

**PENGEMBANGAN MODEL SINUS
(SIMULASI INTERAKTIF *IONIC LIQUIDS* BERBASIS PROGRAM *SKETCH*)
UNTUK MENINGKATKAN KOMPETENSI MAHASISWA
PADA KATEGORI INDUSTRI PENGOLAHAN BAHAN KIMIA
DI POLITEKNIK**

DISERTASI

Diajukan untuk memenuhi sebagian syarat untuk memperoleh
gelar Doktor Pendidikan Teknologi Kejuruan



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(Simulasi Interaktif *Ionic Liquids* Berbasis Program *Sketch*)
Untuk Meningkatkan Kompetensi Mahasiswa
pada Kategori Industri Pengolahan Bahan Kimia di Politeknik

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Sebuah Disertasi yang diajukan untuk memenuhi salah satu syarat memperoleh gelar Doktor Pendidikan (Dr.) pada Fakultas Pendidikan Teknologi dan Kejuruan

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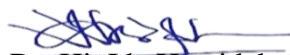
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ABSTRAK

Revolusi industri 4.0 telah berdampak pada perubahan secara besar-besaran di bidang pertanian, pertambangan, transportasi, manufaktur dan teknologi. Kemajuan teknologi akibat revolusi industri ini mengakibatkan tergesernya tenaga manusia oleh mesin/robot yang bisa berakibat pada pemborosan energi dan rusaknya lingkungan. Revolusi industri 4.0 juga berpengaruh pada dunia pendidikan dan pembelajaran. Penelitian ini bertujuan menghasilkan model Simulasi Interaktif pada materi *Ionic Liquids* berbasis program *Sketch (SINUS)* untuk memenuhi kebutuhan bahan ajar dalam upaya untuk meningkatkan kompetensi pengetahuan, keterampilan dan sikap mahasiswa terhadap penggunaan bahan kimia yang aman terhadap lingkungan (*green chemistry*). Model *SINUS* dikembangkan melalui tahapan model *Four-D* meliputi *define, design, development, disseminate* dan diimplementasikan menggunakan model *Experience Learning Theory (ELT)*, dengan metode simulasi interaktif. Karakteristik Model *SINUS* yang dirancang merupakan kumpulan bahan ajar berbasis *web* dengan menu yang tersedia meliputi *homepage*, materi SRT (sains, rekayasa, dan teknologi) cairan ion, video pembelajaran, evaluasi, dan hasil evaluasi dengan menu spesial simulasi interaktif *SINUS*. Model Pembelajaran *SINUS* berbasis web yang telah dikembangkan pada laman <http://mopekimia.co.id> telah divalidasi oleh 9 validator ahli-praktisi konten cairan ion dan media *web*, dengan hasil sangat valid. Hasil uji-coba pengembangan dan implementasi menunjukkan bahwa model pembelajaran *SINUS* mencapai kategori baik, dapat diterima, setuju dan dibutuhkan untuk dapat digunakan pada pembelajaran di politeknik dengan skor N-gain rata-rata mencapai kategori sedang. Terdapat peningkatan kompetensi secara signifikan pada aspek pengetahuan cairan ion dan sikap mahasiswa, akan tetapi peningkatan kompetensi pengetahuan *web* mahasiswa tidak signifikan. Model simulasi interaktif *SINUS* memberikan peluang dan membantu mahasiswa dalam menentukan sifat cairan ion yang *green* melalui rekayasa molekular struktur cairan ion yang dapat digunakan pada suhu ruang. Mahasiswa dapat turut serta menerapkan prinsip *green chemistry* melalui kemampuan merekayasa sifat bahan kimia yang aman untuk proses produksi, tidak mencemari lingkungan, terbarukan, menjamin energi bersih yang terjangkau, sebagaimana tujuan dari pembangunan yang berkelanjutan (*Sustainable Development Goals/SDGs*) dan pendidikan untuk pembangunan berkelanjutan (*Education for Sustainable Development/ESD*).

Kata Kunci : *EDS (Education for Sustainable Development)*, *ELT (Experience Learning Theory)*, *Green Chemistry*, *SDGs (Sustainable Development Goals)*, Simulasi Interaktif, dan *SINUS (Simulasi Interaktif Ionic Liquids Berbasis Program Sketch)*,

DAFTAR ISI

LEMBAR HAK CIPTA	ii
LEMBAR PENGESAHAN	iii
ABSTRAK	iv
DAFTAR ISI	v
REFERENSI	viii
BAB I PENDAHULUAN	
1.1 Latar Belakang Penelitian	1
1.2 Rumusan Masalah	8
1.3 Tujuan Penelitian	9
1.4 Manfaat Penelitian	9
1.5 Sistematika Penulisan	10
BAB II KAJIAN PUSTAKA	
2.1 Pembelajaran Simulasi Interaktif	12
2.2 Pembelajaran Berbasis <i>Web</i>	13
2.3 Cairan Ion	15
2.3.1 Definisi Cairan Ion	15
2.3.2 Sejarah Cairan Ion	16
2.3.3 Struktur Dasar Kation dan Anion	18
2.3.4 Pengkodean	19
2.3.5 Struktur Molekul Garam Cair Imidazolium	20
2.3.6 Sifat Fisika-kimia	21
2.3.7 Titik Leleh	25
2.3.8 Pengaruh Ukuran Ion	26
2.3.9 Pengaruh Perpanjangan Rantai Alkil pada Kation Imidazolium	28
2.3.10 Sintesis	30
2.3.10.1 Reaksi Kuaternisasi	30
2.3.10.2 Reaksi Metatesis (Pergantian)	32
2.3.11 Inovasi Teknologi Cairan Ion	34
2.3.12 Aplikasi	35
2.3.13 Cairan Ion dan <i>Green Chemistry</i>	35
2.3.14 Cairan Ion dan Konsep Keberlanjutan	37
2.3.15 Peluang dan Tantangan	38
2.3.16 Cairan Ion dan Pembelajarannya	40
2.4 <i>Experiential Learning Teori (ELT)</i>	43

2.5 Pendidikan Vokasi	45
2.6 Transformasi, Revitalisasi dan Inovasi Pendidikan Vokasi Abad 21	49
2.7 Standar Kompetensi	50
2.8 Kompetensi Pengetahuan, Keterampilan dan Sikap	53
BAB III METODE PENELITIAN	
3.1 Paradigma Penelitian	57
3.2 Desain Penelitian	58
3.3 Alur Penelitian	59
3.4 Tempat dan Waktu Penelitian	59
3.5 Sampel Penelitian	61
3.6 Prosedur dan Instrumen Penelitian	
3.6.1 Prosedur Penelitian	
3.6.1.1 Pelaksanaan Uji-coba Model <i>SINUS</i>	61
3.6.1.2 Pelaksanaan Implementasi Model <i>SINUS</i>	63
3.6.2 Instrumen Penelitian	63
3.7 Teknik Pengumpulan Data	65
3.8 Teknik Analisis Data	66
3.8.1 Karakterisasi Model <i>SINUS</i>	67
3.8.2 Uji Validitas Produk <i>SINUS</i>	67
3.8.3 Analisis Pengembangan (uji-coba) dan Implementasi Model <i>SINUS</i>	
3.8.3.1 Analisis Model <i>SINUS</i> diterima	68
3.8.3.2 Analisis Model <i>SINUS</i> Meningkatkan Kompetensi Pengetahuan	69
3.8.3.3 Analisis Model <i>SINUS</i> Meningkatkan Kompetensi Keterampilan	69
3.8.3.4 Analisis Model <i>SINUS</i> Meningkatkan Kompetensi Sikap	69
3.8.4 Analisis Respon Mahasiswa	70
BAB IV HASIL DAN PEMBAHASAN	
4.1 Hasil	
4.1.1 Karakteristik Model <i>SINUS</i>	71
4.1.2 Validasi Rancangan Model <i>SINUS</i>	77
4.1.2.1 Hasil Validasi Konten ke 1 & 2	77
4.1.2.2 Hasil Validasi Media ke 1 & 2	78
4.1.2.3 Komentar/saran Validator	78
4.1.3 Potensi Pengembangan Model <i>SINUS</i>	
4.1.3.1 Peningkatan Hasil Tes Kompetensi pada Tahap Uji-coba & Implementasi Sebenarnya	79
4.1.3.2 Peningkatan Hasil Tes Pretes-postes pada Tahap Uji-coba & Implementasi Sebenarnya	80

4.1.3.3 Peningkatan Kompetensi Keterampilan Berdasarkan Hasil Simulasi Interaktif (<i>SINUS</i>)	81
A. Pengaruh Panjang Rantai Alkil terhadap Titik Leleh Garam Imidazolium	81
B. Pengaruh Jenis Anion (Ukuran Anion) terhadap Titik Leleh Garam Imidazolium	81
4.1.3.4 Peningkatan Kompetensi Sikap Berdasarkan Hasil Simulasi Interaktif (<i>SINUS</i>)	82
4.1.4 Hasil Respon Mahasiswa	82
4.2 Pembahasan	
4.2.1 Karakteristik Model <i>SINUS</i>	83
4.2.2 Hasil Validasi	
4.2.2.1 Hasil Validasi Konten Ke-1 dan ke-2	85
4.2.2.2 Hasil Validasi Ahli Media ke-1 dan ke-2	88
4.2.2.3 Penilaian/saran Validator terhadap Model <i>SINUS</i>	90
4.2.3 Potensi Pengembangan Model <i>SINUS</i>	91
4.2.3.1 Peningkatan Hasil Tes Kompetensi (<i>CT</i>) pada Tahap Uji-coba dan implementasi sebenarnya	91
4.2.3.2 Peningkatan Hasil Pretes-postes pada Tahap Uji-coba dan Implementasi	94
4.2.3.3 Peningkatan Kompetensi Keterampilan Berdasarkan Hasil Simulasi Interaktif	
A. Pengaruh Panjang Rantai Alkil terhadap Titik Leleh Garam Imidazolium	96
B. Pengaruh Jenis Anion (Ukuran Anion) terhadap Titik Leleh Garam Imidazolium	97
4.2.3.4 Peningkatan Kompetensi Sikap Berdasarkan Hasil Simulasi Interaktif	98
4.3 Hasil Respon Mahasiswa	99
BAB V SIMPULAN, IMPLIKASI DAN REKOMENDASI	
5.1 Simpulan	107
5.2 Implikasi	108
5.3 Rekomendasi	108

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INA YULIANTI, 2021

PENGEMBANGAN MODEL SINUSN (SIMULASI INTERAKTIF IONIC LIQUIDS BERBASIS PROGRAM SKETCH) UNTUK MENINGKATKAN MAHASISWA

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