

Contents

1	Introduction	1
2	The Nature and State of the Undergraduate Chemistry Lab	3
2.1	Lab Course Instruction Styles	4
2.2	Implementation into the Curriculum	6
2.3	Lab Courses' Contribution to Learning Chemistry and Academic Success ...	8
3	Theories on Laboratory-Supported Learning.....	13
3.1	Prior Knowledge and Laboratory Instruction	13
3.2	Lab Course Learning Goals and Learning Goal Alignment.....	19
3.3	Models on the Effectiveness of Practical Work	22
3.4	Model on Influencing Factors for Lab Course Success	26
4	Research Questions and Hypotheses	29
5	Study Design	31
5.1	Study Context and Sample	31
5.2	Assessed Variables and Test Instruments	35
5.2.1	Content Knowledge	36
5.2.2	Lab Skills	37
5.2.3	Learning Goal Alignment and Learning Goal Perceptions	43
5.2.4	Background and control variables	47
5.3	Data matching.....	49
6	Methodology for Data Analysis	51
6.1	Content Knowledge and Lab Skills (Paper-Pencil Test Data).....	51
6.2	Learning Goal Alignment and Perceptions (Rating Scale / Ranking Data)..	55
6.3	Hands-On Lab Skills (Observation Sheets and Video Data).....	59
7	Pilot Study.....	63
7.1	Sample	65
7.2	Pilot Study 1.....	66
7.2.1	Results and Discussion.....	66
7.2.2	Test Revision for Pilot Study 2	74

7.3 Pilot Study 2	75
7.3.1 Results and Discussion	76
8 Main Study	81
8.1 Final test instruments and test parameters	82
8.1.1 Content Knowledge.....	83
8.1.2 Lab Skills (Paper-Pencil Test).....	85
8.1.3 Lab Skills (Hands-On).....	86
8.1.4 Learning Goal Alignment and Learning Goal Perceptions	88
8.1.5 Background and control variables.....	89
8.2 Sample.....	90
8.3 Results and Discussion	94
8.3.1 Students' Learning Goal Expectations and Perceptions over Time ..	94
8.3.2 Learning Goal Alignment between Students and Lab Instructors ..	101
8.3.3 Prediction of Lab Course Success	103
8.3.4 Effect of Lab Course Enrolment on Learning Chemistry.....	106
8.3.5 Relationship between Lab Course and General Chemistry Final Exam..	108
9 Implications for Research and Teaching	111
10 Conclusion	117
11 References and Lists	121
11.1 Bibliography	121
11.2 List of Figures	131
11.3 List of Tables.....	133
Appendix	137