent instruments were developed based on STEBI-B in teaching chemistry (STEBICHEM, Rubeck & Enochs, 1991) and mathematics (MTEBI, Enochs, Smith, & Huinker, 2000) to measure pre-service teachers' self-efficacy and outcome expectancy in subject area.

Table 1

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture</th>
<th>Preparation phase</th>
<th>Practice phase</th>
<th>Reflection of practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Theories of teaching &amp; learning</td>
<td>Exercise of Second Life</td>
<td>Observation of a model teaching</td>
<td>Preparation of practice</td>
</tr>
<tr>
<td>2</td>
<td>Instructional media</td>
<td>Basic functions</td>
<td>Functions of interaction</td>
<td>Practice of teaching</td>
</tr>
<tr>
<td>3</td>
<td>Instructional design</td>
<td>Functions of communication</td>
<td>Functions of presentation</td>
<td>Reflection of practice</td>
</tr>
<tr>
<td>4</td>
<td>Virtual reality for education</td>
<td>1st observation</td>
<td>2nd observation</td>
<td>Design of teaching</td>
</tr>
<tr>
<td>11</td>
<td>Design of teaching</td>
<td>First practice</td>
<td>Second practice</td>
<td>First reflection</td>
</tr>
<tr>
<td>12</td>
<td>Practice of teaching</td>
<td></td>
<td></td>
<td>Second reflection</td>
</tr>
<tr>
<td>13</td>
<td>Reflection of practice</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 14   | | | |

Activities in the preparation phase and the practice phase by the weeks.
5. Method

5.1. Participants

The participants in this study were 110 pre-service teachers at a national university of education in Korea (Republic of). All participants were enrolled in one of the four sections of a ‘teaching methods and educational technology’ course, which is a two-credit required course that lasts 15 weeks. The course ran for 2 h once a week. The four sections of the course had 34, 28, 17, and 31 students enrolled, respectively. Of these 110 participants, 59 pre-service teachers in two sections of the course were randomly assigned into the ITP (Individual Teaching Practice) group and 51 pre-service teachers in the other two sections were assigned into the CTP (Collaborative Teaching Practice) group. The participants in each section were arranged into teaching practice teams, with 2–5 peers whose major was same in each team. There were 15 teams in ITP group and 16 teams in CTP group (see Tables 1 and 2).

During the course, 11 pre-service teachers left to student teach in the field for three weeks. Thus, final participants for data collection were 99 pre-service teachers, between the ages of 21 and 24 years, from four sections of the course, and 56 pre-service teachers were in ITP group and 43 pre-service teachers were in CTP group. These participants included 88 undergraduates in 5th or 6th semester and 11 graduates in 2nd or 3rd semester, 34 male and 65 female, and 62 elementary and 37 secondary pre-service teachers. All participants had no actual teaching experiences, but 63 of the undergraduate students had a peer teaching experience.

5.2. Design of the practice in second life

Two phases of teaching practice were scheduled throughout the course. Three activities were for preparation phase and two activities for actual practice phase were planned to complement the course’s topics and schedule. The preparation phase contained three activities as exercise of Second Life functions, observation of a model teaching, and preparation of practice. The practice phase contained two activities as practice of teaching and reflection of practice (Table 1). The instructor’s lecture proceeded according to the course schedule about theories of teaching & learning, instructional media, instructional design and practice, and virtual reality for education for 14 weeks. Activities such as exercise of Second Life functions, observation of a model teaching, preparation of teaching, and reflection of practice were performed as a part of or entire class period. The other activities were performed after the class meeting time, as homework.

5.2.1. Preparation phase

The main purpose of this phase was to allow pre-service teachers to prepare for the practice of teaching in Second Life. The exercise of Second Life functions activity was performed during each of the first eight weeks of the course, 30 min at a time, to allow pre-service teachers to become skilled in using Second Life. They were introduced to the Second Life web site and there practiced functions required for interaction, communication, and presentation after the instructor’s demonstration. After the class, they were also encouraged to join the educational groups, explore education-related places, and exercise the functions. The Exercise of Second Life functions activity was under the same conditions for both the ITP and CTP groups.

The observation of a model teaching activity was performed twice in the 7th and 8th week. The first observation was performed in a computer room, and the second was carried out wherever the student wanted. For this model teaching, the instructors prepared a virtual classroom with a projector screen and chairs and desks in Second Life. The instructors also converted presentation slides into images and

Table 2
Numbers of the practice sessions as a teacher and a peer by each team.

<table>
<thead>
<tr>
<th>N of team member</th>
<th>N of teams (ITP, CTP)</th>
<th>N of the practice as a teacher</th>
<th>N of the practice as a peer</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5 (2, 3)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>8 (5, 3)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>14 (8, 6)</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>4 (0, 4)</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

Fig. 1. Screen of a model teaching in second life.
uploaded them into the inventory in Second Life for the lecture. These facilities made it possible for pre-service teachers to listen to the instructor’s lecture while they were watching the texts on the screen in Second Life. The instructors’ model teaching was performed in a didactic mode, as shown in Fig. 1. In the first observation, pre-service teachers observed the teaching in two kinds of views: One view was the instructor’s view because they could see the instructor’s computer monitor through the projector screen in the computer room. The other view was the avatar’s view because they could see and listen to the lecture in Second Life through their PC monitor and headset. Through the instructor’s view, they could observe the usage of functions needed for teaching in Second Life. Through the avatar’s view of the lecture, they could observe how the instructor practices teaching skills. In the second observation, instructor and participants were not in the same physical location, but they were in the same virtual location in Second Life. The instructors recorded the teachings and e-mailed the video clips to participants who needed more practice in Second Life. In the next class following the second model teaching activity, the instructor explained the teaching skills he used and led discussions about the used them, especially emphasizing the reasons why the skills were used, the methods of how the strategies and skills were performed, and the opinions of the pre-service teachers about their experiences. This observation of a model teaching activity was also performed under the same conditions by the ITP and CTP groups.

The preparation of the practice activity had two purposes. One was to prepare a lesson plan and material, the other was to prepare teaching tools needed in Second Life. First, during the 5th and 6th week of the course, the instructor helped pre-service teachers prepare teaching tools needed for the practice. Within Second Life the instructor developed in advance 16 classrooms in a virtual school, each equipped with blackboard, teacher’s desk, desks and chairs, electric lights and switches, doors, windows and so on (Fig. 2). The instructor also delivered necessary virtual objects for teaching, such as desk and chair, and presentation facilities to each pre-service teacher’s avatar, so those avatars could locate the projector screen and desks and chairs at places appropriate for their instructional methods and teaching topics. Within their virtual classrooms the students practiced rezzing (i.e., dragging an object from an inventory to make it appear in Second Life), moving, and locating these objects. They also practiced different means of communication, such as local voice and text chats, instant messaging, and gestures for teaching; and different ways of presenting, such as transforming presentation slides to image files uploading these files into their inventory, and using the files with a presentation object; and different ways of interacting with peer avatars using those communicating and presenting means. Second, during the 7th and 8th weeks, the instructor guided pre-service teachers to prepare a lesson plan and material. The instructor grouped the participants into teams for the practice based on their majors and gave each pre-service teacher a homework assignment to design a didactic lesson. The topic of the lesson was selected freely by pre-service teachers in their various subject areas, but the practice of teaching skills such as motivation skill, questioning skill, communication skill, and reinforcement skill were strategies required to be included in the lessons. As part of the homework assignment, instructors asked pre-service teachers to create presentation slides and instructional materials for their practice in Second Life. All pre-service teachers used Google docs to create the lesson plan and presentation slides. The documents were shared with the instructor through the inviting function of Google docs, and then commented on by the instructor. This preparation of the practice was performed differently by the two CTP and ITP groups. Each team in the CTP group collaboratively planned one lesson and slide, but each pre-service teacher of ITP group created his or her own documents. Team members in a team within the CTP
group shared one lesson plan document and one slide document with their team members and co-wrote them together, in some similar way of Wikipedia because a document in Google docs had a history in which all changes saved by a date, time, and writers.

5.2.2. Practice phase

The first practice teaching session was performed in the Second Life virtual classroom (Fig. 3) during the 9th to 10th week of class. Each of team members logged in to Second Life from any convenient location, such as a dormitory, home, or a computer room. Each pre-service teacher practiced their teaching for about 20 min based on the designed lesson plan and also participated in their peers’ practice sessions. In their teaching they used the prepared objects, practiced ways of communication, presentation, and interaction, and planned teaching skills. During their participation as a student during their peers’ teaching practice, pre-service teachers could have vicarious experiences from observing peers’ teaching and comparing it to their own teaching and/or plan of lesson. The instructor observed every team’s practice teaching session and facilitated each team’s teaching whenever they asked for help through instant messages, local chatting, voice chatting, and telephone communication. At the end of the practice session, each pre-service teacher of the team was required to upload the recorded video clip into the YouTube.

The first reflection of the practice activity was performed in the 11th week of the course. Within each course section the instructor selected one video among uploaded videos to YouTube after the first practice teaching session in order to generate discussion about the teaching skills it used, and showed it to all of the pre-service teachers in that section. The pre-service teacher who did the practice was required to explain the reasons why the teaching skills were used, the methods how the strategies and skills were performed, and her or his impressions from the practice in Second Life. After the explanation, students asked questions and had a discussion about their own experiences in the practice activity. The process was akin to the one performed by the instructor in the observation of a model teaching activity. After the reflection class, all pre-service teachers were required to write a self reflection discussing the differences between the design and the practice, the pros and cons of their teaching, and their impression of their experiences as a teacher and a student. They posted the reports in the form of a ‘description’ of the video they uploaded to YouTube as homework. This first reflection of the practice was performed differently by the CTP and ITP groups. Each team of the CTP group was required to share videos with their team members and get feedback from them in the form of a ‘comment’ to their YouTube video. However, ITP group was not required to share their video with their team. For both the CTP and ITP group the instructor provided feedback for all pre-service teachers’ practices using the YouTube comment posting. Based upon the feedback they received the students were to modify the plan of the lessons and materials.

The second practice teaching session was performed in the 12th and 13th week as a homework assignment, similar to the way of the first practice teaching session. The second reflection of the practice was performed during the course’s 14th week in a way similar to the first reflection of the practice. The numbers of the teaching practice opportunities and the participations as a peer are shown in Table 2. A total of about 180 min were used for the Second Life function opportunities, four class hours were used for observing model teaching, and two class hours were used for reflections in the course. Time for preparation and practice of teaching could not be calculated accurately because the activities were performed as homework, but about 3 h for the preparation and 2 h for the practices as a teacher are estimated per each participant. Time spent practicing as a peer was not estimated because the numbers of team members were different as shown in Table 2.

5.3. Instrument

An instrument with a five-point Likert type scale ranging from “strongly agree” to “strongly disagree” was used to measure pre-service teachers’ teaching efficacy beliefs. The instrument had two subscales: Personal Teaching Efficacy (PTE), including 11 items, and Teaching Outcome Expectancy (TOE), including 10 items. The instrument was adapted from STEBI-B which was originally developed by Ennochs and Rigg’s (1990) to measure pre-service science teachers’ teaching efficacy beliefs. All items of STEBI-B were modified from science specific items to non-science specific items, and then translated into Korean. For example, an original science specific item, “I will continually find better ways to teach science,” was modified into a non-science specific item, “I will continually find better ways to teach my subject,” and then translated into Korean. Two items were deleted from the STEBI-B because the items focused only on the science experiment: “I will not be very effective in monitoring science experiments” and “I will find it difficult to explain to students why science experiments work.” To ensure the validity and reliability of the instrument, first an English teacher and a Korean language teacher reviewed the translated items; then 11 pre-service teachers, who were excluded from data collection because they went to the field for the student teaching for three weeks during the course, participated in the pilot study. Through the process of reviews and pilot study, items were revised and elaborated. The

| Table 3 | Reliability of TOE and PTE across three stages in the current sample. |
|---------|-----------------|-----------------|-----------------|
| Subscales | Item number (‘reverse scoring item’) | Stage | Cronbach-α |
| PTE (N - 11) | 2, 3, 5, 7, 11, 16, 17, 18, 19, 20, 21 | Stage 1 | .84 |
| | | Stage 2 | .86 |
| | | Stage 3 | .91 |
| TOE (n - 10) | 1, 4, 6, 8, 9, 10, 12, 13, 14, 15 | Stage 1 | .80 |
| | | Stage 2 | .83 |
| | | Stage 3 | .85 |

| Table 4 | Means and (SD) of TOE and PTE across three stages. |
|---------|-----------------|-----------------|-----------------|
| Measure | Stage 1 | Stage 2 | Stage 3 |
| TOE | 2.63 (.45) | 2.62 (.58) | 2.64 (.68) |
| PTE | 2.36 (.41) | 2.22 (.40) | 2.33 (.54) |
reliability coefficient in the current sample was calculated on the STE and TOE subscales at each stage (Table 3). The instrument also supplied participants’ demographic data such as gender, grade, major, peer teaching experience, actual teaching experience.

5.4. Data analysis

During the course the 99 participants completed administrations of the instrument three times. Data for this research were collected at the end of each of three stages. Stage 1 was set from the course initiation to just prior to the first observation of a model teaching and represents the preparation phase of the course. The remaining two stages were in the practice phase of the course: Stage 2 was started from the preparation of teaching and completed after the first practice teaching session. Stage 3 was set from the first reflection of the practice to the second practice teaching session.

A quasi-experimental design was used in this research with one independent variable with two levels (ITP and CTP) and one dependent variable (pre-service teachers’ teaching efficacy beliefs). The primary data analysis was a Repeated Measures Analysis of Variance (RM-ANOVA) made across the three administrations during each stages on both of the subscales: PTE and TOE. Based on the results of this RM-ANOVA, a follow-up analysis by Pairwise comparisons using Sidak was conducted to compare mean differences between adjacent stages.

The secondary data analysis was a 2 treatment (ITP, CTP)/C2/C3 stage (Stage 1, Stage 2, Stage 3) RM-ANOVA. Treatment was a between-subjects variable and stage was a within-subject variable. Based on the results of this RM-ANOVA, follow-up analyses by Sidak were conducted to compare mean differences between stages. The statistical significance level was set at $p < .05$ for these analyses.

6. Results

This research had two goals: The first was to examine the change of pre-service teachers’ teaching efficacy during their teaching practices in Second Life, and the second was to examine the difference of changes between ITP and CTP in their teaching efficacy. Results are reported by the two goals as follows.

6.1. Changes of pre-service teachers’ teaching efficacy

The mean scores and SDs of both the TOE and PTE across three stages are shown in Table 4, and the changes of TOE and PTE are shown in Figs. 4 and 5. The instrument used in this research used a 5-point Likert scale from strongly agree (5 point) to strongly disagree (1 point) so
that higher scores mean stronger efficacy. The results of the RM-ANOVA on TOE yielded no significant within-subjects effects ($F(2, 98) = .04$, $p = .948$). This means TOE was not changed across the three stages. The results of the RM-ANOVA on PTE yielded significant within-subjects effects ($F(2, 98) = 7.20$, $p = .002$); that is, PTE was changed significantly across the three stages.

Pairwise comparisons using Sidak were conducted to compare the mean differences of PTE between adjacent stages and Cohen’s $d$ was calculated to identify the effect size on the differences. As shown in Table 5, the mean scores of PTE went down significantly from Stage 1 to Stage 2, and went up significantly from Stage 2 to Stage 3. There was no significant difference between Stage 1 and Stage 3.

6.2. Differences of effects between ITP and CTP

To examine the differences of effects between the ITP and CTP groups, the mean scores and SDs of TOE and PTE were compared across three stages (Table 6, Figs. 6 and 7). To identify the statistical significance of the changes, an RM ANOVA was conducted for both TOE and PTE.

The results of $2 \times 3$ RM-ANOVA on TOE indicated no significant main effect for treatment ($F(1, 97) = .03$, $p = .860$) and stage ($F(2, 194) = .05$, $p = .945$). The RM-ANOVA on TOE also did not indicate a significant treatment by stage interaction ($F(2, 194) = .01$, $p = .990$).

The results of $2 \times 3$ RM-ANOVA on PTE yielded no significant main effect for treatment ($F(1, 97) = .45$, $p = .506$). However, the RM-ANOVA yielded a significant main effect for stage ($F(2, 194) = 8.02$, $p = .001$). In addition, the RM-ANOVA did indicate a significant treatment by stage interaction ($F(2, 194) = 3.80$, $p = .033$). Pairwise comparisons using Sidak were conducted to compare the mean differences of PTE between adjacent stages by group, and Cohen’s $d$ was calculated on the differences as well. As shown in Table 7, the mean scores of PTE from Stage 1 to Stage 2 significantly went down in both the ITP and CTP groups. The mean scores of PTE from Stage 2 to Stage 3 significantly went up in the CTP group, but not for the ITP group. There were no significant PTE differences between Stage 1 and Stage 3 in the both groups. This difference of changes between two groups indicates consistent results in the interaction between treatment and stage. In addition, higher effect size between stage 2 and stage 3 for the CTP group (Cohen’s $d = .47$), as shown in Table 7, as compared to the whole group (Cohen’s $d = .22$), as shown in Table 5, indicates that ITP group’s mean scores of PTE weakened the whole group’s effect size.

7. Discussion

One issue that came forth from the results is that participants’ TOE scores were not changed during the practice sessions, but their scores for PTE did change. Another issue is that the change of PTE was different between the CTP and ITP groups, but the change of TOE was not. Next we discuss these issues in terms of what they mean for identifying the potential of virtual worlds to support pre-service teachers’ teaching practice. We draw upon Bandura’s four sources of self-efficacy (1997) to interpret the characteristics of virtual worlds, as well as previous research.

7.1. Changes of pre-service teachers’ teaching efficacy

7.1.1. Changes of TOE

The results indicated that the students’ TOE did not change across the three stages of (1) the preparation phase of the course, (2) following the first practice teaching session, and (3) following the second practice teaching session. TOE is focused more on the beliefs on capability of teachers in general than on an individual’s personal efficacy. As a result, before student teaching it could be influenced by social persuasion and vicarious experience as much as mastery experience and physiological state. According to Bandura (2006, p. 309), an outcome expectation is a person’s judgment that “a given type of performances” will lead to certain outcomes. Because pre-service teachers have no actual teaching experiences before student teaching, they have no information on a given type of performance to judge teachers’ capability except their own college education, cultural beliefs about teachers from society, and/or the memory of their teachers’ instruction from their school days. These are all indirect experiences, the result of social persuasion and vicarious learning. In recent research on pre-service teachers’ teaching efficacy TOE was not significantly changed during their student teaching in the field (Hwang, Jang, & Choi, 2004; Park, 2007; Yeo & Hong, 2006). Gurvitch and Metzler (2009) reported that general teaching efficacy (similar to TOE) of pre-service teachers was not changed during their program of study, including after student teaching. However, Hoy and Spero (2005) reported that the general teaching efficacy of pre-service teachers was rather enhanced after their student teaching. This previous research indicates that the expectation of a given type of performance established through social persuasion and vicarious experience before pre-service teachers’ actual teaching experiences has no negative effects on their TOE during their student teaching and that once it was established it was

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITP</td>
<td>2.62 (.38)</td>
<td>2.62 (.61)</td>
<td>2.63 (.68)</td>
<td>2.36 (.43)</td>
<td>2.24 (.42)</td>
</tr>
<tr>
<td>CTP</td>
<td>2.64 (.53)</td>
<td>2.63 (.54)</td>
<td>2.65 (.68)</td>
<td>2.37 (.39)</td>
<td>2.21 (.37)</td>
</tr>
</tbody>
</table>
unlikely to change. This research on TOE suggests that teaching practice conducted in Second Life probably did not affect negatively pre-service teachers’ teaching outcome expectancy.

7.1.2. Changes of PTE
The results indicated that PTE was significantly changed across the three stages. Both the indirect sources of self-efficacy, social persuasion or vicarious experience and the direct sources, mastery experience and physiological state (Bandura, 1997) can be present in a course. Bandura (2006, p. 309) wrote “Perceived self-efficacy is a judgment of capability to execute a given type of performances.” That is, PTE is focused on individual’s personal efficacy rather than on beliefs about the capability of teachers in general, so that during teacher education programs it could be more influenced by direct experiences than by indirect experiences.

The mean scores of PTE from Stage 1 to Stage 2 went down significantly. The weakened PTE from stage 1 to stage 2 could be interpreted that the belief on their personal teaching ability established from the indirect experiences of social persuasion and vicarious experience were not connected to the students’ successful mastery experience during their practice sessions. This might reflect that pre-service teachers recognized the differences between theoretical knowledge and practical knowledge through their direct experience of teaching practice. For example during the first reflection of the practice, a pre-service teacher stated “I had known what motivation to learn and strategies are, and I had also known that using the strategies could improve students’ motivation to learn. But extracting practical ideas and cases for my subject topic was difficult and I also felt difficulties in performing the lesson plan through my verbal explanation and materials, and I continuously wondered if this activity could really motivate students to learn.” Most of her peers agreed with this statement.

The students’ mean scores of PTE significantly enhanced from Stage 2 to Stage 3. The additional activities they performed in stage 3 were (a) a self-reflection about their video clips, (b) a comparison of their practice with peers’ practice efforts (only in CTP group), (c) a discussion with peers on their practice efforts (only in CTP group), and (d) modification of their lesson plans and materials (individually in ITP group and collaboratively in CTP group). Then, they performed the second practice teaching session using the modified lesson plans and materials. Therefore, the result could be interpreted that these activities and repeated teaching practice sessions caused the enhancement of PTE.

While there was no significant difference of PTE between Stage 1 and Stage 3, these results from stage 1–2 to 3 are noteworthy if learning to teach is considered as a process. That is, students’ first practice teaching session in stage 2 began their process of learning to teach through direct experiences, and their first-hand experience lowered their PTE. The results show students’ PTE was significantly higher after just one additional direct experience. It would be valuable to forecast the successive changes if there were additional practice sessions after stage 3. However, a limitation of this research is that there were no following measures after the second reflection and no more treatments. This suggests that future research could focus on the effect of successive treatments, such as additional teaching practice session in Second Life, student teaching in the field, and/or actual classroom teaching as a novice teacher.

The change of students’ PTE values in this research is slightly different from the previous research. The research on secondary pre-service teachers’ PTE (Park, 2007), elementary pre-service teachers’ PTE (Yeo & Hong, 2006), and kindergarten per-service teachers’ PTE (Hwang et al., 2004) reported that their PTE was significantly enhanced after the student teaching. Unfortunately, these research studies did not measure PTE...
Table 7

Differences of PTE between adjacent stages by group.

<table>
<thead>
<tr>
<th>Group</th>
<th>(I) PTE</th>
<th>(J) PTE</th>
<th>Mean difference (J–I)</th>
<th>Std. error</th>
<th>Sig. (p)</th>
<th>Effect size (Cohen's d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITP</td>
<td>Stage 1</td>
<td>Stage 2</td>
<td>−.12</td>
<td>.05</td>
<td>.042</td>
<td>−.28</td>
</tr>
<tr>
<td></td>
<td>Stage 2</td>
<td>Stage 3</td>
<td>−.02</td>
<td>.05</td>
<td>.982</td>
<td>.04</td>
</tr>
<tr>
<td></td>
<td>Stage 1</td>
<td>Stage 3</td>
<td>.10</td>
<td>.07</td>
<td>.397</td>
<td>−.21</td>
</tr>
<tr>
<td>CTP</td>
<td>Stage 1</td>
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<td>−.17</td>
<td>.04</td>
<td>.000</td>
<td>−.44</td>
</tr>
<tr>
<td></td>
<td>Stage 2</td>
<td>Stage 3</td>
<td>.22</td>
<td>.05</td>
<td>.000</td>
<td>.47</td>
</tr>
<tr>
<td></td>
<td>Stage 1</td>
<td>Stage 3</td>
<td>.05</td>
<td>.05</td>
<td>.986</td>
<td>.11</td>
</tr>
</tbody>
</table>

repeatedly during pre-service teachers’ student teaching so that a more detailed insight into change of PTE could not be discovered. In the research of Gurvitch and Metzler (2009) and Hoy and Spero (2005), pre-service teachers’ PTE was measured repeatedly. In Gurvitch and Metzler’s (2009) research, the field based practicum experiences in an actual school setting weakened the pre-service teachers’ PTE at their first period of measurement, enhanced it at the second period, and showed no change at third period. They argued that the causes of the drop were the challenges of making instructional decisions and teaching for the first time in an authentic public school setting, and the increase in PTE came from facing those repeated challenges during their ongoing teaching experiences. In Hoy and Spero’s (2005) research, pre-service teachers’ PTE was significantly increased during student teaching but decreased during the first year of teaching, at a level that approached statistical significance (p = .052). Gurvitch and Metzler’s (2009) research suggests that the drop in PTE from stage 1–2, after the first practice teaching session in this study resulted from the challenge posed to pre-service teachers. Then the reflection, discussion, and repeated practice of teaching in Second Life from stage 2–3 led to the increase of students’ personal teaching expectancy.

7.2. Differences of effects between ITP and CTP

7.2.1. Difference of the effect in TOE

The results yielded show that TOE was not changed significantly across the three stages and there were no significant differences of TOE between groups across the three stages. In addition, the RM-ANOVA on TOE did not statistically indicate a significant treatment by stage interaction. These results indicate that different treatments of teaching practice performed in the two groups did not influence pre-service teachers’ teaching outcome expectancy.

7.2.2. Difference of the effect in PTE

The results showed an important difference of PTE between two groups in stage 3. The mean scores of PTE from Stage 2 to Stage 3 significantly went up in the CTP group, but the ITP group did not show a statistically significant increase in PTE mean scores. The two groups performed different activities during the stage 2 and 3. In the CTP group, pre-service teachers showed highly interactive collaboration in creating lesson plans and materials during the preparation phase, and also in practicing teaching, reflection of the practice, and modifying the lesson plan and materials for preparation of the second practice teaching session during the practice phase. However, the ITP group did those activities individually, except the practice of teaching. The CTP group pre-service teachers had more interest in team members’ teaching than did the ITP group members because they designed the lesson together. In addition, although each team in the CTP group practiced their teaching based on the same lesson plan, team members’ teaching styles and actions were not same, and so peer feedback was very frequent and immediate. Because team members’ did not always reach consensus, immediate discussions on their common lesson plan and teaching actions were performed during the practice. In contrast, in the ITP group, while the practice of teaching was the one activity where they worked together, most of the members on a team just observed their peer’s teaching and were passive in their student role playing.

Interpreting this in light of Bandura’s (1997) four sources of self-efficacy, it would appear that the successive first to second practice teaching session (i.e. Stage 2 to Stage 3) in the CTP group led to a more successful mastery experience than in the ITP group because pre-service teachers in the CTP group knew each other better as a result of their mutual interaction and likely were less nervous and more open in sharing ideas while practicing teaching before their peers, as compared to among peers in the ITP group.

8. Conclusions

The important finding from this study is that practice teaching in Second Life affects pre-service teachers’ personal teaching expectancy, and the collaborative practice of teaching has more of a positive impact on their personal teaching expectancy. However, practice teaching conducted in Second Life probably did not affect changes of pre-service teachers’ teaching outcome expectancy, nor did the different treatments of practice teaching performed in the two groups influence their teaching outcome expectancy.

Even though this research was at a nascent stage to discover the effect of pre-service teachers’ practicing teaching in virtual worlds, an implication of the research is the demonstrated potential to new approaches to practicum experiences in pre-service teacher education programs. This research showed that pre-service teachers can practice teaching skills in Second Life without negative impact to students, and the practice can be performed repeatedly and easier than in real life. In addition, it is worthwhile to consider the design of collaborative...
practice in this research as an exploratory way for pre-service teacher education, which showed the practice using avatars in Second Life can have positive influences on pre-service teachers' personal teaching efficacy.

Changes in pre-service teachers' teaching efficacy were relatively short-term experiment results and longitudinal research on the change of their efficacy is needed in the future. The results of this research are expected to be a foundation for development of pre-service teacher education program offering a series of successive indirect and direct experiences which connects effectively attending lectures about teaching and learning to collaborative teaching practice in Second Life in classes, and then to student teaching in the field. Future research is also needed for how laboratory-based practice in games, cases, or simulations might provide better or worse results, as well as successive practice in virtual worlds. It suggests that teacher educators need to become more adept at new technologies such as Second Life and consider them in light of learning practical and procedural knowledge such as instructional decision making, which means teacher educators must forge new ground since the popular notion of Second Life is for more frivolous purposes.

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