

TABLE OF CONTENTS

VALIDITY SHEET	i
PAGE OF ORIGINALITY STATEMENT	ii
APPROVAL PAGE FOR PUBLICATION OF FINAL PROJECT FOR ACADEMIC PURPOSES.....	iii
BIOGRAPHY	iv
ABSTRACT.....	v
PREFACE.....	vi
TABLE OF CONTENTS.....	viii
LIST OF TABLES	xi
LIST OF FIGURES	xii
APPENDIX.....	xiii
CHAPTER I INTRODUCTION	1
1.1. Background of The Problem	1
1.2. Identification of Problems.....	6
1.3. The scope of Research	6
1.4. Scope of Problem	6
1.5. Formulation of The Problem.....	7
1.6. Research Purposes.....	7
1.7. Benefits of Research	7
1.8. Research Hypothesis	8
CHAPTER II THEORETICAL STUDY	9
2.1. Literature Review	9

2.1.1.	Learning and Learning Results	9
2.1.2.	Student Worksheets	12
2.1.3.	STEM (Science, Technology, Engineering and Mathematics).....	14
2.1.4.	Material Developed in STEM Based Student Worksheets.....	17
2.2.	Relevant Research.....	21
2.3.	Framework of Thinking	22
	CHAPTER III RESEARCH METHODS	23
3.1.	Research Location and Time.....	23
3.2.	Types of Research	23
3.3.	Population and Sample.....	23
3.3.1.	Population	23
3.3.2.	Sample	23
3.4.	Research Design and Variables.....	24
3.4.1.	Research Design	24
3.4.2.	Research Variables	24
3.5.	Operational Definition	25
3.6.	Research Instrument.....	25
3.6.1.	Test Instrument (Pretest-Posttest).....	25
3.6.2.	Non-test Instruments.....	26
3.7.	Test Validity.....	27
3.7.1.	Content Validation.....	27
3.7.2.	Construct Validity.....	27
3.7.3.	Reliability Test.....	28
3.7.4.	Level of Difficulty	29
3.7.5.	Differentiating Power	30

3.8. Data Collection Technique.....	32
3.9. Research Procedure	32
3.10. Data Analysis Technique.....	33
3.10.1. Prerequisite Test.....	34
3.10.2. Hypothesis Testing.....	35
3.10.3. Questionnaire Data Analysis.....	36
CHAPTER IV RESULTS AND DISCUSSION	38
4.1. Research Results	38
4.1.1. Pretest Result Data Experimental and Control Class.....	38
4.1.2. Posttest Result Data Experimental and Control Class	39
4.1.3. Student Response Data	40
4.1.4. Data Analysis	41
4.2. Discussion	45
CHAPTER V CONCLUSION.....	50
5.1. Conclusion	50
5.2. Suggestion	50
BIBLIOGRAPHY.....	51

LIST OF TABLES

Table 3. 1. Pretest-Posttest Control Group Design	24
Table 3. 2. Student Response Grid.....	26
Table 3. 3. Interpretation of Validity Index	28
Table 3. 4. Interpretation of Reliability Index.....	29
Table 3. 5. Interpretation of Difficulty Index.....	30
Table 3. 6. Interpretation of Differentiating Power.....	31
Table 3. 7. Recapitulation of Instrument Test Results	31
Table 3. 8. Likert Scale on Student Response Questionnaire	37
Table 3. 9. Interpretation of Questionnaire Scoring.....	37
Table 4. 1. Frequency Distribution of Pretest Data.....	39
Table 4. 2. Frequency Distribution of Posttest Data	41
Table 4. 3. Student Response Results	40
Table 4. 4. Normality Test Results.....	42
Table 4. 5. Homogeneity Test Results	42
Table 4. 6. Hypothesis Data Pretest	43
Table 4. 7. Hypothesis Data Posttest.....	44
Table 4. 8. Percentage of Student Respon.....	44

LIST OF FIGURES

Figure 2. 1. Pendulum	17
Figure 2. 2. Longitudinal Waves.....	18
Figure 2. 3. Transverse Waves.....	19
Figure 4. 1. Average Pretest Experiment and Control Class	39
Figure 4. 2. Average Posttest Experiment and Control Class.....	40
Figure 4. 3. Percentage of Student Response.....	41
Figure 4. 4. Graph of Increasing Learning Outcomes for Experimental and Control Class.....	41

APPENDIX

Attachment 1. Syllabus	54
Attachment 2. Lesson Plan.....	56
Attachment 3. Grid of Learning Outcomes Test Instrument	77
Attachment 4. Learning Outcomes Test Instrument	85
Attachment 5. Instrument Validation Test by Lecturer.....	90
Attachment 6. Student Respon Assesment Questionnaire	93
Attachment 7. Validation of the Question Instrument by Validator I.....	95
Attachment 8. Validation of the Question Instrument by Validator II.....	98
Attachment 9. Instrument Validation Test by Student.....	101
Attachment 10. Table of Reliabiliy Test	105
Attachment 11. Table of Difficulty Level	107
Attachment 12. Differentiating Power	109
Attachment 13. Tabulaion of Experimental Pretest Answers	113
Attachment 14. Tabulation of Control Pretest Answers	115
Attachment 15. Tabulation of Experimental Posttest Answers.....	117
Attachment 16. Tabulation of Control Posttest Answers	119
Attachment 17. Test of Normality.....	121
Attachment 18. Test of Homogeneity	129
Attachment 19. Hypothesis Test	130
Attachment 20. Results of Student Respons	131
Attachment 21. Letter of Research Permit	132
Attachment 22. Letter of Validation Permit.....	133
Attachment 23. Letter of Research Permit Reply	135
Attachment 24. Research Documentation	136
Attachment 25. Student Worksheets with STEM Approach.....	138