

Table of contents

	Preface	12
	<u>Chapter 1</u>	
	Introduction	
1.1	Introduction	16
1.2	Flood risk in the Netherlands	17
1.2.1	Water safety from a geological and historical perspective	17
1.2.2	Flood risk and water-safety policy	18
1.2.3	Flood-risk perception	22
1.2.4	Flood-risk communication	25
1.3	Geography, natural hazards and education	25
1.3.1	Geography and natural hazards	25
1.3.2	Dutch geography education and natural hazards	27
1.3.3	Curriculum guidelines with respect to geography education in the Netherlands	28
1.3.4	Geography textbooks and flood risk in the Netherlands	29
1.4	Research objective, research questions and research design	32
1.5	Outline of this thesis	34
	<u>Chapter 2</u>	
	The role of knowledge in students' flood-risk perception	
	Abstract	40
2.1	Introduction	41
2.2	Theory and expectations	42
2.2.1	Risk perception	42
2.2.2	Hazard knowledge	43
2.2.3	Environmental cues	45
2.2.4	Fear and trust	45

2.2.5	Geography education and flood risk	46
2.2.6	Aims and hypotheses	48
2.3	Method	50
2.3.1	Research group	52
2.3.2	Measurements: risk perception	52
2.3.3	Measurements: knowledge	52
2.3.4	Analysis	53
2.4	Results	54
2.4.1	Principal component analysis	54
2.4.2	Flood-risk perception and knowledge	54
2.4.3	Predictors of flood-risk perception	58
2.5	Conclusions and discussion	58
2.5.1	Future studies	62

Chapter 3

Students' mental models with respect to flood risk in the Netherlands

	Abstract	66
3.1	Introduction	67
3.2	Theory and expectations	69
3.2.1	Saliency	69
3.2.2	Mental models	70
3.2.3	Reasoning	70
3.2.4	Research questions	72
3.3	Method	73
3.3.1	Research group	73
3.3.2	Interviews	73
3.3.3	Measurements	74
3.4	Results	74
3.4.1	Flood-risk saliency	76
3.4.2	Mental models	76
3.4.3	Reasoning	80
3.5	Conclusions and discussion	84

Chapter 4

Designing a flood-risk education program in the Netherlands

	Abstract	90
4.1	Introduction	91
4.2	Method and aims	92
4.3	Analysis	94
4.3.1	Students' perceptions and mental models with respect to flood risk in the Netherlands	94
4.3.2	Learning theory	95
4.3.3	Information processing	96
4.3.4	Risk communication	97
4.4	Outcomes of the design process	99
4.4.1	Underpinning of the flood-risk education program	99
4.4.2	Flood-risk education program	100
4.4.3	Description of the design process and the design principles	104
4.5	Conclusions	108

Chapter 5

Evaluating a flood-risk education program in the Netherlands

	Abstract	112
5.1	Introduction	113
5.2	Expectations of the flood-risk education program	115
5.2.1	Flood-risk education program	115
5.2.2	Aims and hypotheses	116
5.3	Method	118
5.3.1	Research design and research group	118
5.3.2	Measurements	119
5.3.3.	Analysis	121
5.4	Results	121

5.4.1	Differences between the intervention group and control group at T_0	121
5.4.2	Effects of the intervention	122
5.5	Conclusions and discussion	124
5.5.1	Results	124
5.5.2	Limitations	125
5.5.3	Recommendations	127

Chapter 6

Conclusions, discussion and implications

6.1	Introduction	132
6.2	Conclusions and discussion	132
6.3	Reflections	137
6.3.1	Reflection on research outcomes	137
6.3.2	Reflection on research design and approach	138
6.4	Implications for the geography curriculum in lower secondary education	140
6.4.1	The geography curriculum in general	140
6.4.2	Attainment targets with respect to flood hazards in the Netherlands	143
6.5	Implications for further research into students' flood-risk perception	149
6.5.1	The formation of mental representations about flood risk	149
6.5.2	The flood-risk education program and other regions in the Netherlands	153
6.6	Implications concerning some aspects of pedagogical content knowledge	154
6.6.1	Pre-existing knowledge and misconceptions as the basis for conceptual change	154
6.6.2	Intuitive thought and misconceptions	155
6.6.3	Epilogue	162

References	166
Summary	176
Samenvatting	180
Dankwoord	184
Appendices	190
Appendix A Knowledge tests (Chapter 2, section 2.3.3)	190
Appendix B Interview protocol (Chapter 3, section 3.3.2)	193
Appendix C Saliency: pictures (Chapter 3, section 3.3.3)	194
Appendix D Substantive beliefs, gaps and misconceptions (Chapter 3, section 3.4.2)	196
List of photographs at the beginning of each chapter	199