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Collaborative Studio Experiences between South Korean and American Pre-Service Teachers: a Case Study of Designing Culturally-Responsive Virtual Classroom Simulation

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Abstract

Virtual classroom simulations can offer pre-service teachers unlimited opportunities for teaching practice that help them sensitize to classroom diversity. The purpose of this case study was to describe a collaborative simulation design studio initiated between two universities in South Korea and U.S.A. while American pre-service teachers visited South Korea for five days as part of the student exchange program. This paper presents the main components of the design studio program with detailed descriptions of design activities, in which South Korean and American pre-service teachers created four classroom management scenarios and corresponding virtual students/classrooms. We also shared how the design studio experiences helped participants understand different classroom cultures by analyzing their responses to the reflection questions, design outcomes, and the researchers' observation notes. The results showed that the design studio experiences were beneficial for participants to understand different classroom cultures. The analyses revealed two major themes emerged from participants' responses to cultural differences and similarities: classroom management and student attitude. In addition, participants shared perceived benefits of the collaborative design studio experiences: social engagement and tangible experiences.

Keywords Collaborative design experience · Culturally-responsive · Pre-service teacher training · Virtual classroom simulation

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Introduction

The United States is becoming more culturally and ethnically diverse, which creates a variety of cultural viewpoints. In general, distinct cultures consider different norms and values that characterize a culture and distinguish it from other cultures (Gallivan and Srite 2005; Hofstede 1986; Leidner and Kayworth 2006; Srite and Karahanna 2006). Norms and values are shaped through the experiences within the culture and internalized in the form of tacit knowledge. Teachers learn about culture through socialization processes, which ultimately represent our reality and worldview (Cruz-Janzen 2000; Gollnick and Chinn 2002). Hence, understanding cultural differences in the classroom and using culturally relevant teaching strategies require teachers to be more involved in teaching practices by interacting with students from diverse cultural and ethnic background. Teacher training programs in the U.S. has been recognizing the importance of preparing future teachers for the unique opportunities and

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challenges that our multicultural societies provide (Cruz and Patterson 2005). South Korea has also been undergoing significant changes in the national curriculum standards that emphasize cultural and ethnic diversity (Moon 2010). This change indicates the emerging need to train pre-service teachers on cultural diversity in education including all levels. However, recent studies show that teachers in both countries are not prepared to address diversity or to practice multicultural education (Aragona-Young and Sawyer 2018; Jang and Jeon 2013; Lee 2014).

One useful method in sensitizing teachers of diversity is to offer teaching practice opportunities that are almost unlimited within a virtual immersive training simulation. Virtual teaching simulations allow pre-service teachers to experience authentic teaching in a realistic classroom environment with simulated virtual students (Badiee and Kaufman 2014). The immersive teaching experience can be enriched through various classroom situations with uniquely designed virtual students representing different ethnicity, race, and/or culture. Over the past decade, several virtual teaching simulations have been developed and studied (Kaufman and Ireland 2016). Widely used examples include ClassSim, an online simulation developed to train teachers to work with students with special needs (Ferry et al. 2004, 2005); SimSchool, a Web-based pre-service teacher training environment that offers teaching practice experiences (Badiee and Kaufman 2014; Christensen et al. 2011; Gibson 2007); and TeachLivE, a mixed reality-based learning environment that offers teaching practice experiences (Dieker et al. 2014). These simulations have been used in teacher training to provide pre-service teachers with the opportunities to practice specific teaching skills and interpersonal communication/behaviors. However, culturally-responsive virtual simulation scenarios have not been addressed in the current teaching simulations. The challenges exist as designing such culturally-responsive virtual simulation scenarios requires understanding culturally relevant pedagogy and diversity awareness (Cruz 2010; Ellerbrock et al. 2016; Ladson-Billings 1995, 2006). This study offers a new approach to design culturally authentic virtual simulation scenarios by presenting a case of a collaborative design studio, in which pre-service teachers from South Korea and U.S.A. created authentic virtual simulation scenarios from multicultural perspectives.

Review of Literature

Culturally-Responsive Teaching (CRT)

According to Gay (2000), culturally-responsive teaching (CRT) involves using the cultural characteristics, experiences, and perspectives of diverse students to deliver relevant and efficient learning experiences. Previous studies on CRT noted that successful teachers use CRT by listening and observing students attentively and responding to their diverse needs (Ladson-Billings 2006; Howard 2010). Vavrus (2008) stated that

culturally-responsive teachers promote their knowledge on subject matters by increasing multicultural aspect of their teaching activities. They also have specific skills to create learning experiences by actively listening individual students of diverse backgrounds and incorporating their voices into instruction. The knowledge, skills, and dispositions for CRT are required for not only in-service teachers but also pre-service teachers to meet the needs of culturally diverse students. Pre-service teachers often participate in field experiences to gain experiential knowledge of working with students from diverse cultural settings. Vavrus (2008) emphasized that field experiences are one of the most effective approaches that allow pre-service teachers to be connected to CRT. Hence, it is critical to provide pre-service teachers with opportunities to interact with culturally diverse populations in the classroom so that they can expand their multicultural understanding that is necessary to become culturally-responsive teachers.

Culturally-Responsive Classroom Management (CRCM)

Along with CRT, culturally-responsive classroom management (CRCM) is also an integral aspect of supporting cultural diversity in the classroom (Weinstein et al. 2004). Classroom management is the process for teachers to create and maintain appropriate behavior of students and further enhance their academic engagement (Emmer and Sabornie 2015). The goal of classroom management is creating an effective environment for learning to take place. According to Jones and Jones (2013), six basic assumptions of classroom management include (1) classroom management is centered around creating a safe environment where all students feel valued, (2) effective management directly correlates to effective instruction, (3). effective classroom management should increase students' ownership, responsibility, and self-worth, (4) effective classroom management involves helping students develop new behaviors that help them work successfully with others, (5) effective classroom management causes the educators to examine student learning goals as well as their personal values and beliefs, and (6) effective classroom management includes planning, reflection, and growth. Jones and Jones (1995) explained that pre-service teachers need to follow the five-steps of intervention procedure to effectively apply classroom management skills: (1) Step 1 - Use a nonverbal signal to cue the student to stop, (2) Step 2 - If the behavior continues, ask the student to follow the desired rule, (3) Step 3 - If the disruption continues, give the student a choice of stopping the behavior or choosing to develop a plan, which makes an agreement between students and the teacher to follow the rules of classroom, (4) Step 4 - If the student still does not stop, require that the student move to a designated area in the room to write a plan, and (5) Step 5 - If the student refuses to comply with Step 4, send the student to another location (another classroom or the school office) to complete the plan.

To help pre-service teachers practice the classroom management skills and become competent with multicultural understanding, they need to be exposed to the context of possible cultural conflicts that often occur in diverse ethnic groups (Weinstein et al. 2004). According to Weinstein et al. (2003), successful CRCM should be a vital component of pre-service teacher training because, without proper CRCM training, teachers tend to respond student behaviors simply based on their internalized mainstream culture where they are familiar. It can cause unintended discrimination to students from minority groups. To avoid the possible discrimination for culturally underrepresented students, teachers must understand that students' behaviors are influenced by different culture and practice CRCM skills accordingly. Therefore, CRCM requires setting clear and specific behavioral expectations and communicating the expectations with students in culturally consistent way (MacSuga-Gage et al. 2018).

Virtual Classroom Simulation for CRT and CRCM

Since CRT or CRCM skills are not easily obtainable for pre-service teachers (Kidd et al. 2008), teacher training programs need to allow more time for pre-service teachers to learn knowledge/skills on CRT/CRCM and develop dispositions through their continuous reflections of practices. Wu (2011) advocated the importance of offering more multicultural field experiences for pre-service teachers to enrich their cultural reflections while interacting with students with diverse cultural background. Yet, preservice teachers often do not find enough opportunities to participate in field experiences for their teaching practice because their time and field experiences are "limited by the lack of regular access to quality classroom experience" (Ferry et al. 2004, p. 2).

With the advancement of virtual reality technology, however, virtual teaching simulations have been introduced as an alternative method to promote pre-service teacher training (Park and Ryu 2019). Virtual teaching simulations can offer pre-service teachers opportunities to repeatedly practice their teaching and classroom management skills through dynamic teacher–virtual student interactions using realistic simulation scenarios and diverse student personalities (Kaufman and Ireland 2016). For example, Simulation for Teaching Enhancement of Authentic Classroom beHavior Emulator (SimTEACHER) is a virtual scenario-based teacher-training system (Park and Ryu 2019). It utilizes the virtual reality-based immersive simulated environment presented on a wide computer screen. Figure 1 shows a user (pre-service teacher) interacting with virtual student characters simulated in the system.

Well-designed simulation scenarios are essential in designing an authentic, interactive, and immersive teaching simulation. To design culturally-responsive scenarios, it is critical to infuse the scenarios with cultural meaning and nuances derived from the viewpoints and perspectives of multiple cultures (McLoughlin and Oliver 2000). This way, the culturally- responsive scenarios can be used to promote pre-service teachers' understanding of

Fig. 1 Example of simulation use

diverse students' needs and further help them practice how to react to possible classroom problems.

The design activities in this project are supported by the idea of constructionist learning that emphasizes a construction of knowledge through creating projects or digital artifacts (Papert 1991). According to Kafai (2006), when learners are involved in the artifact construction process, learning becomes more meaningful and motivational. Hence, the design studio activities enable students to make connections with their prior experiences while creating physical or digital objects (Kolodner 2006). Furthermore, presenting ideas in different modes facilitates a deeper engagement for the students (Park and Braud 2017). The collaborative design studio was the first step in creating the culturally-responsive virtual simulation scenarios to be used in a virtual teaching simulation for pre-service teachers. Participating pre-service teachers used both text and multimedia simulation to present their perspectives on culturally diverse classroom management scenarios.

The purpose of this descriptive case study was to describe our culturally collaborative design studio by explaining how it was initiated between two universities in South Korea and U.S.A., what studio design activities students experienced, and what design outcomes students had produced. Also, we presented the influences of the studio design experiences on students' perception of different classroom cultures and of virtual teaching simulations by analyzing three types of qualitative data collected at the beginning, during, and at the end of the design studio activities.

Research Questions

The following three research questions guided this study:

1. What are the activities of cultural collaboration for the design studio in designing culturally-responsive virtual classroom?
2. How do American and South Korean pre-service teachers perceive the differences and similarities of each other's classroom culture before and after the collaborative design studio?

3. How do American and South Korean pre-service teachers perceive the benefits of the collaborative design studio experiences?

Method

Research Design

A qualitative descriptive case study methodology guided this study to describe the collaborative design studio and further to capture, describe, and interpret both American and South Korean pre-service teachers' perceptions of classroom culture while they were involved in design activities within three mixed cultural groups. A case study enables the researcher to develop "an in-depth analysis of a case, often a program event, activity, process, or one or more individuals" (Creswell 2014, p.14). We used the descriptive case study design because this study involved reporting multiple perspectives to explore the collaborative simulation design case. We particularly collected information including the perceptions and experiences of American pre-service teachers and South Korean pre-service teachers concerning the influences of the collaborative design studio on their understanding of different and similar classroom cultures.

Participants

A total of three American pre-service teachers and 12 Korean pre-service teachers participated in the collaborative design studio for virtual classroom simulation. American pre-service teachers visited South Korea and joined the collaborative design studio activities for five days as part of the student exchange program established between the two universities. Each of the three American pre-service teachers and 12 South Korean pre-service teachers was randomly assigned into one of the three mixed cultural groups. Two Korean participants were excluded in the analysis because one participant previously had lived in the USA for two years hence might have been familiar with American culture, and the other did not complete the reflection questions. No other American or South Korean pre-service teachers had an experience in visiting each other's country prior to this study. American pre-service teachers were native English speakers on the junior level. The South Korean pre-service teachers were native Korean speakers with one senior and nine on the junior level. All participants were female and had spent their entire elementary and secondary school experiences in their own countries.

Case: Collaborative Design Studio

To promote the awareness of classroom culture differences and similarities for American and South Korean pre-service teachers, we have initiated a collaborative project that allowed the pre-service teachers to develop classroom simulation scenarios and virtual students/classrooms. The project was designed as part of the student exchange program. Pre-service teachers from a four-year university located in the midwestern region of the U.S. visited South Korea and participated in the project hosted at a four-year university located in the southern region of South Korea. Participants created virtual simulation scenarios and shared their understanding of different classroom cultures between two countries. They further designed virtual characters (students) that presented culturally-typical problem behaviors in the classroom. In the design process, we instructed participants to utilize the scenario-based design approach, which has been used as a development technique to concretely describe an early point of a system development (Rosson and Carroll 2002). Descriptive episodes were created using the three steps (problem scenarios, activity scenarios, and information/interaction design scenarios) and employed to guide the development of the virtual classroom to enable teaching experiences with cultural diversity issues. In the first step, *problem scenarios,* participants created a story of current practice. These stories were carefully developed to reveal aspects of the teacher activities that have implications for scenario design. Second, *activity scenarios* involved the participants to create concrete stories about the activities of virtual students to present the problem scenarios and how to properly address the cultural/ethnic diversity issues in a virtual teaching simulation. Lastly, *Information and interaction design scenarios* were created after completing the above two steps. The collaborative participant groups created active scripts to demonstrate the sequence of actions/dialogues between the user (pre-service teacher) and the virtual students.

The design studio was structured in the form of group activities that lasted for five consecutive days.

The main goal of the design studio program was to improve students' understanding of different classroom cultures between two counties. Upon completion of the design studio experiences, students were expected to (1) share and understand different classroom cultures between the U.S. and South Korea, (2) define disruptive classroom behaviors in different cultures, (3) develop stories/ scenarios describing disruptive behaviors in the classroom, (4) design and develop virtual student characters using 3D modeling tools in a virtual classroom environment, and (5) present and simulate a classroom management case to deal with disruptive classroom behaviors using the virtual student characters. Each of three mixed cultural groups identified two concrete and specific classroom management challenges that required culturally relevant pedagogy and diversity awareness for a teacher to resolve. Then each group created two scenarios and virtual characters that could be employed in the virtual simulation space. On the last day of the design studio program, each participant was asked

to reflect upon her design studio experiences by responding to the aforementioned ten open-ended questions.

Data Collection

To answer to the first research question, we presented detailed descriptions of the collaborative design studio, in which South Korean and American pre-service teachers created four classroom management scenarios and corresponding virtual classrooms that are culturally unique. For the research questions two and three, we used participating pre-service teachers' responses to the reflection questions completed on the last day of the design studio program, their design outcomes for each design activity, and the researchers' observation notes while they were engaged in group discussions and design activities. To minimize anticipated problems in data collection, reflection questionnaire was given right after the activity. The researchers also ensure that all participants participated and worked collaboratively to produce design outcomes. In addition, the observation was non-intrusive to students' design activities, as one of the researchers sat in the classroom quietly and took notes while participants worked on their design activities.

Reflection Questionnaire

To answer to the research questions two and three, the researchers discussed possible scope of questionnaire and developed 10 reflection items. The reflection questionnaire consisted of 10 open-ended items with items 1–5 developed for the research question two and the items 6–10 for the research question Three (see in Appendix Table 3). The goal of the reflection questionnaire was to understand how participating pre-service teachers perceived the design studio activities as a mechanism to understand different classroom cultures. Participants completed the 10 questions on the paper for about 10–15 min after completing all studio activities.

Design Outcomes

All participants completed a series of design, development, and testing activities throughout the design studio program. The two main outcomes included the virtual classroom scenario creation and the virtual student/classroom design and development. In the design studio, each group created the virtual student/classroom based on the scenario that they had created. Therefore, the design outcomes involved the process of manifesting participants' perception on different classroom cultures.

Observation Notes

One of the authors served as an observer during the design studio activities. When participants worked in groups, the observer visited each group to make notes of topics that are discussed, storied being shared, group members' emotional expressions, and the process to reach the group decisions. The observation notes were triangulated with students' responses to the reflection questionnaire and their design outcomes to further understand the participants' responses and ascertain a complete picture of the participants' activities.

Data Analysis

Our data analysis comprised two parts. We first coded the open-ended responses to find major themes within research questions. We focused our coding on identifying areas where participants clearly addressed their design studio experiences and perceptions of different classroom culture. Then we developed thematic coding categories to identify any patterns or trends (Silverman 2011). We used the thematic analysis because it is a widely used qualitative data analysis method for identifying, analyzing, organizing, describing, and reporting themes found within a data set (Braun and Clarke 2006). We then triangulated participants' perception of different classroom cultures as presented in the open-ended responses with their design outcomes of both scenarios and virtual student/classrooms, and the observation notes completed during the design studio activities.

Results

The Activities of Cultural Collaboration for the Design Studio

Students used simulation design programs such as iClone/Unity3D and Oculus Rift to create virtual student characters in the virtual classroom. Several completed examples from *SimTEACHER*, which is run by one of the authors' research lab, was shared with all participants on the first day so that they understood what virtual students/classrooms means. Students designed a 3D character that resembles their appearance by using the iClone program and created emotional gestures in Unity3D accordingly. Since the goal of the design activities was to help pre-service teachers prepare to handle disruptive classroom behaviors, all participants shared different classroom cultures and worked in groups to create two or three disruptive classroom scenarios that simulate an authentic classroom situation. The design studio program was offered in both classroom and a computer lab where students had access to the necessary design programs. Prior experiences or knowledge working with the programs was not required because students were trained how to modify and create the appearance and gestures of a virtual student character during the design studio. Also, lab staff were available to help students with technological challenges and difficulties. Table 1 shows the daily design studio activities.

Table 1 Design studio daily activities

Date	Session 1 (1 h)	Session 2 (1.5 h)	Session 3 (1 h)
Day1	Demonstration of Virtual Reality Team building	Behavioral problem identification	Group presentation & feedback
Day2	Developing classroom management scenarios	Group presentation and modification of the scenarios	
Day3	Virtual student character creation (Face morphing)	Virtual student character creation (Gesture creation)	
Day4	Testing of virtual student characters	Modification of Gesture	Continuous testing and modification of virtual student characters
Day5	Final presentation of the virtual simulation preparation	Presentation	

Day 1 Activities: Identifying Problem Behaviors in USA and South Korea

On the first day of the collaborative design studio, participants in each group discussed behaviors considered problematic in the classroom. All participants were instructed to reflect on their own classroom experiences while they were in secondary schools. As upper level pre-service teachers, students were familiar with pedagogical and content knowledge. They identified cultural differences by describing and categorizing problematic behaviors into U.S.A. cases and South Korea cases, respectively, and further creating a total of four cases (minor and major behavioral problems for each of the countries). Participants also provided a description for each case, selected keywords for each case, compared how the cases were different in cultural perspectives, and shared a summary of their group activity with other groups.

Day 2 Activities: Creating Management Scenarios

On the second day of the collaborative design studio, participants received comments from peers about their day 1 activities. Once modified the scenarios, each group worked on creating four virtual classroom management scenarios focusing on problem behaviors (two minor behavior problem scenarios and two major behavior problem scenarios from each country). Each scenario included a name(s) of virtual student(s), unique personality and profile, the scenario context, possible subject matter and lesson plan, and the actual scenario scripts to be used to create a virtual classroom. The lesson plan worked as an initial stage to evoke the simulated situation. In the script for each scenario, the conversation between a teacher and a student(s) were developed (Table 2). Participants were instructed to design various unpredictable authentic scenarios in which the virtual student refuses teacher's directions by displaying problem behaviors.

Day 3 Activities: Designing Virtual Students

On day 3, participants worked in groups to create virtual students to be used in the virtual classrooms. First, each group chose two members in order to design initial character models.

The design process of virtual students required taking pictures of a member's front face and side face. Based on the problem behavior scenarios developed from Day 2, each group modified the gesture and movement of the virtual student character to present the intended actions in the scenarios.

Day 4 Activities: Implementing Scenario Episodes

All completed virtual student avatars were imported into the Unity design platform to create natural gestures within the given conversation scripts. The natural flow of the movement and gestures were designed using the timeline function. The voice of a virtual student was also added by importing recorded voice and combined with gestures of the virtual students.

Day5 Activities: Developing Virtual Classrooms

On the last day of the design studio, all participant groups created a virtual classroom and imported virtual student avatars that they had created from Day 4. Problem behavior scenarios created from day 2 were used as a conversational model to present the virtual simulation episodes. Then each group tied the five classroom management skills to the behavioral problem presented. Lastly, all group members share the intervention with cultural rationale and completed reflection questions at the end.

Perception of Classroom Culture Differences and Similarities

Understanding of Classroom Cultures Prior to the Design Studio Activities

Prior to the design studio experiences, it appeared that the awareness level of classroom culture differences was low for both American and South Korean participants. All three American participants shared that they had no prior information or understanding of what South Korean classrooms would be like, although they thought it would be different from the American classrooms. Most of South Korean students also reported that they had no clear understanding of what American classrooms would look like. Several South Korean participants mentioned that they had learned about the American educational system in

Table 2 Major behavior problem scenarios

Country	Title	Scenario overview / description	Name of student /Student description	Script
South Korea	Using cell phone in the classroom	A student is caught using their cell phone during an exam. The teacher implies they are using the cell phone to cheat. The teacher confronts the student with the issue and the student begins to argue with the teacher. The student is yelling at the teacher while slamming their hands on their desk. This causes a great distraction to the other students while they take their exam.	Doa is a problematic person. He does not study in common time, argues and fight with teacher. Before class, the teacher said students to do not use their cell phone in class time. If so, the teacher took their cell phone away for a moment. But, he brings it always and argue with teacher if he tries to take it. He depends on cell phone too much. Furthermore, he didn't prepare to exam. So, he brings his cell phone to exam and try to use it to	Teacher: Hello, students! Today is the Exam day. Are you ready to take the exam? Students: Yes, Teacher! Teacher: Here are the rules: no cell phones, no talking, no books, no cheating, sit in your assigned seat. I will collect all of your cell phones right now (Teacher walks around the classroom collecting the cell phones). Doa: (Slips his cell phone deep into his pocket) I do not have my cell phone with me. I left it at home today. Teacher: Alright, I hope you are telling the truth Doa. Doa: Yes, I am telling the truth! I would never lie to a teacher. Teacher: (returns to the front of the classroom) Now that I have collected all the cellphones, we may begin the exam. (Teacher passes out the exams) You have one hour to complete the exam. If you studied well, that should be plenty of time to complete the exam. I will know which students did not study. Doa: (Begins to panic) (Takes cellphone out of pocket and begins to Naver search the answers) Teacher: (walks around classroom) DOA, why do you have your cell phone out?! Doa: (quickly puts the cell phone away) I wasn't on a cellphone. I was looking for my wallet in my pocket. Teacher: Yes, you were on a cell phone! I saw you! Doa: (slams his fists on the desk) No I wasn't! Teacher: I know you are lying Doa! Collect your things and go to the teacher's office. I will deal with your punishment when the exam is finished (Doa exits classroom).
USA	Bullying	The teacher assigns a group activity to the students. The teacher notices one of the groups is off task. There are 4 female students chatting about another student. They are saying hurtful words about her. One of the bullies throws an eraser at her head. Another bully pulls her hair. The teacher does not notice this behavior because she is working with another student. The bullying continues when one of the bullies hands this girl a note with a mean message. Finally, the last bully pulls the chair out from under the student and this gets the teacher's attention.	Bully 1,2,3,4 are sneaky, manipulative, and mean. One bully is more powerful than the other; she is their leader. Mary is the student being bullied. Mary is too shy to tell "Don't bully me!" In this situation, the bullies get more confidence because Mary does not say anything, and the bullies repeat their actions again.	Teacher: Hello, students! Today we will be peer editing our research papers. Divide yourselves into groups of four people. Students: (move around the classroom and form groups) Teacher: You have 30 min to read each other's papers and leave comments and suggestions. Make sure you stay focused on the assignment. Bully 1: I do not like Mary. She is so annoying. (throw eraser at Mary's head) Bully 2: (laughing) I'm glad Mary is not in our group! Bully 3: (pulls Mary's hair) How do you like that, Mary?! Mary: (whispers) Please stop it. Bully 4: What is that Mary? Speak up! We can't hear your little mousy voice. Bully 2: (hands Mary a mean note) A wrote something special for you. Mary: (reads note) (begins to cry) Bully 1–3: (repeat the actions) Bully 4: (pulls chair out from under Mary) Get on the floor Mary! You belong down there. Teacher: (noticed Mary on the floor) Why are you on the floor, Mary? What is going on over here? Mary: They pulled my chair out from under me.

Table 2 (continued)

Country	Title	Scenario overview / description	Name of student /Student description	Script
				Bully 1: Why did you have to tell on us? This is why we don't like you! Teacher: Those are mean words. You should not talk that way to your classmate. I will not tolerate such rude behavior. Please apologize to Mary. Bully 2: Well, I am not going to apologize. Bully 3: You can't make us apologize. Teacher: Enough! All 4 of you go to the principal's office immediately! We have a no-bullying policy. Bullies: (Exit classroom)

one of their college courses, but not specifically about American classrooms. A couple of South Korea participants stated that their experiences about American classrooms were limited to only what they had seen from movies or TV shows, which they did not consider as authentic: "Prior to participating in the design studio, I only had simple images of American classrooms as presented in movies or TV shows. I did not have much information or knowledge about American classroom cultures."

All American and South Korean participants also did not have prior experiences or knowledge in working on virtual simulation design. As virtual simulation is considered as an emerging technology, one participant expressed that she would have a tough time using the simulation design programs. Participants from both countries commented that they were not familiar with each country's classroom cultures and had no understanding of how designing a virtual classroom simulation could possibly help improve their understanding of the cultural differences. The lack of cultural understanding was also found from the observation notes. On the first day of design studio activities, all groups actively discussed their own experiences and stories during their K-12 schools. It was clearly noticeable that participants made surprising facial expression when they listened to their group members from other countries. They also repeatedly asked for confirmation of what they heard. For example, when a South Korean participant shared a story regarding the cell phone use in the classroom, an American group member asked several times if it was true. Figure 2 shows the main findings of the study.

Understanding of Classroom Cultures after the Design Studio Activities

After completing all discussions and design activities in the design studio, American participants and South Korean participants expressed a better sense of each other's classroom culture and described their understanding with two major themes: 1) cultural awareness and 2) student attitude.

Cultural Awareness A major theme emerged through the analysis of data was that both American participants and South Korean participants perceived the cultural differences and similarities in the aspect of classroom environments. Participants described that using instructional approaches such as group works or peer paper and moving to a teacher's classroom for a class are common in American schools but not in South Korea. Also, active class participation and cell phone policy are mentioned as differences: "In American schools, students are often assigned groups to work together or review each other's work. That is not as common in Korea. In America, students move to the teacher's classroom. In Korea, students stay in the same room and the teachers move. Also in Korean schools, some of teachers still use physical punishment as like hitting with a stick as a way of discipline.
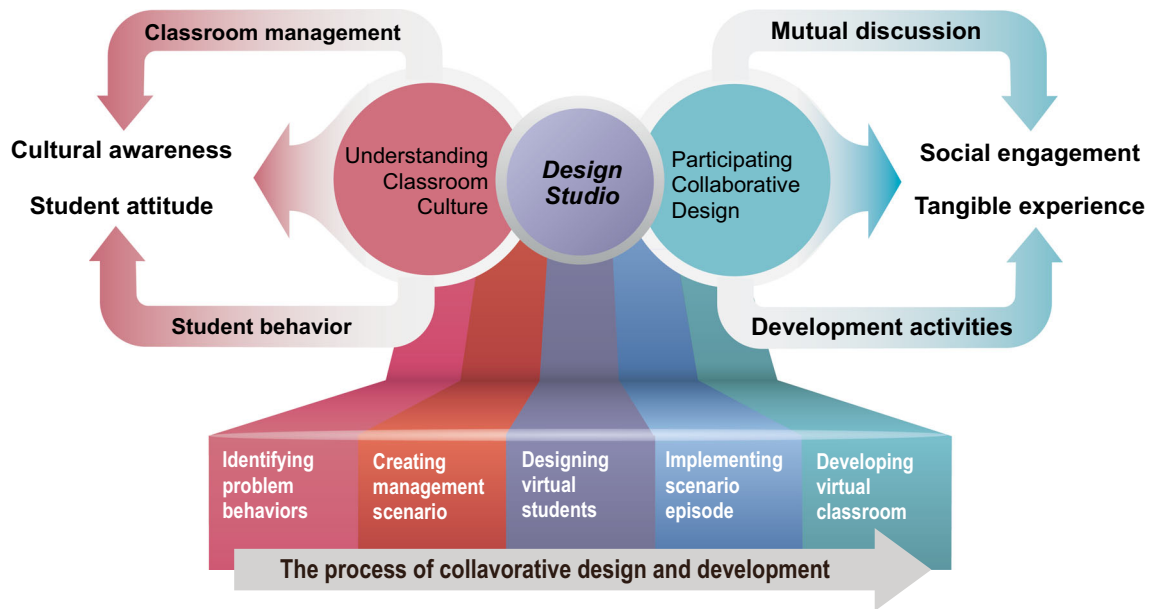
Fig. 2 Visualization of the study findings

However, in USA it's not a common way. In Korea, cell phones are collected in boxes prior to the class."

While there are differences, all participants shared commonly perceived similar problem behaviors in the aspect of classroom environments. They perceived classroom interruption and bullying as similar problem behaviors in both countries:

"Cell phones and technology are distracting and problematic in the schools. Bullying is a problem in both schools. Being a teacher is a tough job in both cultures; they each face sets of problems within the classroom"

Student Attitude Regarding the second theme, student attitude, participants described how students in each country differently express their opinions in the classroom and how they interact with the teacher. American participants pointed out that South Korean students show more respect to teacher authority and rarely complain to their teachers directly. Both American and South Korean participants also described the similarities that they realized regarding student attitude. They mentioned that low motivation and getting bored because of lack of engagement in the class activities were commonly found behavior issues in both countries: "American students feel free to express their opinions even though it is pretty inappropriate. However Korean students mostly feel difficult to complain to their teachers in a direct way. Korean students are more respectful to authority. American students are more actively involved in class; they ask questions and answer their teacher, but Korean students often do not ask questions."

While participants identified both differences and similarities between the classrooms in America and South Korea, they also perceived that the classroom cultures were part of the overall culture of each country. Hence, overall cultural differences in differently perceiving emotional expressions and age in each country might be reasons for classroom culture differences:

"Cultural differences make the differences within the schools. Also, both cultures value education differently. Students in both countries are at different comfort levels with their teacher South Korean students hide their emotion well"

"It's because of the culture. South Korean matters age problem. Younger people should be very polite and expressing their opposite opinion to older people is considered rude. However, in American culture, they've been encouraged to express their opinion"

Perceived Benefits of the Collaborative Design Studio Experiences

All three American participants and 10 South Korean participants indicated that their understanding of two classroom cultures was highly improved after participating in the design studio activities for virtual classroom simulation. They all mentioned certain activities were especially helpful such as group discussions, story sharing, creating problem behavior scenarios, virtual student character design, and virtual classroom design. Majority of participants considered that the design studio activities helped them

ponder about the classroom cultures and different student personality and actions in each culture. By creating the classroom scenarios and virtual students, they actively engaged in the cultural situation; then, it helped them increase mutual understanding of the cultural gaps and similarities. The design and developing virtual classroom scenarios also helped them to be immersed in the classroom situation. The collaborative works facilitated their understanding of the cultural differences in school settings. The analysis of data produced two major themes: 1) interpersonal discussion activities and 2) design and development of virtual scenario activities.

Social Engagement Although all participants expressed the high benefits of design studio activities, American participants particularly emphasized that the group discussion activity was the most helpful activity for them, while South Korean participants perceived that the design and development of virtual classroom simulation was more helpful. All three American participants mentioned "conversation," "working together," "interaction with group members," and "discussion" as the most helpful activities for cultural understanding. In addition, they all shared their enjoyment of talking with group members, creating scenarios through group discussions, and collaborating to accomplish the given design tasks. It was interesting that identifying the differences was a critical factor for the participants to be involved in further discussions. The shared perception of differences played a crucial role in keeping the design studio joyful to engage.

"I believe the workshop presented situations to cause conversations about classroom cultural differences between Korea and USA. Allowing us to work together and work on projects facilitated our understanding of the different cultures. The VR aspect was not important, but beneficial. The interactions between the group members were the most important"

"When we had discussion about the scenarios, we were able to discuss the similarities and differences. We discussed topics such as punishments, parenting, teenage culture, etc"

Tangible Experience Although South Korean participants also perceived the benefits of group discussions to learn about American classroom culture, they also highlighted the design and development of virtual student characters and virtual classroom as being more fun and beneficial for them.

"It was quite interesting to realize some similarities and differences between USA and South Korea classrooms. I think the scenario development was very helpful for us to think deeply about our own classrooms. Designing a

virtual student was a unique way of understanding classroom differences because we had to think about the personality of the student and how he would act/react in the classroom"

"Working with American students, I was able to learn that instant punishment often does not occur in American classrooms for students with behavioral problems, and the types of considered behavioral problems are different from those in South Korea. It was new to me that even a student showed a problem behavior, they are punished differently depending on their classroom cultures"

The development of the virtual classroom was helpful for South Korean pre-service teachers to visualize how the classroom could go in a school setting. Mainly, when a classroom scenario was created visually by providing narrations and gestures of the virtual students, South Korean pre-service teachers seemed to be more comprehensive in the context. Although some South Korean participants have better linguistic competencies than others, English was a significant barrier to discussions with the American participants.

"I most liked the design and development of the virtual classroom using the collaborative scenario we designed. We were able to discuss various topics such as students' personalities and how teacher react to students' behavioral problems while creating virtual characters and recording our own voice to generate conversation between virtual characters"

The design activities seemed to refine the discussions, and South Korean participants were able to easily engage in the activities. The participants were not aware of much of each other's classroom cultures prior to participating in the design studio activities. But after completing the activities, they were able to understand America classroom and South Korea classroom culture, and how to practically utilize the virtual simulation to promote the cultural understanding.

Discussion

The design studio activities for virtual simulation were initiated with a goal to improve both American and South Korean pre-service teachers' understanding of each other's classroom cultures by participating in group works and hands-on design/development activities. While the design studio was only five-days long, the intended goal was achieved as shared in participants' reflections and design outcomes. All participants noted the high value of the design studio experiences, especially through communications within groups and design/development activities. Regarding the benefits of design studio activities, the results showed that American participants valued interpersonal

communication and group discussions more than hands-on design/development activities. On the other hand, South Korean participants shared that they learned more from the design/development activities of virtual students and classrooms.

The findings of this study imply that American pre-service teachers and South Korean pre-service teachers use different approaches to understand each other's cultures. For example, American pre-service teachers tried to understand classroom culture by sharing stories and cases while South Korean pre-service teachers preferred to create artifacts to present their understanding of classroom culture. Also, the design and development components in the design studio activities were perceived more beneficial to South Korean pre-service teachers. The difference could be explained by the concept of high versus low-context cultures (Hall 1976). Kim et al. (1998) empirically showed South Korea as a high-context culture and the United States as low-context. They defined "communication" as one of the main aspects that differentiate high-context cultures and low-context cultures and found that low-context cultures required more detailed and explicit communication than high-context cultures.

The findings were linked to the language and technology skills between the two groups of pre-service teachers. For South Korean participants, language was a barrier that led them to somewhat limited communication with American participants. We often observed that South Korean participants experienced challenges in speaking in English because most of them had no prior experiences in interacting with American peers. Some South Korean participants reported that they felt challenged when discussing in English, but they tried to communicate through Google Docs (for shared writing). Eventually, group members were able to understand each other better as they became friends. All participants reviewed the created scenarios and considered how the scenarios could be played in the virtual environment. Yet, due to the complexity of designing virtual student characters and virtual classroom, American participants reported challenges in terms of using computer programs and creating virtual students/classrooms. Since the design studio was their first experience in using 3D modeling programs, they considered it very hard to follow and difficult to use. They shared that South Korean participants and the lab staff helped them understand how to use program functions to design virtual students/classrooms.

This study has some limitations. Due to the practical constraints, only a small number of participants were included in the study. Readers need to be aware of the extent to which the findings about pre-service teachers' experiences in this study can be generalized. Future study will need to consider using an equivalent number of participants from both countries for more comprehensive views of the design studio activities. In addition, all participants indicated that language and technological skills were two challenges in completing the design/development activities. The perceived challenges might have influenced their perception of the design studio activities. It will be necessary to minimize the potential obstacles by offering communication and technology training sessions before beginning the design studio activities. Lastly, the design studio was offered only for five days, 3.5 h per day. It is possible that five days were not enough to overcome language and technical skill challenges. To maximize the design studio outcomes, participants need to have more time to discuss and create virtual students/classroom scenarios.

Conclusion

The goal of the design studio was to create culturally contextualized virtual teaching scenarios, and this paper presented a case of designing classroom management scenarios through the collaboration between pre-service teachers from South Korea and USA. It was an initial attempt to address the cultural differences and diversity awareness in designing the culturally-responsive virtual teaching simulation. There are several lessons learned from this study. First, it was found that the international collaboration approach added cultural context to the design of virtual simulation scenarios. For example, through the discussion and social engagement, pre-service teachers from each country were able to identify and create realistic virtual simulation scenarios based on their own experiences. In addition, the collaborative design studio offered opportunities for all participants to understand each other's cultural differences and similarities.

Based on the present works, the researchers plan to improve the design studio activities in two aspects. First, to promote active participation of all pre-service teachers, an orientation session will be offered prior to beginning the main design activities. The orientation session will include effective communication skills and technology training sessions to minimize any possible challenges participants might experience. Second, the researchers will also work with pre-service/in-service teachers to review each of the developed scenarios and ensure they are realistic, authentic, and practical for use in pre-service teacher training. The confirmed scenarios will be integrated into the SimTEACHER platform for the final deployment.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Conflict of Interest Sanghoon Park declares that he has no conflict of interest. Jeeheon Ryu declares that he has no conflict of interest. Kristen McChesney declares that she has no conflict of interest.

Appendix

Table 3   Open-ended reflection questionnaire

Please respond to the following questions based on your design studio experiences during the last five days.

1. How much did you know about the classroom culture in South Korea (or America) before participating in this culturally collaborative design studio?

2. How much did you know about the virtual character design and development before participating in this culturally collaborative design studio?

3. What cultural differences did you find between the classrooms in South Korea and USA? Why do you think there are such differences?

4. What cultural similarities did you find between the classrooms in South Korea and USA? Why do you think there are such similarities?

5. Was this culturally collaborative design studio helpful to understand classroom cultural differences between South Korea and USA? How?

6. What parts of this culturally collaborative design studio did you particularly like or enjoy?

7. What did you find frustrating while participating in this culturally collaborative design studio?

8. How did you overcome the frustration or challenges?

9. Have you changed any ideas you used to have on Korean classrooms (American classrooms) after this culturally collaborative design studio?

10. What would you suggest us to change in this culturally collaborative design studio when we offer it next year?

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