DESAIN DIDAKTIS MATERI HIMPUNAN: STUDI *DIDACTICAL DESIGN RESEARCH* DALAM PENDAMPINGAN TRANSPOSISI DIDAKTIS INTERNAL BAGI CALON PENDIDIK PROFESIONAL

DISERTASI

Diajukan untuk Memenuhi Sebagian dari Syarat Memperoleh
Gelar Doktor Pendidikan Matematika

Oleh:

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KATA PENGANTAR

Dengan penuh rasa syukur, saya mempersembahkan disertasi ini sebagai hasil dari perjalanan akademis yang panjang dan penuh tantangan. Disertasi ini merupakan buah dari dedikasi, ketekunan, serta komitmen yang telah teruji dalam menghadapi berbagai rintangan.

Disertasi ini menggali secara mendalam penyusunan dan implementasi desain didaktis dalam pembelajaran materi himpunan, dengan fokus pada proses transposisi didaktis internal oleh calon pendidik profesional melalui pendekatan *Didactical Design Research* (DDR). Tujuannya adalah untuk memberikan kontribusi nyata dalam pengembangan ilmu pengetahuan di bidang pendidikan matematika. Proses penelitian dan penulisan ini melibatkan berbagai pendekatan metodologis yang komprehensif, dengan harapan dapat menyajikan analisis yang tajam dan bermanfaat bagi kemajuan akademis.

Perjalanan ini tidak hanya menguji kemampuan intelektual, tetapi juga menuntut pengorbanan waktu dan tenaga yang tidak sedikit. Setiap langkah dalam proses ini merupakan refleksi dari upaya untuk mencapai kesempurnaan ilmiah dan integritas akademik. Dalam menghadapi setiap tantangan, saya senantiasa mengingat tujuan utama dari penelitian ini, yaitu memberikan sumbangsih yang berarti bagi perkembangan ilmu pengetahuan dan pemahaman kita terhadap desain didaktis.

Disertasi ini diharapkan dapat menjadi referensi berharga bagi penelitian-penelitian selanjutnya, serta memberikan wawasan baru yang dapat diaplikasikan dalam konteks praktis. Harapan terbesar saya adalah bahwa karya ini dapat memberikan dampak positif yang luas, tidak hanya dalam ranah akademis, tetapi juga dalam implementasinya di masyarakat.

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Next for the names below:

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ABSTRAK

Agus Hendriyanto (2024). Desain Didaktis Materi Himpunan: Studi *Didactical Design Research* Dalam Pendampingan Transposisi Didaktis Internal Bagi Calon Pendidik Profesional

Desain didaktis merupakan komponen penting dalam proses difusi dan akuisisi pengetahuan matematika. Namun, keberadaannya cenderung terabaikan dalam sistem pendidikan yang ada, yang lebih cenderung memprioritaskan masalah yang berkaitan dengan interaksi manusia. Sebagai gantinya, proses pewarisan pengetahuan sering kali mengikuti pola yang sudah ada. Namun demikian, apa yang disajikan dan diwariskan tidak selalu merupakan *proporsisional knowledge* sebagai *justified true belief*. Hal ini bertentangan dengan sifat pengetahuan matematika sebagai ilmu pasti yang kebenarannya dapat dipertanggungjawabkan secara pasti. Oleh karena itu, guru, sebagai bagian integral dari *teaching institution* dalam jalur transposisi didaktis, harus memiliki kemampuan untuk memilih dan merancang pengetahuan yang akan disampaikan kepada siswa. Tujuan utama penelitian ini yaitu menghasilkan desain didaktis empiris yang dapat membantu CPP dalam melakukan proses transposisi didaktis sehingga dapat menghasilkan desain didaktis berupa modul ajar untuk peserta didik. Penelitian ini mengadopsi paradigma interpretatif dan kritis dalam kerangka *didactical design research* (DDR). Peneliti menjadi instrumen kunci dalam melaksanakan penelitian ini yang melibatkan partisipan dari berbagai pihak seperti guru, CPP, siswa, dan dosen/matematikawan. Melalui studi interpretatif, ditemukan berbagai permasalahan dalam fenomena transposisi didaktis, termasuk ketidaksesuaian sajian materi di buku teks dengan konsep ilmiah, kecenderungan guru terhadap sikap kredulis, hambatan belajar yang dialami siswa, permanenisasi ketidaksesuaian pemahaman di kalangan CPP, ketidaktahuan guru dan CPP terhadap aspek didaktis, dan dominasi keyakinan yang didominasi oleh *hoax*. Berdasarkan temuan tersebut, paradigma kritis diadopsi untuk menyusun *Hypothetical Learning Trajectory* (HLT) untuk CPP dan mengimplementasikannya. Pelatihan untuk CPP mencakup konsep-konsep seperti himpunan versi *scholarly knowledge*, *praxeology*, *epistemological knowledge*, *theory of didactical situation*, *learning obstacle*, komponen HLT, dan prinsip-prinsip pelaksanaan DDR. Hasilnya menunjukkan bahwa para CPP mampu menyusun desain didaktis secara mandiri dengan perubahan yang signifikan terkait akurasi pengetahuan. Namun, masih terdapat pemahaman lama yang tidak sesuai yang eksis dalam desain yang dihasilkan, terutama berkaitan dengan penyajian himpunan. Akhirnya, dilakukan revisi terhadap desain didaktis hipotesis sehingga menghasilkan desain didaktis empiris yang dapat digunakan untuk memberikan pelatihan kepada CPP dalam proses penyusunan desain didaktis.

Kata Kunci: desain didaktis, *didactical design research*, *propositional knowledge*, teori himpunan, transposisi didaktis.

ABSTRACT

Agus Hendriyanto (2024). Didactic Design of Set Materials: A Didactical Design Research Study in Supporting Internal Didactic Transposition for Prospective Professional Educators

Didactic design is a crucial component in the process of diffusing and acquiring mathematical knowledge. However, its presence tends to be neglected within the existing education system, which tends to prioritize issues related to human interaction. Instead, the process of knowledge transmission often follows established patterns. Nevertheless, what is presented and transmitted does not always constitute propositional knowledge as justified true belief. This contradicts the nature of mathematical knowledge as an exact science with verifiable truth. Therefore, teachers, as integral parts of the teaching institution in the didactic transposition pathway, must possess the ability to select and design the knowledge to be conveyed to students. The main objective of this research is to produce an empirical didactic design that can assist prospective teachers in the didactic transposition process, resulting in didactic designs in the form of teaching modules for students. This study adopts an interpretative and critical paradigm within the framework of didactical design research (DDR). The researcher serves as a critical instrument in conducting this study, involving participants from various parties such as teachers, prospective teachers, students, and lecturers/mathematicians. Through interpretative studies, various issues were found in the phenomenon of didactic transposition, including discrepancies between the material presented in textbooks and scientific concepts, teachers' tendencies towards credulity, learning obstacles experienced by students, the persistence of misconceptions among prospective teachers, the lack of awareness among teachers and prospective teachers regarding didactic aspects, and the dominance of beliefs influenced by misinformation. Based on these findings, a critical paradigm was adopted to develop and implement a Hypothetical Learning Trajectory (HLT) for prospective teachers. The training for prospective teachers included concepts such as sets in the context of scholarly knowledge, praxeology, epistemological knowledge, the theory of didactical situations, learning obstacles, components of HLT, and the principles of DDR implementation. The results showed that prospective teachers could independently design didactic plans with significant improvements in knowledge accuracy. However, some old misconceptions were still present in the designs, particularly related to the presentation of sets. Consequently, the hypothetical didactic designs were revised to produce an empirical didactic design that can be used to train prospective teachers in the process of didactic design development.

Keywords: didactic design, didactical design research, propositional knowledge, set theory, didactic transposition.

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