

DISERTASI

**PENGEMBANGAN PROGRAM PERKULIAHAN PEMBELAJARAN
IPA TERPADU BERBASIS SAINS-EDU UNTUK MENINGKATKAN
KETERAMPILAN BERPIKIR KRITIS DAN KETERAMPILAN
BERPIKIR KREATIF MAHASISWA**

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



Oleh

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**PROGRAM STUDI PENDIDIKAN IPA
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
UNIVERSITAS PENDIDIKAN INDONESIA**

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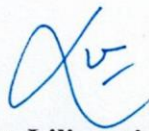
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IPA TERPADU BERBASIS SAINS-EDU UNTUK
MENINGKATKAN KETERAMPILAN BERPIKIR KRITIS DAN
KETERAMPILAN BERPIKIR KREATIF MAHASISWA**

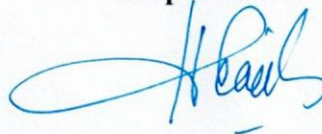
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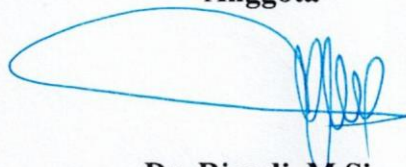
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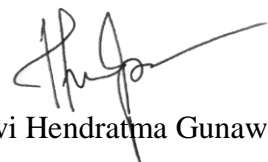
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PERNYATAAN

Dengan ini saya menyatakan bahwa disertasi yang berjudul “PENGEMBANGAN PROGRAM PERKULIAHAN PEMBELAJARAN IPA TERPADU BERBASIS SAINS-EDU UNTUK MENINGKATKAN KETERAMPILAN BERPIKIR KRITIS DAN KETERAMPILAN BERPIKIR KREATIF MAHASISWA” beserta seluruh isinya adalah benar-benar karya sendiri bersama tim promotor dan saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika keilmuan yang berlaku. Atas pernyataan ini, saya siap menanggung sanksi tindakan hukum yang dijatuhkan kepada saya apabila di kemudian hari ditemukan adanya pelanggaran terhadap etika keilmuan dalam karya saya.

Bandung, Juli 2023

Yang membuat pernyataan,



Kadek Dwi Hendratna Gunawan

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KATA PENGANTAR

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Pentingnya melatih keterampilan berpikir kritis dan keterampilan berpikir kreatif bagi mahasiswa pendidikan IPA dalam menghadapi era Revolusi Industri 4.0 dan tantangan global yang kompleks dan dinamis menjadi latar belakang penulisan disertasi ini. Di era digital saat ini, kemampuan berpikir kritis dan berpikir kreatif menjadi keterampilan yang sangat dibutuhkan dalam menghadapi perubahan yang cepat dan kompleks di dunia kerja. Dalam konteks Revolusi Industri 4.0, di mana teknologi dan informasi berkembang pesat, mahasiswa perlu memiliki kemampuan untuk menghadapi tantangan baru dan mengambil keputusan yang tepat dengan berdasarkan pemikiran yang kritis dan rasional. Selain itu, melatih keterampilan berpikir kreatif juga menjadi penting. Inovasi dan pemikiran kreatif menjadi kunci dalam menemukan solusi baru dan menghadapi perubahan yang terus menerus. Mahasiswa perlu dilatih untuk berpikir di luar batas-batas konvensional, menggali ide-ide baru, dan mengembangkan solusi yang inovatif untuk masalah yang dihadapi.

Pengembangan program perkuliahan Pembelajaran IPA Terpadu dengan basis *artificial intelligence* (AI) melalui SAINS-Edu menjadi salah satu pendekatan yang efektif dalam melatih keterampilan berpikir kritis dan keterampilan berpikir kreatif. Dengan memadukan konten dan pedagogi IPA secara terpadu, mahasiswa dapat mengalami pengalaman belajar yang menantang dan mendalam. Sistem rekomendasi berbasis AI melalui SAINS-Edu dapat membantu mahasiswa dalam mengakses sumber daya pembelajaran yang relevan dan mendukung pengembangan keterampilan berpikir kritis dan kreatifnya.

Berdasarkan hasil studi pendahuluan salah satu perguruan tinggi di Jawa Barat menunjukkan bahwa kemampuan mahasiswa yang minim untuk dapat mengintegrasikan konten dan pedagogi IPA yang dimilikinya dalam merancang pembelajaran IPA terpadu. Selain itu capaian pemahaman konsep-konsep, keterampilan berpikir kritis, dan keterampilan berpikir kreatif yang dimiliki oleh mahasiswa juga masih kurang. Berbagai temuan tersebut membuat penulis menyadari perlu adanya Pembelajaran IPA Terpadu berbasis SAINS-Edu sebagai *scaffolding* bagi mahasiswa. Hasil penelitian yang diperoleh menunjukkan program perkuliahan Pembelajaran IPA Terpadu berbasis SAINS-Edu dapat meningkatkan keterampilan berpikir kritis dan keterampilan berpikir kreatif, sekaligus penguasaan konsep mahasiswa pendidikan IPA.

Penulis mengakui adanya berbagai keterbatasan dan kekurangan dalam penulisan disertasi ini. Penulis sangat mengharapkan umpan balik yang konstruktif untuk memperbaiki dan menyempurnakan penulisan disertasi ini. Penulis mengapresiasi segala kritik dan saran yang disampaikan, serta berterima kasih atas perhatian yang diberikan. Semoga upaya penyempurnaan penelitian ini dapat memberikan manfaat dan kontribusi yang lebih besar dalam pengembangan ilmu khususnya dalam pembelajaran IPA.

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Penulis

Kadek Dwi Hendratma Gunawan

**PENGEMBANGAN PROGRAM PERKULIAHAN
PEMBELAJARAN IPA TERPADU BERBASIS SAINS-EDU UNTUK
MENINGKATKAN KETERAMPILAN BERPIKIR KRITIS DAN
KETERAMPILAN BERPIKIR KREATIF MAHASISWA**

ABSTRAK

Mahasiswa perlu memiliki keterampilan berpikir untuk mengintegrasikan berbagai konten dan pedagogi dalam merancang pembelajaran IPA Terpadu. Tujuan penelitian ini adalah menghasilkan program perkuliahan Pembelajaran IPA Terpadu berbasis SAINS-Edu (*Semi-Autonomous: Integrating Natural Science Education*) untuk meningkatkan penguasaan konsep, keterampilan berpikir kritis, dan keterampilan berpikir kreatif mahasiswa. SAINS-Edu memiliki fitur khas untuk membantu mahasiswa berpikir melalui rekomendasi tema pembelajaran, rekomendasi aktivitas untuk merancang pembelajaran, serta asesmennya secara bertahap. Desain penelitian yang digunakan yaitu *Mixed Methods Exploratory Design: Instrumental Development Model*. Pada uji coba program perkuliahan dilibatkan 72 mahasiswa dan implementasi program melibatkan 73 mahasiswa di semester V dari perguruan tinggi negeri di Kota Malang. Teknik analisis data menggunakan statistik deskriptif, N-Gain, uji t, uji ukuran dampak, dan uji korelasi Spearman. Hasil analisis menunjukkan bahwa 1) karakteristik program perkuliahan ini yaitu menggunakan pembelajaran inkuiri sebagai dasarnya dan melibatkan *scaffolding* POEE dan sistem rekomendasi berbasis AI yaitu SAINS-Edu; 2) program perkuliahan ini dapat meningkatkan penguasaan konsep, keterampilan berpikir kritis, dan keterampilan berpikir kreatif berdasarkan N-Gain pada kategori sedang; 3) program perkuliahan ini berdampak positif terhadap penguasaan konsep, keterampilan berpikir kritis, dan keterampilan berpikir kreatif berdasarkan *effect size* berada pada kategori tinggi; 4) keunggulan program ini yaitu pelibatan *scaffolding* POEE dan SAINS-Edu dalam pembelajaran inkuiri, peningkatan keterampilan berpikir kritis, keterampilan berpikir kreatif, dan kolaboratif mahasiswa, sedangkan keterbatasannya yaitu memerlukan waktu pengembangan *software*, perubahan kurikulum, dan ketergantungan terhadap teknologi. Peneliti selanjutnya dapat mengembangkan sistem serupa dengan perluasan cakupan materi, serta berfokus untuk mencapai 4C dalam keterampilan abad 21.

Kata kunci: Pembelajaran IPA Terpadu, SAINS-Edu, Keterampilan berpikir kritis, dan keterampilan berpikir kreatif

THE DEVELOPMENT OF SCIENCE EDU-BASED INTEGRATED SCIENCE LEARNING COURSE PROGRAM TO IMPROVE UNIVERSITY STUDENTS' CRITICAL AND CREATIVE THINKING SKILLS

ABSTRACT

University students need to possess good thinking skills to integrate various contents and pedagogy when designing integrated science learning. This research aimed to generate an Integrated Science Learning lecture program based on SAINS-Edu (Semi-Autonomous: Integrating Natural Science Education) to enhance students' concept mastery, critical thinking, and creative thinking skills. SAINS-Edu had specific features to assist students in their thinking process through recommendations in terms of learning themes, activities for designing lesson plans, and assessments. This research employed a mixed method exploratory design: instrumental development model. In the small scale try out were included 72 students and 73 of fifth-semester students participated in the implementation program in the state university in Malang. The data were analyzed using descriptive statistics, the t-test, the N-gain, the effect size test, and the Spearman correlation test. The results of the data analysis revealed that: 1) This lecture program used inquiry learning as its basis and incorporated POEE (Predict Observe Explain Evaluation) scaffolding and an AI (Artificial Intelligence)-based recommendation system called SAINS-Edu; 2) This program helped to improve concept mastery, critical thinking skills, and creative thinking skills with moderate N-Gain categories; and 3) This program had a positive effect on concept mastery, critical thinking skills, and creative thinking skills with high effect size categories; 4) The advantages of this program included the incorporation of POEE and Science-Edu scaffolding in inquiry learning, improvement of students' critical thinking skills, creative thinking skills, collaboration. On the other hand, the disadvantages of this program included the need for a considerable time to develop the software, curriculum changes, and reliance on technology. Further researchers can continue to develop similar systems to expand the material coverage as well as focus on achieving 4C (Critical Thinking Creativity Collaboration Communication) in 21st-century skills.

Keywords: Integrated Science Learning, SAINS-Edu, Critical Thinking Skills, Creative Thinking Skills

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