

**Lise Matematik Öğretmenlerinin Türevin Tanımına ve  
Türev-Süreklilik İlişisine Yönelik Pedagojik Alan Bilgileri\***

**High School Teachers' Pedagogical Content Knowledge on Definition of  
Derivative, and Relationship Between Derivative and Continuity**

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**Extended Summary**

**Purpose**

Unlike high school teachers, studies for pedagogical content knowledge were often examined with prospective mathematics teachers in the literature. In spite of taking course for the formation towards teaching profession and doing internship at schools during undergraduate education, prospective mathematics teachers do not gain experience sufficiently. Therefore, the informations obtained from the prospective mathematics teachers can't allow to be determined the pedagogical content knowledge in the context of subject matter knowledge of high school mathematics teachers. Thus, the present study was conducted with the teachers in the teaching profession in person and involved in the teaching process. The purpose of this study is to investigate high school mathematics teachers' pedagogical content knowledge in the context of subject matter knowledge on the definition of derivative, the visualization of the definition of derivative, and the relationship between derivative and continuity. The four sub-problems conformed with the overall purpose of this study are described as follows:

1. What are the efficacy perceptions of high school mathematics teachers for the subject matter knowledge on derivatives?
2. What are the levels of high school mathematics teachers to define derivative and give examples to derivatives from everyday life?

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3. What are the levels of high school mathematics teachers to visualize the definition of derivatives?

4. What are the levels of high school mathematics teachers to explain the relationship between derivatives and continuity?

### **Method(s)**

The case study design of the qualitative research models was used in this research. The research was carried out in a small-scaled city of the Black Sea Region of Turkey during the fall semester of 2015-2016 academic terms. The participants of the research were four mathematics teachers working in public high schools connected to the ministry of national education. The maximum variation sampling of purposeful sampling method was used when determining the teachers to join the study. The data collection tool was a semi-structural interview protocol developed by the researchers. The studies examining derivatives and pedagogical content knowledge were considered in the development process of the interview protocol. The research data was analyzed by content analysis. The researchers considered the framework specified by Zazkis and Leiken (2008) and then expanded by Gokkurt (2014) in the identification process under categories and encodes of the data obtained defining derivatives, giving examples to derivatives, visualizing the definition of derivative and explaining the relationship between derivatives and continuity.

### **Results**

When the high school teachers' detailed definitions to derivatives were examining, all teachers had necessary but not sufficient definitions for derivatives. When the teachers' detailed examples to derivatives from everyday life were examining, these examples have prototype features such as instantaneous change, rate of change and exchange ratio. All given examples by the teachers are included in the field of academical instruction and mathematics education books. However, the examples such as instantaneous change, rate of change given by O<sub>1</sub>, O<sub>2</sub> and O<sub>4</sub> teachers and again the examples such as exchange ratio given by O<sub>1</sub> are incomplete and not fully accurate examples. On the other hand, it is just an example of a non prototype given by O<sub>3</sub> teacher. When the teachers' detailed drawing examples for the definition of derivatives were examining, all examples drawn by the teachers are the prototype drawings included in the field of mathematics textbooks and academical instruction books. The drawings made by O<sub>1</sub> and O<sub>2</sub> teachers are related to the relationship between derivative and rate of change. The drawings made by O<sub>3</sub> and O<sub>4</sub> teachers are related to the relationship between derivative and slope. When the teachers' detailed views for the relationship between derivatives and continuity were examining, the statements made and the examples given by O<sub>1</sub> and O<sub>2</sub> teachers are at the sufficient level. Accordingly, O<sub>1</sub> and O<sub>2</sub> teachers explained the derivatives-continuity relationship and done the right drawing examples for this relationship. On the other hand, O<sub>3</sub> and O<sub>4</sub> teachers expressed necessary but insufficient critical features related to the derivatives-continuity relationship.

### **Conclusions and Discussions**

The function has a significant impact in understanding the concepts of limit, continuity and derivatives. Teachers should pay attention to the preconditionality principle in explaining the issue. It should focus on the function and limit concepts intensively to tell without possibility of misconception the relationship between derivatives and continuity accurately. The present study was conducted with high school mathematics teachers. Hence, the qualitative and quantitative studies may be done related to the subject matter knowledges of the mathematics teachers and preservice mathematics teachers in the issues such as the function, limit, applications of derivatives and integration. The teachers' subject matter knowledges for derivatives may be investigated with the help of more data collection tools such as the interviews, observations and document review in qualitative studies. In order to increase the levels of the teachers' subject matter knowledges, more permanent learnings are carried out through micro teaching at the end of the final evaluation.

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