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HPM Lesson Development in the Context of Professional learning Community: A Case Study in Chinese Senior High School

Abstract

Considerable work has been done over the last 15 years on how to integrate the history of mathematics (HM) into mathematic education (ME) (Clark, Kjeldsen et al., 2016), and there are various classifications of approaches (Tzanakis, Arcavi et al., 2000; Jankvist, 2009). However, integrating HM into ME from the perspective of teaching research system has been less researched. In mainland China, a teaching research system has been practiced nationally since the 1950s, the core components of Chinese teaching research activities are studying lessons including Keli (i.e., exemplary lesson) development, and public lessons. Both public lessons and Keli development are known as Chinese Lesson Study (LS) (Huang & Shimizu, 2016). Chinese LS is a form of school-based professional development that aims to update ideas of teaching and learning, to design new learning situations, and to improve classroom practice through Keli. Keli is a community-mediated process of developing an exemplary lesson, including the planning, delivery, debrief, revision and re-teaching of the lesson. This form is developed into a model known as action education (Gu & Gu, 2016). Unlike the West, China has a long history of collaboration between teachers (Wong, 2010). Recently, concepts like “Profession Learning Communities” (PLC) have flourished (Cheng & Wu, 2016). Hord defines PLC as “teachers in a school and its administrators continuously seek and share learning and then act on what they learn. The goal of their actions is to enhance their effectiveness as professionals so that students benefit”. So it is meaningful to research LS in the context of PCL in China. This presentation deals with the teaching research system that integrates HM into ME in the Chinese educational system, asks the question of what is the structure and character of PLC and how does a Chinese LS that integrate HM into ME works in the context of PCL.

By using the concept of Chinese LS and PLC, we construct the conceptual structure of teaching research system that integrates HM into ME in this research. We call the lessons that integrate HM into teaching as HPM lesson. We call The Chinese LS combined with HPM as HPM Lesson Study (HPMLS). The development process of HPMLS includes four stages and between the four stages, there are three reflections. The whole process is done by three teams, including school-based team, HPM research team, and teaching expert team, and each team has its own expertise. These three teams form a community, and it has the characteristics of PLC, so we call it HPM learning community (HPMLC). All concepts mentioned above constitute the conceptual structure of this research.

In this research, we use the research method of case study. We select one case of HPM lesson that integrates the history of conic sections into teaching practice. This is conducted in a Chinese senior high school. We use the module approach in this case (Jankvist, 2009), and integrate the history into the unit of conic section, which lasts two class periods. The participants include three teachers in senior high school, one teaching expert and the HPM research group. By analyzing the data of interview, instruction design, tapes and videos in the development process of this HPMLS, we can better explain what is the structure and character of the HPMLC and how does the HPMLS works in the context of HPMLC. Therefore, it can provide insights on how to conduct HPM lesson from the perspective of the teaching research system.

Two teachers in senior high school are responsible for implementing those two HPM lessons. The HPM

research group provides the historical material on conic sections. The teaching expert gives the recommendations for the implementation. Through the planning, discussing, implementing and analyzing, these two HPM lessons become two exemplary lessons.

History integrated in those two class period includes three classical geometric problems in ancient Greece, the three-line and four-line problems studied by Apollonius and Pappus, the derivation of the equation of an ellipse by L'Hospital and the British mathematician Wright in the 19th century, and the Dandelin spheres discovered by the Belgian mathematician Dandelin in 1822.

The first class period introduces three classical geometric problems in ancient Greek and let the students find the conic section through the problem of three-line and four-line. In the second class period Dandelin's spheres are used to define an ellipse and the students explore the methods to derive the equation of an ellipse.

References

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