

TABLE OF CONTENT

Page

APPROVAL SHEET	<i>i</i>
ORIGINALITY STATEMENT	<i>ii</i>
BIOGRAPHY	<i>iv</i>
ABSTRACT	<i>v</i>
ACKNOWLEDGEMENT	<i>vi</i>
TABLE OF CONTENT	<i>viii</i>
TABLE OF TABLE	<i>xiii</i>
TABLE OF APPENDIX	<i>xv</i>
CHAPTER I INTRODUCTION.....	17
1.1 Background of Study	17
1.2 Problem Identification.....	20
1.3 Scope of Research.....	20
1.4 Problem Formulation	20
1.5 Research Objectives	21
1.6 Research Benefits.....	21
CHAPTER II LITERATURE REVIEW	20
2.1 Student Worksheets Development Model.....	20
2.1.1 ADDIE Development Model	20
2.1.2 ADDIE Development Model Phase.....	21
2.2 Student Worksheets.....	22
2.2.1 Definition of Student Worksheets	22
2.2.2 Functions and Objectives of Student Worksheets	23

	<i>Page</i>
2.2.3 Student Worksheet Preparation Steps.....	23
2.2.4 Student Worksheets Eligibility	24
2.3 Development of Electronic Student Worksheets (E- Student Worksheets)	25
2.4 STEM (Science, Technology, Engineering, Mathematics) 26	
2.4.1 STEM-Education	26
2.4.2 STEM Education Approach.....	26
2.4.3 Benefits of STEM Education.....	27
2.4.4 The Objectives of STEM Education.....	27
2.5 Learning Outcomes	29
2.6 Electrolyte and Non-Electrolyte Solution Material	30
2.7 Relevant Study	33
2.8 Framework of Thinking	37
CHAPTER III RESEARCH METHODOLOGY	38
3.1 Location and Time of Research	38
3.2 Type of Research	38
3.3 Population and Sample.....	38
3.4 Operational Definition	39
3.5 Research Design.....	40
3.6 Research Procedure.....	41
3.7 Data Collection Technique.....	44
3.7.1 Observation Techniques	44
3.7.2 Interview Techniques.....	44
3.7.3 Questionnaire Technique	44

	<i>Page</i>
3.7.4 Test Technique.....	44
3.8 Research Instruments	45
3.8.1 Material Expert Validation Assessment Sheet	45
3.8.2 Learning Expert Validation Assessment Sheet	46
3.8.3 Design Expert Validation Assessment Sheet	46
3.8.4 Instrument Test Validation	48
3.9 Data Analysis Technique	48
3.9.1 Expert Validation Questionnaire Results Data Analysis.....	48
3.9.2 Students' Learning Outcomes.....	51
CHAPTER IV RESULTS AND DISCUSSIONS	53
4.1 The Development of the STEM-based E-Student Worksheets.....	53
4.1.1 Analysis	53
4.1.2 Design.....	55
4.1.3 Development.....	57
4.2 The Standardization of STEM-based E-Student by Experts	68
4.2.1 Assessment of E-Student Worksheets According to Material Experts.....	68
4.2.2 Assessment of E-Student Worksheets According to Learning Experts.....	68

	<i>Page</i>
4.2.3 Assessment of E-Student Worksheets	
According to Design Experts.....	69
4.2.4 Analysis of Validation Data	70
4.3 The Implementation in Class of the STEM-based E- Student Worksheets in Improving students' learning outcomes	71
4.3.1 Limited Group Trial Assessment of the Effectiveness of E-Student Worksheets in Improving Student Learning Outcomes	71
4.3.2 Student Group Work Skills Assessment.....	73
4.3.3 Evaluation.....	75
CHAPTER V CONCLUSIONS AND RECOMMENDATIONS	77
5.1 Conclusions.....	77
5.2 Recommendations.....	77
REFERENCES.....	79
APPENDIX.....	86

