

ABSTRAK

Artha, I. N. W., Sudatha, I. G. W., & Suartama, I. K. (2026). Pengembangan e-modul berbasis *problem based collaborative learning* pada mata pelajaran fisika untuk meningkatkan sikap ilmiah dan prestasi belajar siswa kelas XI SMAK Harapan. Tesis, Teknologi Pendidikan, Program Pascasarjana, Universitas Pendidikan Ganesha.

Tesis ini sudah disetujui dan diperiksa oleh Pembimbing I: Prof. Dr. I Gde Wawan Sudatha, S.Pd., S.T., M.Pd. dan Pembimbing II: Dr. I Kadek Suartama, S.Pd., M.Pd.

Kata-kata kunci: E-Modul Fisika, *Problem-Based Collaborative Learning*, Simulasi PhET, Sikap Ilmiah, Prestasi Belajar.

Penelitian ini bertujuan untuk mengembangkan E-Modul CoLearn Physics berbasis *Problem-Based Collaborative Learning* (PBCL) terintegrasi simulasi PhET pada materi Gerak Parabola serta menguji validitas, kepraktisan, dan efektivitasnya dalam meningkatkan sikap ilmiah dan prestasi belajar peserta didik. Penelitian menggunakan metode *Research and Development* (R&D) dengan model ADDIE yang meliputi tahap *analysis, design, development, implementation, dan evaluation*. Subjek penelitian terdiri atas dua ahli materi, dua ahli media pembelajaran, dua ahli desain pembelajaran, dua guru fisika, dan 36 peserta didik kelas XI SMAK Harapan. Data dikumpulkan menggunakan lembar validasi, angket kepraktisan, angket sikap ilmiah, dan tes prestasi belajar. Efektivitas produk diuji menggunakan desain *one-group pretest-posttest* dan dianalisis menggunakan *paired sample t-test*, N-gain, dan Cohen's d. Hasil penelitian menunjukkan bahwa E-Modul yang dikembangkan memperoleh kategori sangat baik berdasarkan validasi ahli materi (81%), ahli media pembelajaran (92%), dan ahli desain pembelajaran (94%). Uji kepraktisan menunjukkan bahwa E-Modul berada pada kategori sangat praktis berdasarkan penilaian guru (90,00%), uji perorangan (86,00%), uji kelompok kecil (87,80%), dan uji kelompok besar (88,72%). Hasil *paired sample t-test* menunjukkan adanya perbedaan yang signifikan antara skor pretest dan posttest pada sikap ilmiah ($t(35) = -18,260$; $p < 0,001$) dan prestasi belajar ($t(35) = -10,051$; $p < 0,001$). Nilai N-gain berada pada kategori sedang untuk sikap ilmiah (0,33) dan prestasi belajar (0,51), sedangkan nilai Cohen's d menunjukkan ukuran pengaruh besar pada sikap ilmiah (1,15) dan prestasi belajar (2,46). Dengan demikian, E-Modul CoLearn Physics berbasis PBCL terintegrasi simulasi PhET dinyatakan valid, sangat praktis, dan efektif untuk mendukung pembelajaran fisika pada materi Gerak Parabola.

ABSTRACT

Artha, I. N. W., Sudatha, I. G. W., & Suartama, I. K. (2026). *Development of a problem based collaborative learning e-module in physics to improve scientific attitudes and learning achievement of grade XI students at SMAK Harapan. Thesis. Educational Technology Study Program, Postgraduate Program, Universitas Pendidikan Ganesha.*

This thesis has been approved and examined by Supervisor I: Prof. Dr. I Gde Wawan Sudatha, S.Pd., S.T., M.Pd., and Supervisor II: Dr. I Kadek Suartama, S.Pd., M.Pd.

Keywords: Physics E-Module, Problem-Based Collaborative Learning, PhET Simulation, Scientific Attitude, Learning Achievement

This study aimed to develop a PBCL-based CoLearn Physics E-Module integrated with PhET simulation on Projectile Motion and to evaluate its validity, practicality, and effectiveness in improving students' scientific attitudes and learning achievement. The study employed a Research and Development (R&D) method using the ADDIE model, which consists of the analysis, design, development, implementation, and evaluation stages. The participants included two subject matter experts, two instructional media experts, two instructional design experts, two physics teachers, and 36 eleventh-grade students of SMAK Harapan. Data were collected using validation sheets, practicality questionnaires, scientific attitude questionnaires, and learning achievement tests. Product effectiveness was examined using a one-group pretest-posttest design and analyzed through paired sample t-test, N-gain, and Cohen's d. The results indicated that the developed E-Module achieved a very good category based on expert validation, with scores of 81% from subject matter experts, 92% from instructional media experts, and 94% from instructional design experts. The practicality test showed that the E-Module was categorized as highly practical based on teacher assessment (90.00%), individual trials (86.00%), small-group trials (87.80%), and large-group trials (88.72%). The paired sample t-test revealed significant differences between pretest and posttest scores in scientific attitudes ($t(35) = -18.260$; $p < 0.001$) and learning achievement ($t(35) = 10.051$; $p < 0.001$). The N-gain values were in the moderate category for scientific attitudes (0.33) and learning achievement (0.51), while Cohen's d indicated large effect sizes for scientific attitudes (1.15) and learning achievement (2.46). Therefore, the PBCL based CoLearn Physics E-Module integrated with PhET simulation is considered valid, highly practical, and effective for supporting physics learning on Projectile Motion.