

ABSTRAK

Yunanto, Riskhi Alif 2025. *Pengembangan Media RelaPhy (Remote Laboratory Physics) Materi Gerak Jatuh Bebas untuk Meningkatkan Keterampilan Proses Sains Siswa SMA*. Program Studi Pendidikan Fisika, FKIP, Universitas PGRI Madiun. Pembimbing (I) Dr. Tantri Mayasari, M.Pd., (II) Mislan Sasono, S.Pd.Si.,M.Pd.

Rendahnya keterampilan proses sains (KPS) siswa SMA menjadi tantangan dalam pembelajaran fisika, khususnya pada materi gerak jatuh bebas. Permasalahan ini diperparah oleh terbatasnya fasilitas laboratorium fisika di sekolah. Penelitian ini bertujuan untuk: mengembangkan media pembelajaran *Remote Laboratory Physics* (RelaPhy) berbasis *Internet of Things* (IoT) pada materi gerak jatuh bebas; mendeskripsikan karakteristik media yang dikembangkan; dan mengetahui pengaruh penggunaan media tersebut terhadap peningkatan KPS siswa. Metode penelitian yang digunakan adalah *Research and Development* (R&D) dengan model pengembangan Gall and Borg yang dimodifikasi, serta pendekatan *mixed methods embedded experimental design*. Subjek uji coba dalam penelitian ini adalah 26 siswa kelas XB SMAN 1 Jiwon. Instrumen yang digunakan meliputi observasi, wawancara, angket validasi, dokumentasi, dan tes keterampilan proses sains. Hasil penelitian menunjukkan bahwa: Media RelaPhy berhasil dikembangkan melalui tahapan analisis kebutuhan, desain, validasi ahli, revisi, serta uji coba terbatas, dan memperoleh penilaian sangat valid dari ahli media dan materi; Media ini memiliki karakteristik berupa aksesibilitas jarak jauh, fitur eksperimen digital berbasis sensor IoT, teori konsep, panduan laporan ilmiah, serta evaluasi mandiri yang interaktif; dan Uji Wilcoxon menunjukkan bahwa penggunaan RelaPhy memberikan peningkatan signifikan terhadap KPS siswa (nilai signifikansi $p < 0,05$), mencakup aspek observasi, perencanaan eksperimen, interpretasi data, dan komunikasi ilmiah. Dengan demikian, dapat disimpulkan bahwa RelaPhy efektif sebagai media inovatif yang mampu menjawab keterbatasan praktikum konvensional serta meningkatkan kualitas pembelajaran sains secara bermakna.

Kata kunci: RelaPhy, laboratorium virtual, keterampilan proses sains, Internet of Things, fisika SMA.

ABSTRACT

Yunanto, Riskhi Alif. 2025. Development of RelaPhy (Remote Laboratory Physics) Media on Free Fall Motion to Improve High School Students' Science Process Skills. Physics Education Study Program, Faculty of Teacher Training and Education, Universitas PGRI Madiun. Advisors: (I) Dr. Tantri Mayasari, M.Pd., (II) Mislan Sasono, S.Pd.Si., M.Pd.

The low level of high school students' science process skills (SPS) poses a challenge in learning physics, particularly in the topic of free fall motion. This problem is exacerbated by the limited physics laboratory facilities in schools. This research aims to: develop a Remote Laboratory Physics (RelaPhy) learning media based on the Internet of Things (IoT) for free fall motion; describe the characteristics of the developed media; and determine the effect of using this media on improving students' SPS. The research method employed was Research and Development (R&D) with a modified Gall and Borg development model, along with a mixed methods embedded experimental design. The trial subjects of this study were 26 tenth-grade students of SMAN 1 Jiwan. The instruments used included observation, interviews, validation questionnaires, documentation, and science process skills tests. The results showed that: RelaPhy media was successfully developed through stages of needs analysis, design, expert validation, revision, and limited trials, obtaining a "very valid" assessment from media and material experts; the media is characterized by remote accessibility, IoT-based digital experiment features, conceptual theory, scientific report guidelines, and interactive self-evaluation; and the Wilcoxon test indicated that the use of RelaPhy significantly improved students' SPS (significance value $p < 0.05$), covering aspects of observation, experimental planning, data interpretation, and scientific communication. Thus, it can be concluded that RelaPhy is effective as an innovative medium that addresses the limitations of conventional practicum and enhances the quality of science learning meaningfully.

Keywords: RelaPhy, virtual laboratory, science process skills, Internet of Things, high school physics.