DESAIN PEMBELAJARAN BERBASIS PEDAGOGI DIGITAL
UNTUK MENGEMBANGKAN KEMAMPUAN BERPIKIR MATEMATIS
DAN KOMPUTASIONAL SISWA KELAS IX
DALAM MENYELESAIKAN PERMASALAHAN MATEMATIKA

DISERTASI

Diajukan untuk Memenuhi Sebagian dari
Persyaratan Memperoleh Gelar Doktor Ilmu Pendidikan
dalam Bidang Pendidikan Matematika

DISUSUN OLEH
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PRGORAM STUDI PENDIDIKAN MATEMATIKA
FAKULTAS PENDIDIKAN MATEMATIKA DAN ILMU PENGETAHUAN ALAM
UNIVERSITAS PENDIDIKAN INDONESIA
2024

DESAIN PEMBELAJARAN BERBASIS PEDAGOGI DIGITAL UNTUK MENGEMBANGKAN KEMAMPUAN BERPIKIR MATEMATIS DAN KOMPUTASIONAL SISWA KELAS IX DALAM MENYELESAIKAN PERMASALAHAN MATEMATIKA

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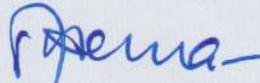
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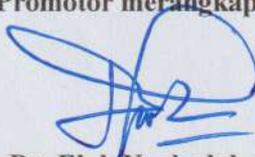
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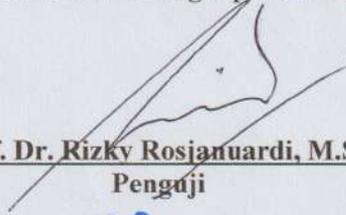
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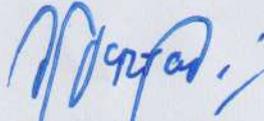
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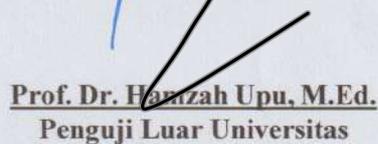
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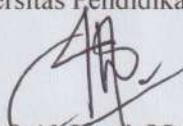
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Abstrak

Tuntutan perkembangan teknologi mengharuskan pembelajaran matematika terintegrasi dengan teknologi dengan tetap mengutamakan kualitas proses berpikir siswa. Terdapat dua kemampuan berpikir yang erat kaitannya dengan pembelajaran matematika dan harus dikonstruksi untuk memecahkan permasalahan matematika kompleks, yaitu berpikir matematis dan komputasional. Untuk itu penelitian ini bertujuan memperoleh deskripsi mengenai kemampuan berpikir matematis dan komputasional siswa dalam pembelajaran matematika, karakteristik guru matematika ditinjau dari dimensi pedagogi digital, serta desain pembelajaran berbasis pedagogi digital yang dapat mengembangkan kemampuan berpikir matematis dan komputasional siswa kelas IX. Penelitian menggunakan jenis penelitian desain tipe *validation studies* meliputi tiga fase yaitu desain pendahuluan, percobaan desain, dan analisis retrospektif, dengan produk berupa HLT dan LIT. Subjek dalam penelitian ini terdiri dari guru matematika sebanyak tiga orang, dan siswa sejumlah tujuh puluh satu orang. Pada akhir penelitian terpilihlah sepuluh siswa yang memiliki penguasaan kedua kemampuan berpikir pada level paling baik. Hasil dari studi pendahuluan menemukan bahwa kemampuan berpikir matematis masih terbatas pada indikator *specializing*, sedangkan kemampuan berpikir komputasional pada konsep *decomposition*. Sementara itu guru berada pada kemampuan penguasaan media sosial *whatssapp* untuk membagikan tugas dan media ajar konkrit di kelas, sementara pemanfaatan aplikasi digital sebagai media pembelajaran belum ada. HLT terus mengalami revisi secara berkala sampai terbentuk LIT dan desain pembelajaran lengkap. Pencapaian hasil belajar siswa ditunjukkan dengan 77% siswa mencapai kriteria kelulusan dan respon positif terhadap implementasi desain pembelajaran. Untuk itu desain pembelajaran berbasis pedagogi digital dapat mengembangkan kemampuan berpikir matematis dan komputasioonal siswa kelas IX pada materi bilangan berpangkat, bentuk akar, dan persamaan kuadrat.

Kata Kunci: Penelitian Desain, Kemampuan Berpikir Matematis, Kemampuan Berpikir Komputasional, Pedagogi Digital, Pemecahan Masalah Matematika Kompleks.

Digital Pedagogy-Based Learning Design to Develop Class IX Students' Mathematical and Computational Thinking Abilities in Solving Mathematical Problems

Abstract

The demands of technological advancements necessitate the integration of technology into mathematics education while maintaining the quality of students' thinking processes. There are two types of thinking skills closely related to mathematics education that must be developed to solve complex mathematical problems: mathematical thinking and computational thinking. This study aims to describe students' mathematical and computational thinking skills in mathematics learning, the characteristics of mathematics teachers from the perspective of digital pedagogy, and a digital pedagogy-based learning design that can enhance the mathematical and computational thinking abilities of ninth-grade students. The research employed a validation studies design, encompassing three phases: preliminary design, design experimentation, and retrospective analysis, resulting in products such as Hypothetical Learning Trajectory (HLT) and Local Instruction Theory (LIT). The subjects of this study included three mathematics teachers and seventy-one students. By the end of the study, ten students who demonstrated the highest level of mastery in both thinking skills were selected. Preliminary study results revealed that mathematical thinking skills were still limited to the specializing indicator, while computational thinking skills were focused on the concept of decomposition. Meanwhile, teachers predominantly utilized WhatsApp for sharing assignments and concrete teaching materials in class, with little to no use of digital applications as learning media. The HLT underwent periodic revisions until the formation of a complete LIT and learning design. Student learning outcomes showed that 77% of them met the passing criteria, and there was a positive response to the implementation of the learning design. Therefore, digital pedagogy-based learning design can enhance the mathematical and computational thinking skills of ninth-grade students, particularly in the topics of exponents, root forms, and quadratic equations.

Keywords: Design Research, Mathematical Thinking Ability, Computational Thinking Ability, Digital Pedagogy, Solving Complex Mathematical Problems

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