

The Formative evaluation of VR-based Teacher Education Simulation: SimTEACHER

Kukhyeon Kim (Chonnam National University)*

This study aims to develop effective VR-based teacher education simulation through formative evaluation. VR-based teacher education could be a tool to train strategies to handle challenging classroom situations. For this purpose, following three steps, we will validate the design and contents in the VR-based teacher education simulation. First, the scenario will be vilified by in-service teachers. Second, the simulation design will be revised based on the focused group interview. In the last step, we will collect the perception of users' intention to use based on the TAM model questionnaire. Based on these three steps, the design and the content of the VR-based teacher education simulation could be validated.

Keywords: Formative evaluation, VR Simulation, teacher education, TAM, Focused interview

* First author, Dept. of Education, College of Education, Chonnam National University(kukhyeon8@gmail.com)

1. Necessity and purpose of the study

Recently, the types of students' emotional and behavioral problems have been diversified, and the problems have also been increasing. Students' emotional and behavioral problems are revealed as problem behaviors in school. If teachers fail to respond appropriately to sudden student problem behaviors of students in the classroom, the problematic behavior may escalate and lead to a more challenging situation. In addition, it could result in a loss of authority and respect from students, which decreases the teachers' sense of efficacy. Furthermore, it could disrupt learning and decrease students' engagement, which leads to poor academic performance. Therefore, it is necessary for teachers to know the types of student problem behaviors and have the professional competency to mediate these problem behaviors.

Simulation-based training is an effective method used to teach and evaluate complex skills (Kelleci & Aksoy, 2021). Simulation-based learning is efficient in human resource development because it enables training in dangerous or non-popular situations and expensive training at a relatively low cost (Harris, Wilson & Vine, 2020). Accordingly, in teacher education, classroom simulation is applied as a tool for preservice teacher training (Kaufman & Ireland, 2016). In a situation where face-to-face classroom practice has become difficult such as the COVID-19 pandemic, classroom simulation can be an effective alternative for teacher education (Kelleci & Aksoy, 2021). In a virtual reality drama method, several student avatars appear in the virtual reality classroom environment. The virtual avatars demonstrate the problem situations implemented in advance, increasing the user's sense of immersion in the problem (Kim et al., 2017).

To verify the effectiveness of the simulation, the problem scenarios should be likely to happen in real situations. To identify the reality of the scenario, it is necessary to review the simulation feasibility by experts. An expert refers to a person who has relevant knowledge through experience (Kim, 2013). Experts have insightful knowledge accumulated through various experiences in the field, so they can make judgments by considering more diverse points of view than beginners in the same situation (Stahnke et al., 2016; Stahnke & Blomeke, 2021). In addition, the ultimate target users' opinion is also important to identify if the developed simulation could be used in the future. Thus, usability evaluation of experts and ultimate users is necessary to develop an effective and efficient simulation.

In-service teachers are experts in examining the validity of problem situations provided by classroom simulation. This is because in-service teachers have experience and knowledge about classroom

management during class through many class experiences. So, in-service teachers can quickly judge problem situations that occur during class and make effective decisions based on professional insight (Wolff, van den Bogert, Jarodzka, & Boshuizen, 2015). In-service teachers' perception of the suitability or reality of the scenario in the classroom simulation is important in determining the effectiveness and necessity of the developed classroom simulation. If an in-service teacher evaluates that the scenario and usability of the classroom simulation adequately reflect realistically the problem situation during class and expect the simulation could be useful for improving classroom management skills, it could be judged that it is appropriate as a classroom simulation for pre-service teacher education.

Pre-service teachers also have intuition about the effectiveness of the simulation as target users. They have the need to use classroom simulation and have high relevance to it. They could judge the final intention to use this simulation based on the system's quality, information, service, and attractiveness. According to Technology Accepted Model (TAM), the target users' perceived usefulness and ease to use could influence their attitude toward use, intention to use, and actual usage (Alkhawaja et al., 2022).

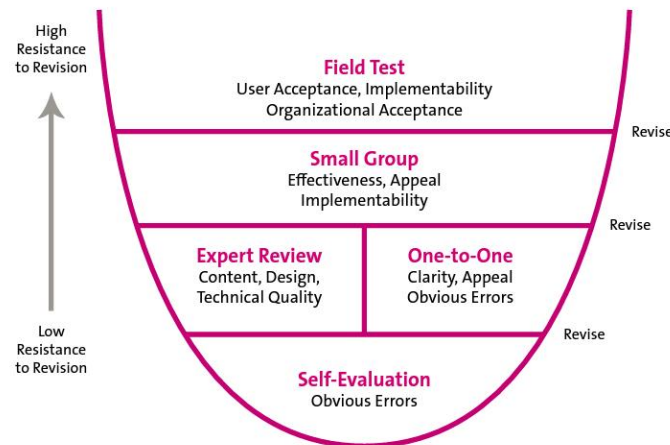
The benefits of virtual classroom simulation platforms have been studied in the teacher education area (Gregory et al., 2015; Ledger, 2021; Bondie, Mancenido & Dede, 2017; Medula, 2017). The virtual classroom simulation environments provide real-life phenomena and the users could practice strategies and skills without having any bad influence on real students (Kwaulitch & D'Alba, 2019). There are developed classroom simulation platforms, which include Second Life (Gregory & Bannister-Tyrrell, 2017), Mursion (Dalinger et al., 2020), SimSchool (Tyler-Wood et al., 2017), and TeachLivE (Dieker et al., 2017). These simulations could facilitate pedagogies of practice based on educational theories (Estepa et al., 2018). Although all the classroom simulations revealed practical tools to practice for pre-service teachers, the culturally different scenario could be unsuitable for the Korean classroom environments.

Cultural differences could influence the virtual presence. Pre-developed virtual classroom simulation background is quite different from Korean classroom environments. In the study about designing culturally-responsive virtual classroom simulations, the participants recognize the different classroom cultures that emerged from their responses on classroom management and student attitude (Park et al., 2019). In addition, culturally different visual information such as the appearance of virtual student avatars and classroom backgrounds could impede the pre-service teacher's immersion in the virtual classroom training situation. Thus, to enhance the effectiveness of simulation-based learning, visually and situationally culture-proper information needs to be provided.

This study is designed to develop a virtual reality teacher education simulation based on the formative

evaluation method. The instructional design for teaching and learning could be improved by the application of a formative evaluation examination. Tessmer (1993) suggested many possible formative evaluation methods (see figure 1). Dependent on the research goals, formative evaluation designs could be chosen. An expert review or focus group is appropriate to check the content and technical quality. A small group evaluation is effective and appeals to the implementation ability.

Figure 1. Tessmer(1993) (from Nieveen, N., & Folmer (2013))



This study proceeds following three steps for formative development. In the first step, the scenarios' usefulness with a small expert will be reviewed and modified. In the second step, the simulation will be modified based on the usability interview with one-to-one interaction. In the final step, we will check the target users' intention to use the virtual classroom simulation in a small group. This study is an initial stage to develop Korean culture-based virtual classroom simulation. This study's results could lead to conducting empirical studies to identify how pre-service teachers engage with tasks and learn in virtual classroom environments.

The purpose of this study is to evaluate VR-based simulation formatively to develop an effective simulation: SimTEACHER. For this purpose, the following research questions were derived.

What are the in-service evaluations in SimTEACHER on scenario usefulness?

What are the in-service and pre-service teachers' perceptions of SimTAEHR on effectiveness?

What are the pre-service teachers' perceptions in SimTEACHER on their intention to use the simulation based on the Technology Accepted Model?

Method

1. Participants

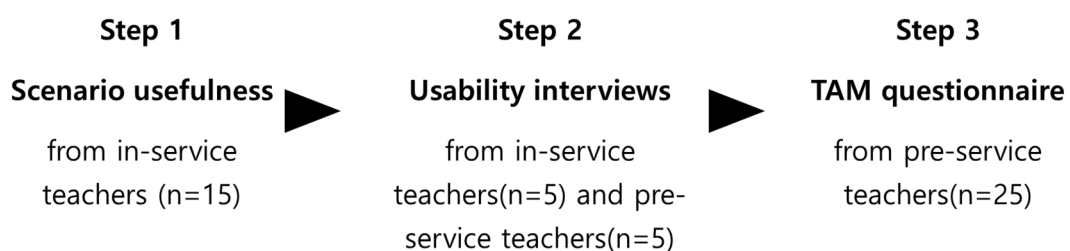
In the first step, scenario usability is targeted to the in-service teachers, and the anticipated number of participants is 10 in-service teachers. In-service teachers are teachers who have over five years of field experience in teaching in the school.

In the second step, to investigate the effectiveness of the simulation, pre-service teachers' and in-service teachers' opinion is critical in improving the simulation design. About five pre-service teachers and five in-service teachers will be recruited to do an interview.

In the third step, the pre-service teachers' perceptions will be used to identify the target users' perception of TAM. Twenty-five pre-service teachers are needed because this is a survey questionnaire. A pre-service teacher is an undergraduate student who does not have field experience in the school.

The Snowball method would be used to recruit in-service teachers because it is hard to recruit in-service teachers in the public documents or process. Pre-service teachers would be recruited voluntarily by advertising recruitment notices on the university website for random sampling.

Figure 2. Three steps for formative development



2. Instruments

Figure 2 shows the instruments and participants in three formative development steps.

Scenario usefulness

Scenario usefulness is done to evaluate how useful a scenario related to a student's problem behavior is perceived as useful in a virtual classroom simulation. This questionnaire was used by partially modifying the terminology of the measurement questionnaire used in the previous study (Park & Nam, 2012). This questionnaire consists of a total of six items on a 7 Likert scale.

Usability interview

The questionnaire was adopted by Waterlander et al. (2011). The items included questions that asked for the overall ease of understanding of the software, and the ability to easily navigate the virtual environments. It also included open-ended questions that were designed specifically for this study. Participants were asked to express their initial thoughts, report aspects of the simulation that frustrated them and offer final comments and improvements.

TAM

The questionnaire for TAM is focused on the VR experience. Sagnier et al. (2020) studied user acceptance of Virtual Reality. This TAM item included 'presence, cyber sickness, realism' that is added to traditional TAM items.

3. Data Collection

Scenario usefulness

The researchers will email the participants with the questionnaire and its explanation, and then, the participants will email back in a week. The total number of scenarios is 15.

Usability interview

The researchers will interview the participants after they experience the VR classroom simulation.

TAM

The participants will experience the three scenarios of VR-based classroom simulations for 10–15 minutes and then the survey will be conducted.

4. Data Analysis

Scenario usefulness

The scenario will be revised based on the comments of the in-service teachers.

Usability interview

This recorded audio data will be transcribed and coded into themes based on the researchers. Also, based on the advantages and disadvantages, the design and intervention of the simulation could be revised.

TAM

SPSS would be used to analyze the data to identify the mean score and standard deviation; only descriptive analysis would be used.

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