

Pre-service Teachers' Growth in Epistemic Cognition through Learning Pedagogical Knowledge

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Abstract: This study examined pre-service teachers' growth in epistemic cognition by learning pedagogical knowledge. We evaluated whether pre-service teachers could describe a classroom practice's aim, processes, and ideals coherently by referring to the pedagogical knowledge they had learned in a course on learning theories. The results suggested that they did not necessarily recognize that aims, processes, and ideals should be coherent as components of the lesson.

Background and Research Purpose

Many studies in recent years have focused on how teachers promote adaptive epistemic cognition. Epistemic cognition is important for teachers to reflect on existing teaching practices and improve them (Lunn Brownlee et al., 2017). Barnes and Fives (2020) investigated in-service teachers' epistemic cognition as the teachers evaluated students' classroom assessments and revealed that the components of epistemic cognition, including *epistemic Aims and value, epistemic Ideals, and Reliable processes* (Chinn et al., 2014), emerged in these teachers' assessment processes. However, the teachers rarely justified the reliable processes by citing a source to support their use. Accordingly, preparing teachers to ground their decisions in scientific theories as well as in their own experiences and observations would be a critical focus in pre-service teacher education (Hartmann et al., 2021).

In line with these studies, this study examines whether understanding scientific theories about teaching and learning could promote pre-service teachers' epistemic cognition. We particularly focused on pre-service teachers' cognitive engagement in epistemic performance, identified as an aspect of apt epistemic performance (Barzilai & Chinn, 2018). The purpose of our research was to reveal pre-service teachers' growth in epistemic performance through learning pedagogical knowledge when they have epistemic aims to interpret one recorded lesson presented by video. As a reliable process for this task, we evaluated whether pre-service teachers can describe the lesson's aim, processes, and ideals coherently by referring to the pedagogical knowledge they learned.

Method

Course Description, Participants and Video-based Evaluation

The course that was used in this study comprised a three-day summer intensive course on the design of classroom lessons for 21st century skills. Eighteen university students took the course as part of their program requirements. The course comprised three modules, in which students learned knowledge-centered approach, collaborative learning, and self-regulated learning. Their activities in each module were designed as collaborative multiple text integration using Jigsaw method.

The same video was used to measure pre-service teachers' situation-specific epistemic cognition at the beginning and end of the course, which helped us evaluate their growth after taking the course. The video was a summary of a science lesson on weather and pressure. It was about eleven minutes long. In the video, an experienced female teacher taught eighth-grade students. The students watched the video twice and were asked to describe on their worksheets (1) what they noticed as aims of the lesson, (2) what they noticed as reliable processes, and (3) what they noticed as ideals. The evaluation procedure took about forty minutes in total.

Data Analysis

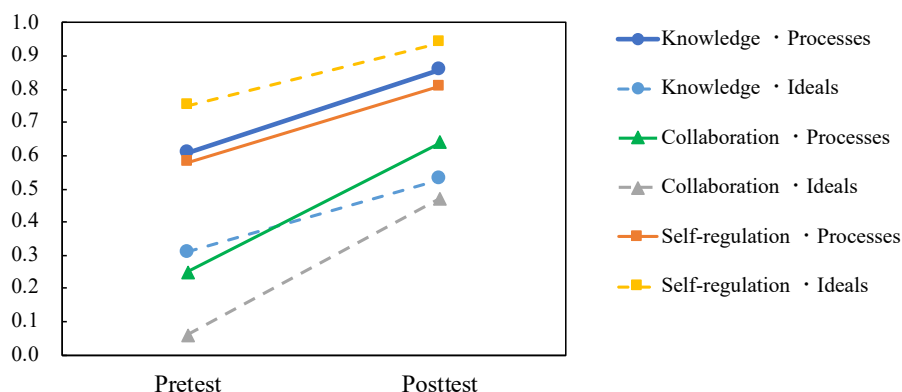
We developed a coding scheme to capture descriptions of the lesson's aims, processes, and ideals based on pedagogical knowledge that students could have learned through the three modules of our course. In terms of the lesson's aim, we assessed whether the overall goal of the lesson was described. For the processes and ideals, the descriptions were evaluated from the viewpoint of each of the three modules: knowledge-centered approach, collaboration, and self-regulation (1 point for each valid description, 0.5 point for partially valid description).

Results

Almost all students could describe the lesson's aim at the pretest (valid: eight students, partially valid: nine students), and at the posttest (valid: thirteen students, partially valid: four students). We analyzed whether the

students could describe the lesson's processes and ideals coherently. Figure 1 shows the average scores for the processes and ideals. We conducted a three-factor within-subjects ANOVA for each scale on time (pretest/posttest), modules (knowledge-centered/collaboration/self-regulation), and components (processes/ideals). Significant main effects were identified for the time factor ($F(1,17)=38.08, p<.001$), and module factors ($F(2,34)=13.67, p<.001$). The total average score increased from pretest to posttest, and multiple comparisons showed significant differences in the module factor (self-regulation > knowledge > collaboration, $p=.05$). Furthermore, a simple interaction effect between modules and components was found ($F(2,34)=5.09, p<.05$), and multiple comparisons showed significant differences in the knowledge module (processes > ideals, $p<.05$), in the process component (knowledge, self-regulation > collaboration, $p=.05$), and in the ideal component (self-regulation > knowledge, collaboration, $p<.05$). In the knowledge module, the results showed that the pre-service teachers did not necessarily examine the presented lesson from the viewpoints of both processes and ideals.

Figure 1
Results of the pretest and posttest



Discussion

The findings indicate that pre-service teachers learned to explain the lesson using supportive learning theories during our course. Regarding the knowledge module, they did not necessarily grasp that aims, processes, and ideals should be cohesive as lesson components and tended to focus on processes rather than on ideals. Thus, it was found that our course should be redesigned to support pre-service teachers' epistemic growth in the awareness of coherence among this component. Additionally, the background of those outcomes should be examined by further analysis of the process data, such as the recordings of group discussions or worksheets during our course. Finally, epistemic aims that our students may have had when performing the evaluation task should also be considered. Redesigning the course to promote metacognitive aspects of apt epistemic performance would be beneficial for educating pre-service teachers to explain and question classroom practices in order to improve as teachers and learners.

References

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