

ABSTRAK

PENGEMBANGAN *E-MODUL ENERGI TERBARUKAN BERBASIS STEAM* DENGAN PRINSIP *DEEP LEARNING* UNTUK MENINGKATKAN KETERAMPILAN *COLLABORATIVE PROBLEM SOLVING* DAN *ENTREPRENEURIAL SKILLS*

Oleh

Rizki Mirantika

Pembelajaran energi terbarukan di sekolah masih didominasi oleh pendekatan teoretis dan belum optimal dalam mengintegrasikan konteks lingkungan lokal serta pengembangan keterampilan abad ke-21. Salah satu potensi lokal yang belum dimanfaatkan secara maksimal dalam pembelajaran adalah pengelolaan limbah organik singkong, yang memiliki kandungan elektrolit alami dan berpotensi digunakan sebagai sumber energi alternatif sederhana.

Penelitian ini bertujuan untuk mengembangkan e-modul energi terbarukan berbasis STEAM dengan prinsip *deep learning* untuk meningkatkan keterampilan *Collaborative Problem Solving* dan *Enterprenerial skills*. Penelitian ini menggunakan metode *Desaign and Development Reseach* (DDR) yang meliputi tahap desain, pengembangan, dan evaluasi.

Subjek penelitian melibatkan peserta didik SMA yang dibagi ke dalam kelas eksperimen dan kelas kontrol. Instrumen penelitian meliputi angket validasi ahli, angket kepraktisan, serta tes *pretest* dan *posttest* untuk mengukur peningkatan kemampuan *Collaborative Problem Solving* dan *Enterprenerial skills*.

Hasil penelitian menunjukkan bahwa e-modul yang dikembangkan berada pada kategori sangat valid dengan persentase sebesar 86,25% berdasarkan penilaian validator ahli dan praktisi, serta sangat praktis dengan persentase sebesar 92,50% berdasarkan respons peserta didik. Uji efektivitas menunjukkan nilai N-Gain menunjukkan katagori sedang dan hasil perhitungan *effect size* pada aspek CPS katagori sedang dan ES dengan katagori kecil. Dengan demikian, e-modul dinyatakan efektif sebagai sarana pembelajaran dalam meningkatkan keterampilan *collaborative problem solving* serta berkontribusi terhadap pengembangan *entrepreneurial skills* peserta didik.

Kata kunci: *Collaborative Problem Solving*, *Deep learning*, *Enterprenerial skills*, Energi terbarukan, STEAM,

ABSTRAK

PENGEMBANGAN *E-MODUL* ENERGI TERBARUKAN BERBASIS STEAM DENGAN PRINSIP *DEEP LEARNING* UNTUK MENINGKATKAN KETERAMPILAN *COLLABORATIVE PROBLEM SOLVING* DAN *ENTREPRENEURIAL SKILLS*

Oleh

Rizki Mirantika

Renewable energy learning in schools is still dominated by theoretical approaches and is not yet optimal in integrating the local environmental context and 21st century skill development. One of the local potentials that has not been utilized optimally in learning is the management of cassava waste, which has natural electrolyte content and has the potential to be used as a simple alternative energy source.

This research aims to develop STEAM-based renewable energy e-modules with deep learning principles to improve Collaborative Problem Solving and Entrepreneurial skills. This study uses the Design and Development Research (DDR) method which includes the design, development, and evaluation stages.

The research subjects involved high school students who were divided into experimental classes and control classes. The research instruments include expert validation questionnaires, practicality questionnaires, and pretest and posttest tests to measure the improvement of Collaborative Problem Solving and Entrepreneurial skills.

The results of the study show that the e-modules developed are in the category of being very valid with a percentage of 86.25% based on the assessment of expert validators and practitioners, and very practical with a percentage of 92.50% based on student responses. The effectiveness test showed that the N-Gain value showed medium category and the effect size calculation results in the medium category CPS and ES aspects with small category. Thus, e-modules are declared effective as a means of learning in improving collaborative problem-solving skills and contributing to the development of students' entrepreneurial skills.

Keywords: Collaborative Problem Solving, Deep learning, Entrepreneurial skills, Renewable energy, STEAM.