

ABSTRAK

Yonaria Agustina Sianturi, NIM 4223131036 (2026). Pengembangan E-Modul Berbasis *Discovery Learning* Terintegrasi *PhET Simulation* pada Materi Laju Reaksi Kelas XI SMA.

Penelitian ini bertujuan untuk mengetahui analisis kebutuhan e-modul berbasis *discovery learning* terintegrasi *PhET simulation* pada materi laju reaksi kelas XI SMA serta untuk mengetahui apakah e-modul yang dikembangkan sudah memenuhi kriteria BSNP. Metode penelitian yang digunakan adalah *Research & Development (R&D)* dengan model 4D yang terdiri dari tahap *define*, *design*, *develop*, dan *disseminate*. Namun, dalam penelitian ini dibatasi hingga tahap *develop*. Instrumen yang digunakan berupa lembar angket wawancara, angket analisis kebutuhan siswa, dan lembar validasi e-modul. Hasil penelitian menunjukkan bahwa proses pembelajaran kimia khususnya laju reaksi masih didominasi pendekatan *teacher-centered* dengan metode ceramah. Siswa cenderung menjadi pendengar pasif sehingga mengalami kesulitan dalam memahami konsep kimia. Kesulitan tersebut semakin meningkat karena bahan ajar yang digunakan masih terbatas pada buku paket dan belum tersedianya e-modul sebagai alternatif pembelajaran. Pengembangan e-modul berbasis *discovery learning* terintegrasi *PhET simulation* pada materi laju reaksi kelas XI SMA sudah memenuhi kriteria BSNP, dengan perolehan rata-rata presentase pada aspek materi yaitu 90,27% dan aspek media dengan rata-rata 88,68% yang berada pada kategori sangat valid.

Kata Kunci: E-Modul, *Discovery Learning*, *PhET Simulation*, Laju Reaksi

ABSTRACT

Yonaria Agustina Sianturi, NIM 4223131036 (2026). Development of a Discovery Learning-Based E-Module Integrated with PhET Simulation on Reaction Rate Material for Grade XI Senior High School.

This research aims to determine the needs analysis for a discovery learning-based e-module integrated with PhET simulation on the topic of reaction rates for grade XI senior high school, as well as to determine whether the developed e-module meets the BSNP criteria. The research method used is Research & Development (R&D) with the 4D model consisting of the define, design, develop, and disseminate stages. However, this research is limited to the develop stage. The instruments used were interview questionnaires, student needs analysis questionnaires, and e-module validation sheets. The results of the study indicate the chemistry learning specifically reaction rate is still dominated by a teacher-centered approach with lecture methods. Students tend to be passive listeners, thus experiencing difficulties in understanding chemical concepts. These difficulties are exacerbated because the teaching materials used are still limited to textbooks and the unavailability of e-modules as a learning alternative. The development of a discovery learning-based e-module integrated with PhET simulation on the topic of reaction rates for grade XI senior high school has met the BSNP criteria, with an average percentage score of 90.27% for the material aspect and 88.68% for the media aspect, both falling into the highly valid category.

Keywords: E-Module, Discovery learning, PhET Simulation, Reaction Rate