

# VU Research Portal

## **Dry feet in the polder? Improving flood-risk perception of 15-year-old students in the Netherlands**

Bosschaart, A.M.W.

2015

### **document version**

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

### **citation for published version (APA)**

Bosschaart, A. M. W. (2015). *Dry feet in the polder? Improving flood-risk perception of 15-year-old students in the Netherlands*. [, Vrije Universiteit Amsterdam].

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

### **Take down policy**

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

### **E-mail address:**

[vuresearchportal.ub@vu.nl](mailto:vuresearchportal.ub@vu.nl)

## Table of contents

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

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

## **Chapter 5**

### **Evaluating a flood-risk education program in the Netherlands**

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

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