Challenges of Lesson Plan on Data and Chance with an Intervention of Video Analysis: Preservice Secondary Mathematics Teachers

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Abstract
The study aimed to investigate the effects of scaffolding on preservice secondary mathematics teachers' (PSMTs') lesson plans. A series of well-organized activities were conducted, which included design, peer discussion, video analysis, microteaching, and revision. The theme was on data and chance. Video analysis aimed to bring new comprehension of effective teaching for PSMTs. Semi-structured interviews were conducted with four PSMTs to collect data. Findings showed that PSMTs faced lesson planning challenges because of a lack of content knowledge and pedagogical content knowledge in data and chance. As for the lesson plan before video analysis, the challenges included predicting students' behavior and estimating the time needed in teaching. After video analysis, they showed their efforts to pursue effective teaching when reflecting and revising their lesson plans. The findings suggested that video analysis benefits PSMTs' awareness of some features of effective teaching. Yet, more scaffolding is needed in supporting their noticing, reasoning, and the pursuit of interactive teaching involving the design of activities.

Keywords: Preservice Teachers, Lesson Plan, Video Analysis, Effective Teaching

Introduction

Ball, Thames, and Phelps (2008) proposed the importance of pedagogical content knowledge, which is knowledge of content and students as well as knowledge of content and teaching. Video analysis is a pedagogical tool to support teachers in noticing and reflection, which may benefit the development of CK and PCK (Karsenty & Arcavi, 2017; Star & Strickland, 2008). Our study is interested in employing video analysis to support preservice secondary mathematics teachers (PSMTs) in lesson planning. Additionally, peer evaluation benefits reflection in teacher preparation and thus improves the quality of the lesson plan (Etscheidt, Curran, & Sawyer, 2012; Ozogul, Olina, & Sullivan, 2008). Therefore, we anticipate PSMTs may benefit from both video analysis and peer evaluation.

Referred to literature, PSMTs faced at least three kinds of challenges in statistics teaching: lack of content knowledge, lack of pedagogical content knowledge, and lack of confidence in statistics teaching with and without technology use (Lovett & Lee, 2017). Task analysis, modification, and design are paramount in mathematics teacher training. PSMTs may find more challenges in task modification and design than in task analysis (Lim, Song, & Kim, 2018). Similarly, PSMTs may encounter many challenges of lesson plans, including task modification and design on data and chance. Considering the effects of video analysis and peer evaluation on lesson plans, we investigated PSMTs' challenges of lesson plans on data and chance before and after peer evaluation and video analysis. Therefore, we will explore the following research questions:

1. What challenges do preservice secondary mathematics teachers (PSMTs) encounter in designing a lesson plan on data and chance?
2. What challenges do preservice secondary mathematics teachers (PSMTs) encounter in peer evaluation?
3. What challenges do preservice secondary mathematics teachers (PSMTs) encounter in video analysis?

Method

Twenty-nine PSMTs enrolled in a teaching methods course at a university located in the capital city of Taiwan. The course had two contact hours per week over 18 weeks. The objectives of the course were understanding the curriculum, analyzing textbooks, and designing lessons. The practice of the lesson plan lasted for three weeks. In the first week, PSMTs set learning objectives and transformed their CK and PCK into a 20-minute lesson plan on statistics. After that, they did peer evaluation, which aimed to facilitate reflection and assessment of effective teaching. In the second week, PSMTs worked in small groups on video analysis to bring new comprehension of effective teaching practice. After that, PSMTs did a whole group class discussion on what they noticed and reflected. In the third week, PSMTs did micro-teaching and lesson revision with other PSMTs of the same small group. A semi-structured interview was conducted with four selected PSTs on their challenges and gains when planning and revising lessons one week later. The interview lasted about 40 minutes for one PSMT. These four PSMTs' lesson plans and responses to the interview tasks constituted the study's data sources.

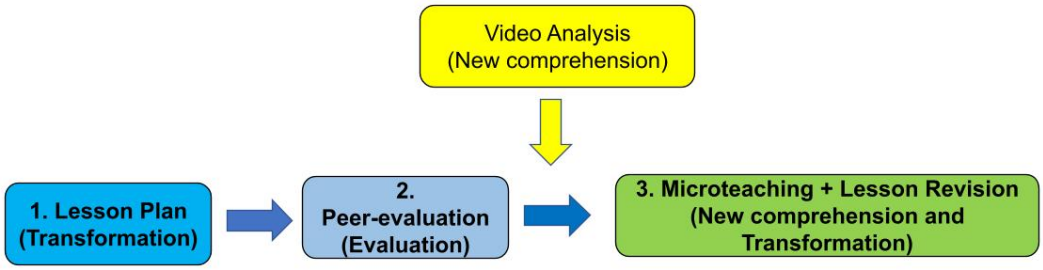

Figure 1: A Framework of Using Video Analysis to Prepare Psmts for Lesson Plan

Results

PSMTs encountered different kinds of challenges in various activities. The main challenge in the lesson plan is transforming the knowledge of content, students, and teaching for predicting students' responses and estimating reasonable teaching time. In peer evaluation, PSTs encountered challenges in proposing critical feedback for each other's lesson plan because of not knowing the features of good teaching. In video analysis, PSMTs displayed weakness in CK and PCK, which may diminish the influence of video analysis on lesson plans and revision. In lesson revision and micro-teaching, PSMTs felt it challenging to integrate the learning of video analysis and peer evaluation into lesson revision. It may be due to a lack of understanding of students' cognition in data and chance and the desire or capability to pursue interactive teaching.

On the other hand, PSMTs learned a lesson on effective teaching from different activities. Two of the four PSTMs used information and communication technology (ICT) to teach more effectively from the lesson plan. PSTMs evaluated the feasibility of their peer's lesson plans and reflected on their teaching from peer evaluation. From video analysis, PSTMs viewed activity-based learning as an efficient entry to develop concepts and noticed some features of effective teaching, such as teacher-student interaction. As a result, two of the four PSMTs revised their lesson plans for more effective teaching. In sum, peer evaluation and video analysis encouraged PSMTs to critically reflect on their lesson plans and recognize some features of effective teaching.

Conclusion and Suggestion

The investigation explored PSMTs' challenges in the lesson plan and found PSMTs' lack of confidence in predicting students' behavior. Though analyzing video analysis brought new comprehension of effective teaching, it didn't push all the PSMTs to revise their lesson plans or guarantee the success of the new transformation. The result may be due to PSMTs' overstress on time efficiency and lack of motivation to pursue interactive teaching. Thus, PSMT may need more scaffolding in noticing and reflecting on the features of interactive teaching (Lee, Lee, & Park, 2019), which may bring about a new transformation in the pursuit of effective instruction.

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