

**PROGRAM PERKULIAHAN TERMODINAMIKA BERBASIS
PEMECAHAN MASALAH KOLABORATIF BERBANTUAN SIMULASI
INTERAKTIF DAN *DERIVATIVE GAMES* UNTUK MENINGKATKAN
KEMAMPUAN PEMECAHAN MASALAH DAN BERPIKIR REFLEKTIF**

DISERTASI

Diajukan Sebagai Salah Satu Syarat untuk Memperoleh Gelar Doktor
Kependidikan dalam Bidang Pendidikan Ilmu Pengetahuan Alam



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LEMBAR PENGESAHAN
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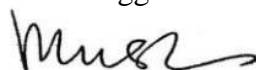
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ABSTRAK

Penelitian ini bertujuan untuk menghasilkan program perkuliahan termodinamika berbasis pemecahan masalah kolaboratif (PMK) berbantuan simulasi interaktif dan *derivative games* untuk meningkatkan kemampuan pemecahan masalah dan berpikir reflektif. Metode yang digunakan dalam penelitian ini adalah *Design and Development Research* (DDR) yang terdiri dari enam tahapan yaitu; analisis, tujuan, desain dan pengembangan, pengujian, evaluasi dan komunikasi hasil. Subjek dalam penelitian ini terdiri dari 23 mahasiswa kelompok eksperimen menggunakan program PMK berbantuan simulasi interaktif dan *derivative games* dan 18 mahasiswa kelompok kontrol menggunakan program perkuliahan konvensional. Instrumen penelitian yang digunakan adalah tes pemecahan masalah dan skala berpikir reflektif. Berdasarkan hasil uji validitas diperoleh 16 soal tes pemecahan masalah valid (CVR= 1) dan reliabel ($r = 0,81$), sedangkan pada skala berpikir reflektif diperoleh 24 item butir pernyataan reliabel ($r = 0,73$) dan 100 % model *fit* dengan data sesuai kriteria *Goodness-of-Fit Index*. Berdasarkan penelitian diperoleh temuan sebagai berikut: (1) Program perkuliahan memiliki karakteristik membangun kesiapan mahasiswa dalam belajar, mengembangkan kemampuan eksplorasi masalah, mengaktifkan mahasiswa dalam proses pemecahan masalah bersama, melatih berpikir refleksi mahasiswa dan mampu mengases proses dan hasil pembelajaran. Selain itu, program ini memiliki spesifikasi media simulasi interaktif dan *derivative games*. (2) Kemampuan pemecahan masalah kelompok eksperimen lebih besar secara signifikan dibandingkan dengan kelompok kontrol dengan nilai p (aspek total) 0,000; p (*Problem Schema*) 0,000, p (*Analogy*) 0,015, p (*Causal*) 0,018 dan p (*Argumentation*) 0,016. (3) Kemampuan berpikir reflektif mahasiswa kelompok eksperimen lebih besar secara signifikan dibandingkan dengan kelompok kontrol dengan nilai p (level total) 0,000; p (*understanding*) 0,003, p (*reflection*) 0,000 dan p (*critical reflection*) 0,015 kecuali pada *habitual action*. (4) Mahasiswa memberikan respon setuju bahwa program memotivasi dalam belajar termodinamika sebesar (77,3%), simulasi interaktif dan *derivative games* membantu dalam penjelasan konsep (75,9%), meningkatkan keaktifan (77,9%), kemampuan pemecahan masalah (78,2 %) dan berpikir reflektif (71,7%). Keseluruhan hasil tersebut menunjukkan bahwa program yang dikembangkan efektif untuk meningkatkan kemampuan pemecahan masalah dan berpikir reflektif.

Kata Kunci: Pemecahan Masalah Kolaboratif, Simulasi Interaktif, *Derivative Games* dan Berpikir reflektif

ABSTRACT

This research aims to produce a program of thermodynamics based on collaborative problem solving (CollaPs) assisted by interactive simulations and derivative games to improve problem-solving ability and reflective thinking. The method used in this research is Design and Development Research (DDR) which consists of six stages, namely analysis, objectives, design, and development, testing, evaluation, and communication of results. Participants in this study consisted of 23 experimental group students using the CollaPs programs assisted by interactive simulations and derivative games and 18 control group students using conventional programs. The research instruments used were problem-solving tests and reflective thinking scales. Based on the validity test results obtained 16 valid test questions (CVR = 1) and reliable (r = 0.81), while on the scale obtained 24 items reliable statement items (r = 0.73) and 100% model fit with data according to Goodness criteria -of Fit Index. Based on the research, the following findings were obtained: (1) The lecture program has the characteristics of building students' readiness in learning, developing problem exploration abilities, activating shared problem-solving processes, practicing reflection thinking, and assessing processes and results learning. In addition, this program has the characteristics of interactive simulation program specifications and derivative games (2) Problem solving ability of students in the experimental group was significantly greater than the control group with a p-value (total aspect) of 0.000; p (Problem Schematic) 0.000 with a p-value (total aspect) of 0,000; p (Problem Schema) 0,000, p (Analogy) 0.015, p (Causal) 0.018 and p (Argumentation) 0.016. (3) Students' reflective thinking ability in the experimental group was significantly greater than the control group with p value with a p-value (total level) of 0,000; p (understanding) 0.003, p (reflection) 0,000, and p (critical reflection) 0.015 except for habitual action. (4) Students respond to agree that the program motivates thermodynamic learning by (77.3%), interactive simulations and derivative games help in the explanation of concepts (75.9%), increase activity (77.9%), problem-solving ability (78.2%) and reflective thinking (71.7%). The overall results show that the program developed is effective in improving problem-solving ability and reflective thinking.

Keyword: Collaboratif Problem Solving, Interactive Simulation, *Derivative Games* and Reflective Thinking.

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DAFTAR ISI

HALAMAN SAMPUL	i
HALAMAN PENGESAHAN	ii
SURAT PERNYATAAN	iii
KATA PENGANTAR	iv
UCAPAN TERIMAKASIH	v
ABSTRAK	vii
ABSTRACT	viii
DAFTAR ISI	ix
DAFTAR TABEL	xii
DAFTAR GAMBAR	xiii
DAFTAR LAMPIRAN	xiv
BAB 1 PENDAHULUAN	1
1.1 Latar Belakang.....	1
1.2 Rumusan Masalah.....	9
1.3 Tujuan Penelitian.....	10
1.4 Manfaat Penelitian.....	11
1.5 Penjelasan Istilah.....	11
1.6 Struktur Organisasi Disertasi.....	13
BAB 2 KAJIAN PUSTAKA	15
2.2 Hakikat Fisika dipandang sebagai Hakikat Sains.....	15
2.1 Karakteristik dan Struktur Materi Termodinamika.....	18
2.3 Kemampuan Pemecahan Masalah.....	26
2.4 Kemampuan Berpikir Reflektif.....	30
2.5 Model Pemecahan Masalah Kolaboratif.....	35
2.6 Simulasi Interaktif dalam Perkuliahan Termodinamika.....	39
2.7 <i>Derivative Games</i> dalam Perkuliahan Termodinamika.....	43
2.8 Integrasi model PMK, Simulasi Interaktif dan <i>Derivative Games</i> perkuliahan termodinamika.....	46
BAB 3 METODE PENELITIAN	50

3.1 Desain Penelitian	50
3.2 Alur Penelitian	55
3.3 Lokasi dan Subjek penelitian	57
3.4 Instrumen Penelitian	58
3.5 Teknik Analisis data Hasil Pengujian Program	67
BAB 4 TEMUAN DAN PEMBAHASAN	74
4.1 Temuan	74
4.1.1 Karakteristik Program Perkuliahan Termodinamika	75
4.1.1.1 Landasan Empirik Pengembangan Program	75
4.1.1.2 Spesifikasi Program Perkuliahan Termodinamika	77
4.1.1.3 Sintak Program Perkuliahan Berbasis PMK.....	80
4.1.1.4 Perangkat Program Perkuliahan Termodinamika.....	83
4.1.1.5 Temuan Ujicoba Program.....	84
4.1.2 Implementasi Program PMK	104
4.1.2.1 Dampak Program Terhadap Peningkatan Kemampuan Pemecahan Masalah	105
4.1.2.2 Dampak Program Terhadap Peningkatan Kemampuan Berpikir Reflektif	108
4.1.2.3 Korelasi antara Kemampuan Berpikir Reflektif dengan Kemampuan Pemecahan Masalah.....	115
4.1.2.4 Keefektifan Program Berdasarkan Respon Mahasiswa	116
4.2 Pembahasan	117
4.2.1 Program PMK sebagai Alternatif dalam Perkuliahan Termodinamika yang Efektif.....	118
4.2.2 Eksplanasi Peran Program Perkuliahan PMK untuk Meningkatkan Kemampuan Pemecahan Masalah.....	125
4.2.3 Eksplanasi Peran Program Perkuliahan PMK untuk Meningkatkan Kemampuan Berpikir Reflektif.....	130
4.2.4 Eksplanasi Korelasi Kemampuan Pemecahan Masalah dan Berpikir Reflektif	134
4.2.5 Ekplanasi Keefektifan Program untuk Meningkatkan Kemampuan Pemecahan Masalah dan Berpikir Reflektif	135

BAB 5 KESIMPULAN, IMPLIKASI DAN REKOMENDASI	138
5.1 Kesimpulan	138
5.2 Implikasi	140
5.3 Rekomendasi.....	141
DAFTAR PUSTAKA	142
LAMPIRAN	157

DAFTAR TABEL

2.1 Capaian Pembelajaran Termodinamika.....	21
2.2 Level Berpikir Reflektif.....	34
2.3 Prinsip-prinsip desain untuk PMK berdasarkan peraturan Bersama ...	38
2.4 Daftar Permainan Epistemis	44
2.5 Gerakan Kunci untuk Setiap <i>Games Epistemic</i>	45
3.1 Desain Pengujian program.....	54
3.2 Karakteristik Kelas Uji Coba dan Implementasi	56
3.3 Tujuan, Sumber, Teknik pengumpulan data dan jenis instrumen	58
3.4 Hasil Validasi Instrumen Tes Pemecahan Masalah.....	60
3.5 Hasil Validasi Instrumen Skala Berpikir Reflektif.....	62
3.6 Indeks <i>Goodness of Fit</i> Variabel Skala Berpikir Reflektif.....	64
3.7 Hasil Validasi Sintak Perkuliahan	66
3.8 Sintak Perkuliahan Termodinamika Sebelum dan Setelah Revisi.....	67
3.9 Kriteria Besarnya nilai N-gain.....	69
3.10 Interpretasi ukuran dampak	71
3.11 Interpretasi Nilai r_{xy}	72
3.12 Kategori Persentase Responden Terhadap suatu Tanggpan	73
4.1 Tanggapan Mahasiswa Uji Coba.....	93
4.2 Peningkatan kemampuan pemecahan masalah Uji Coba	94
4.3 Peningkatan kemampuan Berpikir reflektif pada tahap Uji Coba	95
4.4 Revisi Perkuliahan Termodinamika Berdasarkan Hasil Uji Coba	99
4.5 Uji Signifikansi Kemampuan Pemecahan Masalah.....	106
4.6 Level Kemampuan Berpikir Reflektif pada Tiap Pertemuan	109
4.7 Hasil N-Gain Kemampuan berpikir Reflektif.....	113
4.8 Uji Signifikansi Kemampuan Level Berpikir Reflektif.....	114
4.9 Hasil uji korelasi (Korelasi Person) Kemampuan pemecahan masalah dengan Kemampuan berpikir reflektif.....	115
4.10 Respon Mahasiswa Terhadap Keefektifan Program Perkuliahan	116

DAFTAR GAMBAR

2.1 Tiga Domain Sains	16
2.2 Bagan Materi Termodinamika.....	25
2.3 Simulasi interaktif pada aplikasi <i>C.K physics</i>	42
2.4 Simulasi interaktif pada aplikasi <i>Physlet</i>	42
2.5 <i>Games epistemic analitic</i>	45
2.6 Keterampilan pada komponen PMK	47
2.7 Integrasi Model PMK	49
3.1 Tahapan <i>Desain Development Research (DDR)</i>	50
3.2 Proses Evaluasi pada tahapan Ujicoba	54
3.3 Alur Penelitian	56
3.4 Analisis Faktor Skala Kemampuan Berpikir Reflektif.....	64
4.1 Struktur konten materi dan Teknik pembelajarannya.....	78
4.2 Sintak Program PMK.....	80
4.3 Aktivitas Mahasiswa Ujicoba	85
4.4 Hasil Temuan Kelompok dalam Penjelasan Temuan.....	89
4.5 Analisis diagram P-V pada mesin kalor	92
4.6 Bagan Evaluasi Program Perkuliahan Pada Fase Uji Coba.....	96
4.7 Aktivitas Mahasiswa Tahap Implementasi	105
4.8 Grafik Perbandingan Rata-Rata Skor N-Gain	108
4.9 Perubahan level kemampuan berpikir reflektif.....	111
4.10 Kemampuan mahasiswa dapat mengeksplorasi masalah	124
4.11 Kemampuan mahasiswa dapat menjelaskan temuan	124

DAFTAR LAMPIRAN

LAMPIRAN A

Rencana Pembelajaran Semester.....	158
Sampel LKM Termodinamika	174
Soal Kemampuan Pemecahan Masalah	178
Skala Kemampuan Berpikir Reflektif.....	182
Skala Respon Mahasiswa.....	184

LAMPIRAN B

Reliabilitas Tes Pemecahan Masalah	186
Reliabilitas Skala Berpikir Reflektif	187
Analisis Faktor Skala Berpikir Reflektif.....	188

LAMPIRAN C

Uji Signifikansi Perbedaan Kemampuan Pemecahan masalah	190
Uji Signifikansi Perbedaan Kemampuan Berpikir Reflektif.....	193
Korelasi Antara Kemampuan Pemecahan Masalah dan Berpikir reflektif	195

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