

A STUDY ON THE GEOMETRIC MEANING OF THE DERIVATIVE FROM THE HPM PERSPECTIVE BASED ON THE “DUAL-CORRESPONDENCE PRINCIPLE”

Yunke Yue
Yanbian University
China
yueyunke103@126.com

ABSTRACT

The “General High School Mathematics Curriculum Standards (2017 Edition, Revised in 2020)” advocate that teachers “promote student learning through diverse teaching methods and enhance classroom effectiveness through precise and efficient teaching strategies.” Derivatives are a core concept in high school mathematics and a key focus and challenge in teaching. The concept of limits forms the foundation of derivatives. Neglecting to explore the concept of limits within derivatives is one of the reasons for difficulties in future higher mathematics learning. Fredenthal proposed the concept of mathematical recreation, arguing that understanding the historical context of related concepts helps teachers deeply grasp the concepts and design effective teaching strategies. Professor Tu Rongbao's “dual-correspondence principle” of mathematics education emphasizes the correspondence between mathematical knowledge, student cognition, and disciplinary knowledge, which is beneficial for guiding mathematics education research and improving classroom teaching effectiveness. This study adopts a History and Philosophy of Mathematics (HPM) perspective, following two main threads: “correspondence between teaching and learning” and “correspondence between teaching and mathematics.” drawing on the mathematical history of Liu Hui's method of inscribing circles and the development of tangents, to understand the transition from the static to the dynamic definition of tangents, achieving a leap from the finite to the infinite. It explores the correspondence of the “dual-correspondence principle” in the teaching design of the geometric meaning of derivatives, and discusses the unit teaching design of the geometric meaning of derivatives, with the aim of enhancing secondary mathematics teaching focused on improving subject-specific core competencies and providing new insights for teaching practice.

Keywords: The geometric meaning of derivatives; the “dual-correspondence principle” of mathematics teaching; HPM.