

Summary

This study among 15-year old students shows that they are unaware of flood risks in their own surroundings. It also demonstrates that geography teaching material that consists of simulations, field work and research in their own surroundings is effective in giving students a better understanding of flood risks. The teaching material designed in this study does not lead to a greater fear of floods. It is highly desirable to incorporate the theme of flood risks in the learning goals derived from elaborated attainment targets for the first three years of secondary education.

Background and objective

The Netherlands is well known for its struggle against the water and for its water works. However, since the beginning of this century the Dutch authorities have become more and more aware that despite all the preventive efforts flooding still is a threat. Although the chance of flooding is small, the consequences would be enormous. At the same time the Dutch population is hardly aware of a flood threat. The 1953 flood disaster and the successive construction of the Deltaworks thoroughly influenced the way people in the Netherlands think about flood risk. As a consequence most people believe that the struggle against the water is fought as if the authorities could guarantee 100% safety. This is called "the myth of dry feet". Until now flood-risk perception in the Netherlands was solely studied as it relates to adults. The first phase of this study focuses on the way 15-year-old students perceive flood risk and think about flood preparedness. The second phase of this study aims at the role geography education can play in deconstructing "the myth of dry feet".

The first phase of the study

In general students' flood-risk perception is in accordance with the way Dutch citizens perceive flood risk. A survey among 483 15-year-old students in flood-prone areas showed that they are hardly aware of a potential flood threat, thinking about flood risk does not cause fear and their trust in water safety is high. Furthermore, this study showed that the optimistic bias is applicable to the way 15-year-old students in the Netherlands perceive flood risk. Although their perception of flood exposure with respect to the Netherlands in general is moderate, students' perception of personal flood exposure is low. That students have a general notion of flood risk in the Netherlands which is not connected to their own surroundings is also evident from their low level of knowledge about flood risk in the surroundings. These results were corroborated by the outcomes of interviews among 50 students at two schools in flood prone areas. These schools were not the same ones

that participated in the survey. Flood risk in the surroundings shows low salience among students. Their mental models, mental schemes of knowledge and beliefs, with respect to flood risk in the surroundings turn out to be fragmentary. These mental models consist mainly of factual knowledge while knowledge with respect to causes and effects largely fails. Knowledge about prevention, preparedness and disaster response is also absent.

The way students perceive flood risk appeared to be influenced by cognitive and affective factors. In accordance with previous studies fear proved to be an important predictor of flood risk perception. However, in contrast to other studies concerning hazard perception, local knowledge plays an important role in the formation of students' flood-risk perception. In addition, the interviews show that students' beliefs with respect to flood risk and flood preparedness are partly based on the use of analogies and heuristics.

The second phase of the study

This phase focused on the design and evaluation of a flood-risk education program that aimed at improving 15-year-old students' flood-risk perception and preparedness intentions. The design process was guided by the principles of educational design research and had an iterative character. The design of the program was based on the outcomes of the first research phase as well as theoretical understandings from learning theory, information processing and risk communication. During the development of the program, the intermediate products were evaluated formatively with the participation of geography teachers, focusing on the consistency, practicality and effectiveness of the program.

In the flood-risk education program, learning processes and content were modeled in such a way that the arousal of moderate levels of fear should prompt experiential and analytical information processing. Combining both types of information processing should contribute to accommodative learning which is necessary for belief change. The content has to do with the chain of events related to flood risk (high water > dike breach > flooding water > effects) as well as prevention and disaster response. In this way, understanding of flood risk in the surroundings should prompt students' threat and coping appraisal. To accomplish this, the program consists, besides teacher-directed activities, of a variety of student-directed parts. A 3D-serious game concerning dike breaches as well as a 2D-flood simulation make up an important part of the program. The flood-risk education program comprises seven lessons.

The effectiveness of the flood-risk education program was evaluated by means of an experiment. The experiment consisted of a pretest/posttest-design with an intervention group and a control group in a region of the province of North-Holland, a flood-prone area in the Netherlands. 271 students participated in this study. As expected, the results showed that the intervention caused increases in risk perception, while perceptions of fear and trust remained the same. These outcomes showed that intrusiveness of the flood-risk education program was the case to such an extent that students' appraisal of the threat of flooding changed without causing feelings of anxiety or panic. This is important because authorities often think that presenting simulations and worst case scenarios cause panic and decrease trust. However, students' preparedness intentions did not change. This could have been caused by methodological limitations with respect to the measurement or the limited presentation mode that was used to present the intrusive information in the 3D-game and the flood simulation. But it is necessary to take into account that "the myth of dry feet" is deeply embedded in Dutch society. Therefore, it seems plausible to assume that changing attitudes with respect to flood risk needs more time than seven lessons. A prolonged learning path in which more fundamental aspects that underlie beliefs with respect to flood risk, seems crucial. The prolonged learning path comprises the final classes of primary education as well as lower secondary education.

During the design and evaluation of the flood-risk education program, substantive design principles, which represent the essential functions and characteristics of the program, were determined and evaluated. Affect, availability, blended learning and prolonged learning path were determined as guiding design principles.

Implications

This thesis made clear how geography education could play a role in raising awareness and changing perceptions with respect to flood risk. When geography education has the intention to contribute to the formation of flood-risk awareness of future generations, it is necessary to incorporate the topic of flood risk and elaborate the existing attainment targets into goals to attain. In this way more clarity and guidance will be created.

As the flood-risk education program has a composite character, the evaluation of the program only covered the overall effect. The assumption that the program contributes to the formation of students' mental representations with respect to flood risk in their surroundings, should be further investigated. This applies also to

the effectiveness of the flood-risk education program in various flood-prone areas in the Netherlands.

This thesis showed that extensive understanding of students' pre-existing knowledge and beliefs plays a crucial role in the underpinning and design of the flood-risk education program. To enhance teachers' conception of the role of intuitive thought in learning processes, it seems necessary to provide them with insight in the dual process modes of thinking.