

**DISERTASI**  
**DESAIN DIDAKTIS KONSEP TURUNAN FUNGSI**  
**UNTUK MAHASISWA CALON GURU MATEMATIKA**  
**BERBASIS LEARNING OBSTACLE DENGAN MEMPERTIMBANGKAN**  
**GAYA BELAJAR VISUAL AUDITORI DAN KINESTETIK**

Diajukan untuk Memenuhi Salah Satu Syarat untuk Memperoleh  
Gelar Doktor Pendidikan Matematika



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**LEMBAR HAK CIPTA  
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Sebuah disertasi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Doktor Pendidikan Matematika pada FPMIPA UPI

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GAYA BELAJAR VAK VISUAL, AUDITORI DAN KINESTETIK

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## ABSTRAK

Tujuan penelitian ini adalah merancang dan mengembangkan desain didaktis hipotetik konsep turunan fungsi dengan mempertimbangkan *learning obstacle* dan beragam gaya belajar mahasiswa calon guru matematika. Penelitian ini merupakan penelitian kualitatif dengan metode Didactical Design Research (DDR), dengan tiga tahapan yaitu analisis situasi didaktis sebelum pembelajaran, analisis metapedadidaktik, dan analisis retrospektif. Partisipan dalam penelitian ini adalah: tahap satu sebanyak 42 orang mahasiswa yang telah memperoleh mata kuliah Kalkulus Diferensial; tahap dua dan tiga sebanyak 44 partisipan yang sedang mengikuti perkuliahan Kalkulus Diferensial pada salah satu Program Studi Pendidikan Matematika di Bandung. Data dikumpulkan melalui instrumen Tes Kemampuan Responden (TKR), wawancara, angket, dan studi dokumentasi. Hasil penelitian menunjukkan (1) Mahasiswa calon guru matematika mengalami ketiga jenis *learning obstacle* yaitu *didactical learning obstacle*, *ontogenic learning obstacle* (tipe instrumental, tipe psikologis, maupun tipe konseptual), dan *epistemological learning obstacle* pada konsep turunan fungsi; (2) Dari 44 orang partisipan target implementasi desain didaktis hipotetik, diperoleh informasi bahwa 18,2% memiliki gaya belajar visual, 27,3% memiliki gaya belajar auditori dan 54,5% memiliki gaya belajar kinestetik; (3) Desain didaktis hipotetik dikembangkan berdasarkan *Theory of Didactical Situation* (TDS) dengan empat tahapan yaitu situasi aksi berupa sajian masalah sebagai stimulus, situasi formulasi yang mengarahkan kepada terbentuknya pemahaman konsep, situasi validasi sebagai justifikasi terhadap respon yang muncul, dan situasi institusionalisasi yang memberi ruang kepada mahasiswa untuk dapat menerapkan konsep pada permasalahan lain dalam konteks yang berbeda; pada setiap tahapan TDS dilengkapi dengan teknik *Socratic Questioning* dilakukan dengan mengajukan pertanyaan-pertanyaan yang dapat memandu mahasiswa dalam mengkonstruksi pengetahuan; Desain didaktis juga mempertimbangkan temuan *learning obstacle* dan perbedaan gaya belajar; (4) Desain didaktis hipotetik yang dikembangkan cukup efektif mengatasi hampir semua temuan *learning obstacle* pada konsep turunan fungsi, namun demikian *ontogenic learning obstacle* tipe psikologis dan tipe instrumental muncul dalam bentuk yang berbeda; (5) Implementasi desain didaktis hipotetik memiliki dampak kualitatif terhadap konstruksi pengetahuan konsep turunan fungsi, mahasiswa dapat menentukan turunan fungsi komposit, menentukan pola turunan ke-n, menentukan turunan implisit, dan dapat mengaplikasikannya pada konteks terkait. Analisis hasil penelitian menghasilkan desain didaktis alternatif yang dapat membantu calon guru matematika dalam mengkonstruksi pengetahuan, mahasiswa akan memiliki pengalaman dalam mengkonstruksi pengetahuan di level sekolah.

**Kata kunci:** *Learning Obstacle, Didactical Design Research, Theory of Didactical Situation, Gaya Belajar*

## ABSTRACT

This study aims to design and develop a hypothetical didactic design of the concept of function derivative by considering learning obstacles and the various learning styles of prospective mathematics teacher students. This research is qualitative research using the Didactical Design Research (DDR) method, with three stages: analysis of the didactical situation before learning, metapedagogic analysis, and retrospective analysis. Research participants were divided into the first stage, as many as 42 students who had received Differential Calculus courses; stages two and three, as many as 44 participants who were taking Differential Calculus lectures in one of the Mathematics Education Study Programs in Bandung. Data has been collected from the results of the Respondent Ability Test (TKR), interviews, questionnaires, and documentation studies. The results showed (1) Student prospective teachers of mathematics experienced three types of learning obstacles, namely didactic learning obstacles, ontogenic learning obstacles (instrumental type, psychological type, and conceptual type), and epistemological learning obstacles in the concept of derivative functions; (2) Of the 44 participants who targeted the implementation of the hypothetical didactic design, information was obtained that 18.2% had a visual learning style, 27.3% had an auditory learning style and 54.5% had a kinesthetic learning style; (3) The hypothetical didactic design was developed based on the Theory of Didactical Situation (TDS) with four stages, namely an action situation in the form of a problem presented as a stimulus, a formulation situation that leads to the formation of conceptual understanding, a validation situation as justification for the response that appears, and an institutionalization situation that gives space to students to be able to apply the concept to other problems in different contexts; at each stage of TDS, equipped with the Socratic Questioning technique by asking questions that can guide students in constructing knowledge; The didactic design also considers the findings of learning obstacles and differences in learning styles; (4) The hypothetical didactic design that was developed was quite effective in overcoming almost all learning obstacle findings in the concept of derivative functions, however, ontogenic learning obstacles of the psychological type and the instrumental type appeared in different forms; (5) The implementation of the hypothetical didactic design has a qualitative impact on the construction of knowledge of the concept of derivative functions, students can determine the composite derivative, determine the pattern of the  $n$ th derivative, determine the implicit derivative, and can apply it to related contexts. Analysis of the research results resulted in an alternative didactic design that could assist prospective mathematics teachers in constructing knowledge, and students would have experience constructing knowledge at the school level.

**Keywords:** Learning Obstacle, Didactical Design Research, Theory of Didactical Situation, Learning Style

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**DESAIN DIDAKTIS KONSEP TURUNAN FUNGSI UNTUK MAHASISWA CALON GURU MATEMATIKA BERBASIS LEARNING OBSTACLE DENGAN MEMPERTIMBANGKAN GAYA BELAJAR VISUAL AUDITORI DAN KINESTETIK**

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