## Content

0. Introduction	7
1. Theoretical background	11
1.1 The German school system	12
1.2 Challenges for science teaching at the end of primary school	16
1.3 A model for quality of instruction	21
1.4 Content knowledge and its role in teachers' professional knowledge	24
1.5 General conditions for teaching physics in primary school	27
1.6 The "PLUS" Project	29
1.7 Aims and research questions	32
1.8 Hypotheses	34
1.9 Summary of the theoretical background	38
2. Methodology	39
2.1 Planning and organisation	39
2.2 Instruments	42
2.2.1 Teacher test for content knowledge	42
2.2.2 Instrument for video analysis	52
2.2.3 Student test	71
2.3 A description of the sample	72
2.4 Overview of statistical analyses	73
2.4.1 Rasch model	74
2.4.2 Hierarchic linear model	75
2.4.3 Validation of the instruments	77
2.5 Summary of the methodology	79



3. Results and findings	81
3.1 Quality criteria of the instruments	82
3.1.1 Teacher test	82
3.1.2 Video instrument	83
3.1.3 Student test	86
3.2 Descriptive results	86
3.2.1 Teacher's content knowledge	87
3.2.2 Quality of instruction	93
3.3 Evaluation of the underlying model	98
3.3.1 Relation between teachers' content knowledge	
and quality of instruction	98
3.3.2 Relation between quality of instruction	
and students' achievement	101
3.3.3 Relation between teachers' content knowledge	
and students' achievement	103
3.4 Summary of results	107
4. Discussion and perspectives	111
5. References	117
6. Appendix	
I. Video coding manual (basic coding)	. 1
II. Video coding manual (basis models and content structure)	23
III. List of contents	46
IV. Table of figures	47