

**PELATIHAN STEM *LEARNING* BERBASIS *INTERNET OF THINGS*
(STEM-IoT) PADA TEMA HEMAT ENERGI UNTUK MENINGKATKAN
TPACK DAN KREATIVITAS GURU IPA DI JAWA BARAT**

DISERTASI

Diajukan untuk Memenuhi Sebagian dari Syarat untuk Memperoleh Gelar Doktor
Pendidikan Ilmu Pengetahuan Alam



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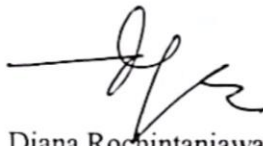
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Aay Susilawati

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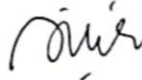
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PERNYATAAN KEASLLIAN DISERTASI

Dengan ini menyatakan bahwa disertasi yang berjudul **“Pelatihan STEM *learning* berbasis *Internet of Things* (STEM-IoT) pada tema hemat energi untuk meningkatkan TPACK guru IPA di Jawa Barat”** beserta seluruh isinya adalah benar-benar karya saya sendiri, dan saya tidak melakukan penjiplakan atau pengutipan dengan cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan tersebut, saya siap menanggung resiko yang dijatuhkan kepada saya apabila dikemudian hari ditemukan adanya pelanggaran terhadap etika keilmuan dalam karya saya ini, atau ada klaim dari pihak lain terhadap karya saya ini.

Bandung, 22 Juli 2025

Yang membuat pernyataan,



Aay Susilawati

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Penelitian ini diangkat sebagai upaya dalam pengembangan program pelatihan untuk meningkatkan TPACK guru IPA dalam merancang pembelajaran IPA menggunakan pendekatan STEM berbantuan teknologi IoT. Oleh karena itu disertasi ini berjudul **“Pelatihan STEM *learning* berbasis *Internet of Things* (STEM-IoT) pada tema hemat energi untuk meningkatkan TPACK guru IPA di Jawa Barat”**. Disertasi ini memaparkan bagaimana program pelatihan STEM *learning* berbasis Internet of Things pada tema hemat energi ini dikembangkan dan memberikan manfaat bagi guru IPA. Kebermanfaatan pelaksanaan program pelatihan STEM IoT dalam meningkatkan TPACK guru IPA di Jawa Barat menjadi tujuan dari peneliti. Selain itu penelitian ini juga melihat bagaimana tanggapan guru IPA terhadap proses pelaksanaan pelatihan yang dikembangkan.

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Bandung, 22 Juli 2025

Aay Susilawati

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ABSTRAK

Penelitian ini bertujuan untuk mengembangkan dan mengevaluasi pelatihan *STEM learning* berbasis *Internet of Things* (STEM-IoT) dalam meningkatkan kompetensi *Technological Pedagogical Content Knowledge* (TPACK) dan kreativitas guru IPA. Metode penelitian yang digunakan adalah *mixed methods* dengan *exploratory sequential design*. Fokus penelitian ini pada tiga aspek utama, yaitu pengembangan, pelaksanaan, dan kebermanfaatan pelatihan terhadap peningkatan TPACK guru IPA. Partisipan yang terlibat dalam penelitian ini sebanyak 79 guru IPA yang bertugas di Jawa Barat. Instrumen yang digunakan diantaranya: lembar analisis dokumen, soal kemampuan TPACK guru, lembar observasi, angket, lembar penilaian RPP STEM IoT, panduan wawancara, dan catatan lapangan. Data kuantitatif dianalisis dengan menggunakan uji statistik sedangkan data kualitatif digunakan untuk menggali informasi tentang pengembangan program pelatihan STEM IoT untuk meningkatkan TPACK guru IPA. Hasil penelitian menunjukkan bahwa perancangan program pelatihan STEM *learning* berbasis *Internet of Things* (STEM IoT) yang dikembangkan memiliki karakteristik berlandaskan teori belajar andragogi dan model TPACK dengan menggunakan pendekatan inovasi STEM-IoT dan tehnik *learning by doing*. Program pelatihan STEM IoT dinilai valid dalam meningkatkan TPACK dan kreativitas guru IPA. Dimana kompetensi TPACK meningkat dengan kategori tinggi. Kreativitas guru IPA dalam mendesain pembelajaran STEM IoT pada tema hemat energi memiliki nilai persentase pada aspek *fluency* dengan rata-rata 86% berkategori sangat baik, *flexibility* 71% berkategori baik, dan *originality* 60% dengan kategori cukup. Guru IPA memberikan respon positif terhadap pelaksanaan program pelatihan STEM IoT pada tema hemat energi dan hampir lebih dari 90% tertarik untuk melaksanakan pembelajaran STEM IoT dan merancang produk IoT. Pelatihan STEM-IoT memiliki potensi besar dalam menyiapkan guru untuk menghadapi tantangan pendidikan abad ke-21 dan mendorong pembelajaran yang mendukung pencapaian kompetensi era Society 5.0 dan tujuan pembangunan berkelanjutan (SDGs).

Kata kunci: Guru IPA, *Internet of Things*, Kreativitas, STEM, TPACK.

INTERNET OF THINGS-BASED STEM LEARNING TRAINING (STEM-IoT) ON THE THEME OF ENERGY SAVING TO IMPROVE TPACK AND CREATIVITY OF SCIENCE TEACHERS IN WEST JAVA

ABSTRACT

This study aims to develop and evaluate Internet of Things-based STEM learning training (STEM-IoT) in improving the Technological Pedagogical Content Knowledge (TPACK) competency and creativity of science teachers. The research method used is mixed methods with exploratory sequential design. The focus of this study is on three main aspects, namely the development, implementation, and usefulness of training on improving TPACK of science teachers. Participants involved in this study were 79 science teachers working in West Java. The instruments used include: document analysis sheets, teacher TPACK ability questions, observation sheets, questionnaires, STEM IoT lesson plan assessment sheets, interview guides, and field notes. Quantitative data were analyzed using statistical tests while qualitative data were used to gather information about the development of STEM IoT training programs to improve TPACK of science teachers. The results of the study indicate that the design of the Internet of Things-based STEM learning training program (STEM IoT) developed has characteristics based on andragogy learning theory and TPACK model using the STEM-IoT innovation approach and learning by doing techniques. The STEM IoT training program is considered valid in improving TPACK and creativity of science teachers. Where TPACK competency increased with a high category. The creativity of science teachers in designing STEM IoT learning on the theme of energy saving has a percentage value in the fluency aspect with an average of 86% in the very good category, flexibility 71% in the good category, and originality 60% in the sufficient category. Science teachers gave a positive response to the implementation of the STEM IoT training program on the theme of energy saving and almost more than 90% are interested in implementing STEM IoT learning and designing IoT products. STEM-IoT training has great potential in preparing teachers to face the challenges of 21st-century education and encourage learning that supports the achievement of competencies in the Society 5.0 era and sustainable development goals (SDGs).

Keywords: Science IPA, *Internet of Things*, Creativity, STEM, TPACK.

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