Microteaching for Pre-service Science Teachers during the COVID-19 Pandemic: A Theoretical Framework

Zeni Haryanto[1]*, Nurul Fitriyah Sulaeman[1], Atin Nuryadin[1,2], Pramudya D.A. Putra[3]
Shafira Aulia Putri[1], Annisa Zahra Rahmawati[1]
[1]Physics Education Program, Mulawarman University
[2]Graduate School of Sciences and Technology for Innovation, Yamaguchi University
[3]Science Education Program, University of Jember

Abstract

Teaching has a unique complexity that intertwines the ability to deliver information and the information itself. While the terminology of teaching is specifically used for teachers, developing teaching ability is well-known through microteaching classes for pre-service teachers that were initially conducted at Stanford University in 1966. On the other hand, the COVID-19 pandemic forces the pre-service science teacher program to switch from face-to-face to an online system. Therefore, the specific framework of microteaching for pre-service science teachers as an adaptation to the need of online teaching is essential to be explored deeper. Our research conducted a literature review on articles in various educational databases, journals, and books. This paper outlines the coherence in microteaching during the pandemic, TPACK for pre-service science teachers, and a conceptual framework for microteaching for pre-service science teachers during the pandemic.

Keywords: Microteaching, Pre-service Science Teacher, Theoretical Framework

1 Introduction

Since the well-known sentence "The one who can, does; he who cannot teach" has been clarified, there is a constant need to ensure teacher professional knowledge (Shulman, 1986). This central issue was also growing in line with the transformation of teacher knowledge, especially its relationship with technology (Fransson & Holmberg, 2012). This concern also emphasizes that the pre-service teacher program needs to focus on developing the knowledge and skills to prepare future teachers. Earlier with this concern, a pre-service teacher program has developed a course called "microteaching" (Fortune et al., 1967). The relation between developing essential skills for pre-service teachers and microteaching courses became a central issue (Arsal, 2014; Diana, 2013; Onwuagboke et al., 2017). Microteaching activity provides the opportunity for the pre-service teachers to transform their knowledge into a mini teaching experience.

The development of technological-pedagogical-content-knowledge (TPACK) consists of three single domains: technological knowledge, content knowledge, and pedagogical knowledge (Mishra & Koehler, 2008). The uniqueness of content plays one of the important elements. The development of TPACK in pre-service science teachers is essential to explore (Efwinda & Mannan, 2021a) due to the nature of science itself (Bayram-Jacobs et al., 2019). Unfortunately, in the specific science content such as energy, content knowledge of pre-service science teachers is not satisfied (Putra & Kumano, 2018).

During the COVID-19 pandemic, reflection on the urgent need to emphasize the technological knowledge supporting science teachers strongly appears (Campbell et al., 2021; Reiss, 2020). Theoretical frameworks are critically important to all research, especially in science education, to justify the importance and significance of the work (Lederman & Lederman, 2015). This study investigates the framework of microteaching for pre-service science teachers during the COVID-19 pandemic. The framework is beneficial to direct the microteaching course in line with the knowledge and skills during the online classroom that is essential for the pre-service science teacher.

2 Methodology

Literature about microteaching was Qualitative-Philosophical (QualPhil). This literature was studied to develop a theoretical framework of microteaching for pre-service science teachers during the COVID-19 Pandemic. QualPhil is a pragmatism-grounded approach that blends qualitative and philosophical research approaches (Mpofu, 2019). The knowledge on microteaching was drawn from different sources and perspectives in literature, and ongoing research works. Finally, the framework model was developed by linking main categories (themes).

3 Results and Discussion

3.1 Seeking coherence in microteaching during COVID-19 pandemic

Much ambiguity still surrounds microteaching, its adaptation and implementation during the pandemic. Generally, microteaching is a course that is supposed to be taken by pre-service teachers in the third year of their four-year program. The course is taken after the pre-service teachers complete their pedagogy and content courses. Since it was introduced at Stanford University in 1963(Fortune et al., 1967), microteaching is a compulsory course that scales down the total classroom teaching activity complexity. In microteaching, the duration is shorter, and the number of students is reduced. The pre-service teachers take turns to be a teacher and students. Microteaching aims to identify teaching behaviour as observable skills and the development and measurement of appraisal instruments (Spelman & St. John-Brooks, 1972). The teaching skills develop continuously with the needs of modern education. In this fast-changing world, the roles and expectancies of teachers are constantly evolving as they face the challenges of new skills requirements, technological developments, individualized teaching, special learning needs, and increasing social and cultural diversity (Peng et al., 2014).

The critical stages of microteaching are planning, implementation, and reflection (Elias, 2018; Kilic, 2010). The reflection stage is less utilized even though it is identified as a crucial stage (Karlström & Hamza, 2019). On the other hand, the COVID-19 pandemic forces to shift the microteaching class from traditional to online. The utilization of video becomes commonly used during microteaching. Additional skills are required for the pre-service teacher to conduct the online microteaching classroom.

3.2 TPACK for pre-service science teachers

Teachers are entrusted with more than just comprehending the links between content and pedagogy as technology continues to permeate educational institutions and surroundings (Swallow & Olofson, 2017). There are three fundamental components at the heart of successful technology-enhanced teaching: content, pedagogy, and technology, as well as the interactions within and between them. The interactions between and among the three components, which play out differently in different situations, explain the significant differences in the degree and quality of educational technology integration seen (Koehler & Mishra, 2009). The TPACK framework extends Shulman's definitions of PCK to describe how instructors' understanding of educational technologies and PCK interact with one another to generate successful technology-assisted instruction (Efwinda & Mannan, 2021; Koehler & Mishra, 2009; Mishra, 2019). However, while the TPACK hypothesis is intriguing, additional research into the link between these areas is required before the curriculum is redeveloped (Archambault & Barnett, 2010). Researchers concentrating on the framework's theoretical underpinnings have focused on whether the overlapping components of knowledge in the framework are better characterized as integrative, where the domains of knowledge in the TPACK framework are separate or transformational (Rosenberg & Koehler, 2015).

There are three main components of teachers' knowledge: content, pedagogy, and technology. Equally important to the model are the interactions between and among these bodies of knowledge, represented as PCK, TCK (technological content knowledge), TPK (technological pedagogical knowledge), and TPACK (Koehler & Mishra, 2009). Teachers' content knowledge (CK) is their understanding of the subject matter to be learnt or taught (Koehler & Mishra, 2009). The information provided in middle school science differs from the stuff covered in an undergraduate astrophysics course. Therefore teachers must be well-versed in their subject matter. Pedagogical knowledge (PK) refers to instructors' in-depth understanding of the processes and practices or strategies of teaching and learning. Understanding how students learn, basic classroom management abilities, lesson preparation, and student evaluation are all examples of generic knowledge (Koehler & Mishra, 2009). Acquiring technological knowledge (TK) enables a person to do a wide range of activities utilizing information technology and devise novel approaches to completing a particular work. This view of TK does not postulate an "end state" but rather views it growing across a lifetime of creative, open-ended engagement with technology (Koehler & Mishra, 2009). The other three cores combined result in four additional knowledges. The knowledge about specific teaching practices that appropriately fit the nature of particular subject content is known as pedagogical content knowledge (PCK). Technological pedagogical knowledge (TPK) is the knowledge about standard technologies' existence, components, and capabilities that could be appropriately used to support teaching and learning processes and practices. The understanding of how genuine subject matter knowledge may be transformed into suitable representations via standard technologies is known as technical content knowledge (TCK). The most integrated one is the knowledge about how the transactional relationship between knowledge about the content (C), pedagogy (P), and technology (T) was dynamic in order to develop appropriate, context-specific strategies and representations for better learning of content knowledge (TPACK) (Srisawasdi, 2012). Moreover, science has a specific framework to follow. The scientific framework consists of content knowledge, procedural knowledge, and epistemic knowledge (OECD, 2019). Therefore, the content of science plays a unique role to build TPACK in pre-service science teachers.

To adapt the digitalization, teachers must integrate technology into their classroom instruction to prepare students for a digitalized future. As a result, it is commonly suggested that pre-service teachers should obtain subject-specific professional expertise about technology integration to assist the learning of their future students (Lachner et al., 2021). It only makes sense that pre-service teachers are demanded to have TPACK skills (Turmuzi & Kurniawan, 2021). Pre-service teachers with strong TPACK abilities have a better probability of completing their programs and becoming well-polished instructors who can understand their subject matter extensively and thoroughly (Koyuncuoglu, 2021; Santika et al., 2021).

3.3 The conceptual framework for microteaching for pre-service science teachers during the COVID-19 pandemic

Our framework proposes that online microteaching needs to preserve the three core stages of traditional microteaching: plan, teaching, and reflection. We presented the need to clarify the TPACK components written in the lesson plan measured by the Guttman scale (1 = observable and 0 = not observable). The group reflection of the lesson plan opens the opportunities to share and discuss among a small group of pre-service science teachers. After the reflection, they may revise their lesson plan if it is needed. The implementation stage is an online microteaching classroom with a duration between 15 – 25 minutes. The teaching videos became the main source of the second reflection stage. After having experience of planning, reflection and teaching implementation, the TPACK components that showed through the video should be observable through more specific level. We proposed Likert scale could be used in the video observation sheet.

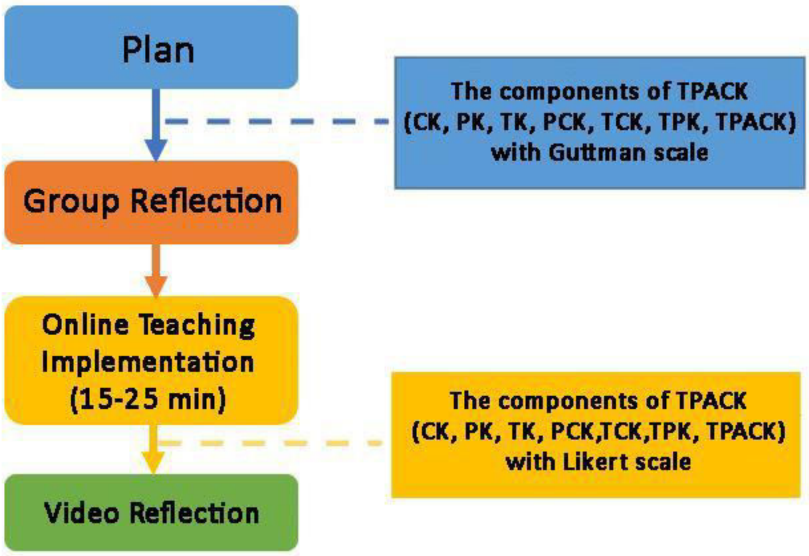

Figure 1. Conceptual Framework of Microteaching beyond Pandemic

4 Conclusions

Our framework proposes that online microteaching for pre-service science teachers consists of4 main stages: planning, group reflection, online science teaching implementation, and video-based reflection. We proposed the need to clarify the TPACK components written in the lesson plan measured by the Guttman scale. Moreover, the TPACK components that showed through the video should be observable through the Likert scale.

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