

**PENGEMBANGAN *PROBLEM BASED E-WORKSHEET* (PBeWs) UNTUK
MENINGKATKAN KETERAMPILAN BERPIKIR TINGKAT TINGGI**



DISERTASI

Diajukan sebagai salah satu syarat untuk memperoleh gelar Doktor Pendidikan
Teknologi dan Kejuruan

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2025**

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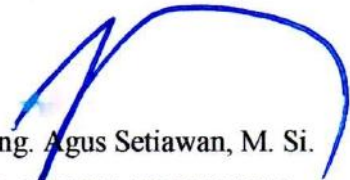
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MENINGKATKAN KETERAMPILAN BERPIKIR TINGKAT TINGGI

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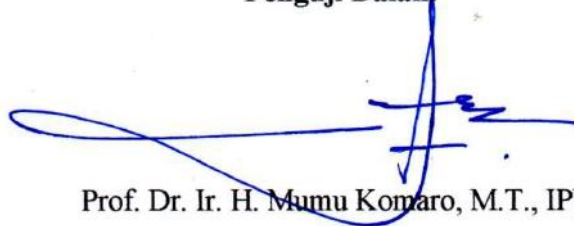
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PENGEMBANGAN *PROBLEM BASED E-WORKSHEET* (PBeWs) UNTUK MENINGKATKAN KETERAMPILAN BERPIKIR TINGKAT TINGGI

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ABSTRAK

Penelitian ini bertujuan untuk mengembangkan *Problem-Based e-Worksheet* (PBeWs) berbasis platform *Learning Management System* (LMS) untuk meningkatkan keterampilan berpikir tingkat tinggi yaitu keterampilan berpikir kritis dan pemecahan masalah siswa SMK pada pembelajaran pneumatik dengan topik gerbang logika. Pengembangan PBeWs menggunakan metode *Design-Based Research* (DBR) yang melibatkan tahapan analisis kebutuhan, desain produk, uji coba, dan revisi. Uji coba dilakukan dengan metode *mix-method (explanatory sequential design)*, diawali dengan pengumpulan data kuantitatif melalui *pre-test-post-test control group design*, yang dilanjutkan dengan penggalan data kualitatif melalui wawancara untuk menjelaskan temuan kuantitatif. Partisipan penelitian terdiri dari 80 siswa kelas XI Teknik Mekatronika di dua sekolah (negeri dan swasta). Hasil penelitian menunjukkan bahwa PBeWs berbasis LMS memiliki karakteristik interaktif, terstruktur dalam skenario pembelajaran berbasis masalah, dilengkapi fitur multimedia, panduan langkah pemecahan masalah, forum diskusi, serta integrasi umpan balik otomatis, dinilai sangat layak oleh para ahli, efektif dalam meningkatkan keterampilan berpikir kritis dan pemecahan masalah, serta diterima dengan baik oleh siswa dengan tingkat niat penggunaan yang tinggi. Faktor pendukung utama meliputi kemudahan penggunaan, relevansi materi, dan dukungan guru, sedangkan faktor penghambat terkait keterbatasan literasi digital dan fasilitas teknologi di sebagian sekolah.

Kata kunci: *Problem-Based e-Worksheet*, LMS, pneumatik, SMK, keterampilan berpikir kritis, keterampilan pemecahan masalah.

DEVELOPMENT OF PROBLEM-BASED E-WORKSHEETS (PBeWs) TO IMPROVE HIGHER-ORDER THINKING SKILLS

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ABSTRACT

This study aims to develop a Problem-Based e-Worksheet (PBeWs) based on a Learning Management System (LMS) platform to enhance higher-order thinking skills, namely critical thinking and problem-solving skills, of vocational high school students in pneumatic learning with the topic of logic gates. The development of PBeWs employed a Design-Based Research (DBR) method, which involved the stages of needs analysis, product design, trials, and revisions. The trials were conducted using a mixed-method approach with an explanatory sequential design, beginning with the collection of quantitative data through a pre-test–post-test control group design, followed by qualitative data collection through interviews to explain the quantitative findings. The research participants consisted of 80 eleventh-grade Mechatronics Engineering students from two schools (public and private). The results indicate that the LMS-based PBeWs possess interactive characteristics, are structured within a problem-based learning scenario, and are equipped with multimedia features, step-by-step problem-solving guides, discussion forums, and integrated automatic feedback. They were rated highly feasible by experts, proven effective in improving critical thinking and problem-solving skills, and well-received by students with a high level of intention to use. The main supporting factors include ease of use, relevance of the content, and teacher support, while the inhibiting factors relate to limited digital literacy and technological facilities in some schools.

Keywords: *Problem-Based Worksheet, LMS, pneumatik, SMK, critical thinking skills, and problem-solving skills.*

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DAFTAR SINGKATAN

ATP = Alur Tujuan Pembelajaran
CP = Capaian Pembelajaran
C-TAM TPB = *Collaboration Technology Acceptance Model and Theory of Planned Behaviour*
DBR = *Design-Based Research*
HOTS = *Higher Order Thinking Skills*
IPK = Indikator Pencapaian Kompetensi
KBK = Keterampilan Berpikir Kritis
KPM = Keterampilan Pemecahan Masalah
LMS = *Learning Management System*
LOTS = *Lower Order Thinking Skills*
MM = Memahami Masalah
MNR = Merefleksi dan Revisi
Moodle = *Modular Object-Oriented Dynamic Learning Environment*
MR = Melaksanakan Rencana
MS = Merencanakan Solusi
OECD = Organization for Economic Co-operation and Development
PBeWs = Problem-Based e-Worksheet
PISA = *Programme for International Student Assessment*
SCORM = *Sharable Content Object Reference Model*
SMA = Sekolah Menengah Atas
SMK = Sekolah Menengah Kejuruan
TAM = *Technology Acceptance Model*
TP = Tujuan Pembelajaran
TPB = *Theory of Planned Behaviour*
UNESCO = United Nations Educational, Scientific and Cultural Organization
TVET = *Technical and Vocational Education and Training*
ZPD = *Zone of Proximal Development*

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