

*This work is dedicated to my wife Karen, daughter Kaela, and son Cole whose sacrifices, which were realized by our loss of precious time together, were for me the most painful and humbling of all.*

## Acknowledgments

I believe I would never have completed this work and gotten this far without the years of support of Joe Pitt, and I am sure that a simple thank you will never be enough to convey my gratitude for his criticisms and praise. To merit his approval is a great honor for me. I feel extremely lucky and humbled to have had the opportunity to learn from such an impressive and supportive committee. Each member, Joe Pitt, Michael Bentley, Marianne de Laet, Skip Fuhrman, Jim Garrison, and Barbara Reeves has inspired me in their own way to love and pursue my academic desires. They have all taught me to value and enjoy my education by modeling excellence in their teaching and scholarship, and that is worth more than can be told. I owe a special thank you to Jack Carroll who not only provided me the needed and generous support to complete the work but also a great deal of crucial feedback and substance in writing it. Jack treated me with considerable respect and understanding and made me feel like a worthy employee and colleague. The work also owes a great deal to the help of Philip Isenhour who dedicated a considerable amount of time and patience explaining to me, discussing with me, and reviewing the work for me, and also Dennis Neale who, along with Philip, not only made me feel like a valuable colleague, but more importantly a valuable friend. I would especially like to thank Kathy Bunn, Mark Freeman, Suzan Mauney, and Fred Rencsok for their gracious and vital help along the way in completing the work. Last but not least, I would like to thank my entire family. Special thanks to my mother Julia Dunlap, father Ramon Dunlap, and wife Karen Dunlap who have all made incredible and selfless sacrifices for me over many years that I might someday have this privilege.

## Table of Contents

### 1. Introduction

Introduction.....	1
Background.....	2
Purpose of the Study.....	3
Methods.....	3
Data.....	5
Participant Observation in the LiNC Project.....	5
The LiNC Project Research.....	7
Data Collection and Recording Procedures.....	7
LiNC Project Data Analysis.....	9
Technology Studies.....	11
Social Construction of Technology (SCOT).....	12
Participant Observation.....	14
A Note on Reflexivity.....	15
Questions.....	16
Setting and Limitations.....	17
Significance.....	18
Outline of Dissertation.....	18

### 2. The Technology

Introduction.....	21
Technological Infrastructure: Definitions.....	22
Social Construction of LiNC Technology.....	23
Histories of the Internet and Historiography.....	24
Another Brief History of the Internet.....	27
Telnet.....	29
The Web and HTML.....	32
Java and Applets.....	33
The Virtual School.....	34
Context of Use of the Virtual School.....	36
MOOsburg.....	37
Putting in the CORK.....	40
Technology Transfer.....	42
Sieve.....	45
JAMM, Culture, and Subclassing.....	46
PEPPER, CORK, and Sun.....	48
Summary.....	48

### 3. The Policy and Funding

Introduction.....	51
1980s Crisis of Education: “A Nation At Risk”.....	51
NSF Response: NII and NIE.....	53
Funding LiNC.....	55
Before the LiNC Grant: BEV and “The Planning Grant”.....	55

PCs for Families Grant.....	57
The LiNC Project.....	59
The LiNC Grant.....	59
Big Technology: NSF's Big Science Approach to Networks for Education..	61
Big Education: The NREN.....	62
The Field of HCI: People and Wires.....	64
The Center for HCI at Virginia Tech: Disciplines and Dollars.....	67
Summary.....	70

#### **4. The Teachers: Technology In the Classrooms**

The LiNC Project and the LiNC Grant .....	74
Timeline.....	75
The Years Before: Early work by Laughton.....	78
The LiNC Grant Proposal.....	78
Design goals in LiNC.....	79
Educational Expertise: John Burton.....	81
Year 1 of LiNC (1995-1996).....	82
George Chin's Work.....	83
Year 2 (1996-1997).....	87
Teacher Revolt.....	88
Teachers Understanding Their Differences.....	89
Year 3 (1997-1998).....	92
PCs Deployed.....	93
Long-Term Projects.....	93
The Virtual School is Born.....	95
Year 4 (1998-1999).....	97
The Virtual School Projects.....	97
The Virtual School in Action.....	98
Short-term Virtual School Projects.....	98
Long-term Virtual School Projects.....	101
Year 5 (1999-2000).....	104
On-going Use of the Virtual School: The Lego Projects.....	104
Investigators Data Collection.....	106
Research from the Teachers' Perspective.....	109
Summary.....	111

#### **5. Conclusions**

Introduction.....	114
Technological Infrastructure and Development Work.....	116
Political Context and Funding of the LiNC Project: NII and Research.....	117
Big Education and Network Technology: NSF, NREN, and NIE....	117
Social Networks and The Center for HCI.....	118
Border Crossing.....	119
Teaching, Technology, and Research.....	121
Teachers' Work in the LiNC Project.....	123
Teacher Collaboration in LiNC.....	124

Collaborative and Cooperative Learning in the Virtual School.....	125
School and University Collaboration.....	128
Teachers, Technology, Research, and Participatory Design.....	128
Teachers' View of "Research" and Researcher Intervention.....	130
Researchers' Ignorance of Teaching.....	131
Social Construction of Technology Revisited.....	132
Technology and Anthropomorphosis.....	133
Opportunities for Further Research.....	134
<b>References.....</b>	<b>138</b>
<b>Appendix A: Acronyms.....</b>	<b>145</b>
<b>Appendix B: Related Grant Awards.....</b>	<b>147</b>
<b>Appendix C: Surveys and Interviews.....</b>	<b>149</b>
<b>Vita.....</b>	<b>150</b>