

Andi Setiawan. 2026. *Pengembangan E-Modul Arduino Berbasis Simulasi Tinkercad Pada Materi Dasar-Dasar Mikrokontroler di SMK Negeri 1 Kamal*. Program Studi Pendidikan Informatika, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Trunodjoyo Madura. Pembimbing Muhamad Afif Effindi, S.Kom., M.T.

ABSTRAK

Penelitian ini bertujuan untuk mengembangkan e-modul Arduino berbasis simulasi Tinkercad pada materi dasar-dasar mikrokontroler di SMK Negeri 1 Kamal. Pengembangan e-modul dilatarbelakangi oleh keterbatasan media pembelajaran praktik mikrokontroler yang menyebabkan peserta didik mengalami kesulitan dalam memahami konsep dan penerapan Arduino. E-modul ini dirancang sebagai bahan ajar digital yang interaktif, mudah diakses, dan mendukung pembelajaran berbasis proyek. Metode penelitian yang digunakan adalah penelitian dan pengembangan (*Research and Development*) dengan tahapan meliputi analisis kebutuhan, perancangan, pengembangan, implementasi dan evaluasi produk. E-modul yang dikembangkan memuat materi pengenalan mikrokontroler Arduino, struktur dasar pemrograman, input dan output digital, serta proyek pembelajaran menggunakan simulasi Tinkercad dengan model pembelajaran *Project Based Learning* (PjBL). Pengumpulan data dilakukan melalui validasi ahli materi, validasi ahli media dan angket respon peserta didik. Hasil penelitian menunjukkan bahwa e-modul yang dikembangkan memperoleh klasifikasi layak digunakan, mendapatkan nilai kelayakan 76% dari validator ahli materi, 77,14% dari validator ahli media. Selain itu, hasil angket respon siswa pada kelompok kecil mendapatkan nilai presentase 80,22% dan kelompok besar 79,42% dengan kategori layak. Dapat disimpulkan bahwa pengembangan e-modul Arduino berbasis simulasi Tinkercad dinyatakan layak digunakan sebagai media pembelajaran dan memperoleh respon positif dari peserta didik pada materi dasar-dasar mikrokontroler.

Kata kunci: E-modul, Arduino, Tinkercad, Mikrokontroler, *Project Based Learning* (PjBL)

Andi Setiawan. 2026. Development of an Arduino Teaching E-Modul Based on Tinkercad Simulation for Basic Microcontroller Material at SMK Negeri 1 Kamal. Informatics Education Study Program, Faculty of Teacher Training and Education, Universitas Trunodjoyo Madura. Advisor: Muhamad Afif Effindi, S.Kom., M.T.

ABSTRACT

This study aims to develop an Arduino e-module based on Tinkercad simulation for the basic microcontroller material at SMK Negeri 1 Kamal. The development of the e-module was motivated by the limited availability of practical learning media for microcontroleller subjects, which caused students to experience difficulties in understanding Arduino concepts and applications. The e-module was designed as an interactive and easily accessible digital teaching material that support project based learning. The research method employed was Research and Development (R&D), which included the stages of needs analysis, design, development, implementation, and product evaluation. The developed e-module contains materials on the introduction to Arduino microcontroller, basic programming structures, digital input and output, as well as learning projects using Tinkercad simulation with the Project Based Learning (PJBL) model. Data were collected through material expert validation, media expert velidation, and student response questionnaires. The result indicate that the developed e-module was classified as feasible for use, obtaining a feasibility score of 76% from material experts and 77,14% from media experts. In addition, the results of student response questionnaires showed a percentage of 80,22% in the small group trial and 79,42% in the large group trial, booth categorized as feasible. It can be concluded that the Arduino e-module based on Tinkercad simulation is feasible to be used as a learning medium and recives positive responses from student in the basic microcontroller material.

Keywords: *E-module, Arduino, Tinkercad, Microcontroller, Project Based Learning (PjBL)*