3. Design and development of a geography curriculum for first-year primary student teachers
Abstract

This paper describes the result of a design study in which a geography course was developed and tested aiming to develop the Pedagogical Content Knowledge (PCK) of first-year primary student teachers. This resulted in a course called ‘Consciously Teaching Geography’ with characteristics as (1) starting from students’ preconceptions and everyday geographic experiences, (2) an underlying conceptual framework that incorporates key concepts of geography, (3) the use of active learning strategies and (4) explicit modelling to (5) leave room for reflection. Also room for the ‘couleur locale’ of the institute and the teaching style of the teacher educator proved necessary.

Keywords

design research, geography, primary teacher training, pedagogical content knowledge, modelling

3.1. Introduction

In this study, we develop and test a course for primary student teachers that aims to teach them to design and teach good geography lessons in primary school, as well as to think geographically. This is a challenging task, largely because many primary student teachers have little formal preparation in the subject of geography when they begin teacher education (Catling, 2004; Catling & Willy, 2009; Martin, 2008b; Morley, 2012; Jo & Bednarz, 2014). Their geographic knowledge base is narrow, and their image of the subject is mainly knowledge-oriented. They do not see that many daily life experiences are geographic in nature and therefore feel no relationship with and motivation for the subject (Martin, 2006a; 2008a).

This raises the question of what a course that focuses on the development of the knowledge, skills and attitudes – in other words, the geographical Pedagogical Content Knowledge (PCK) – that primary student teachers need for teaching the subject of geography might look like. Pedagogical Content Knowledge (Shulman, 1986; 1987) can be defined as the synthesis of all knowledge needed in order to be an effective teacher (Gess-Newsome, 1999). Although there is no generally accepted conceptualization of PCK (Van Driel, Verloop, & De Vos, 1998), there is agreement on the nature of the two key elements distinguished by Shulman, which are ‘knowledge of representations of subject matter’ and ‘understanding of specific learning difficulties and student conceptions’ (Shulman, 1986). In addition, there appears to be agreement on the nature of PCK as being concerned with the teaching of particular topics and developed through an integrative process rooted in classroom practice.

So far little is known about effective ways to prepare student teachers to teach geography in primary schools. The need for such research, however, is recognized (Bednarz, Heffron, & Huynh, 2013; Jo & Bednarz, 2014; Blankman, Van der Schee, Volman, & Boogaard, 2015).

This study contributes to answering this need by focusing on the characteristics of a geography course for first-year primary student teachers with the aim of developing their Pedagogical Content Knowledge for the subject of geography.

3.2. Theoretical background

In their overview of research on learning and teaching, Bransford, Brown and Cocking (2003, pp. 14-18) present three key insights that they feel have strong implications for teaching:

Students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp the new concepts and information that are taught, or they may learn them for purposes of a test but revert to their preconceptions outside the classroom.
To develop competence in an area of inquiry, students must (a) have a deep foundation of factual knowledge, (b) understand facts and ideas in the context of a conceptual framework, and (c) organize knowledge in ways that facilitate retrieval and application.

A ‘metacognitive’ approach to instruction can help students take control of their own learning by defining learning goals and monitoring their progress in achieving them.

In line with the first insight, several authors have argued that it is important to take into account the preconceptions and images of geography and teaching of student teachers because both factors influence their thinking about teaching and classroom practice (Martin, 2000; 2005; Corney, 2000; Catling, 2004; Alkis, 2009; Lane & Coutts, 2012; Morley 2012). Research also shows that student teachers fall back on their memories of the geography lessons they themselves were taught at school that were often based on a knowledge-oriented and informational approach, with a central role for a teacher who transfers information (Martin, 2005; Catling, 2004; Bradbeer, Healey, & Kneale, 2004). Martin (2006a; 2008a) also argues that (student) teachers often do not recognize that many experiences in the world (everyday knowledge) are geographic in nature. According to Martin, these ‘everyday geographies’ could provide a suitable starting point for geography lessons in primary teacher education.

The second insight suggests that factual knowledge of geography is a requirement to teach the subject (in primary school) properly. In addition to this factual knowledge, student teachers must be aware of the main geographical concepts and their interconnectedness. Briefly stated, geography is about space and place (Gersmehl, 2008), or as declared by the International Geographical Union: “Geography is the science that seeks to explain the character of places and the distribution of people, features and events as they occur and develop over the surface of the earth, and it is concerned with human-environment interactions in the context of specific places and locations” (Haubrich, 1992). Key geographic questions are: Where is it? What is it like? Why is it there? How did it happen? What impact does it have? How does it change? and Who is saying what? (Haubrich, 1992; Taylor, 2008). Another important geographic concept is scale (Catling & Willy, 2009); the geographical scale at which we examine a phenomenon can affect the observations we make.

These geographic concepts are not isolated; they are an integrated whole as the model of geographic analysis demonstrates (Van der Schee, 2000). As shown in figure 3.1, the basic components of the model are areas or regions (e.g., region A, region B, region C) (where), and human and natural phenomena (which can explain why something, e.g., tourism, is present in a certain region). Two kinds of relationships can be distinguished: vertical relationships between several characteristics of regions and horizontal relationships between regions by means of the flow of people, products, money, and so on. The dimension ‘time’ is included through past developments (genesis) and future developments (planning). The model also shows that regions are composed of a number of sub-
regions (e.g., A1 and A2) and that horizontal relationships are present at different levels of scale. In this way, concepts are organized in a conceptual framework. Using such a framework in teacher education, will — according to Bransford et al. (2003) — ensure greater transfer and allow students to apply what they learn in new situations and adopt related information more quickly.

In teacher education, a ‘metacognitive’ approach to instruction (insight 3) can be realized by explicitly demonstrating the behaviour the teacher educator expects his/her student teachers to show in practice (Loughran & Berry, 2005; Swennen, Lunenberg, & Korthagen, 2008). This way of teaching is called ‘explicit modelling’ (Lunenberg, Korthagen, & Swennen, 2007) or ‘congruent teaching’ (Swennen, Lunenberg, & Korthagen, 2008), and implies that the choices that are made in teaching are linked with theory and that an analogy can be drawn to the student teachers’ own practices by connecting exemplary behaviour with theory. In this way, the transfer of knowledge can be achieved (Korthagen & Kessels, 1999): student teachers are invited to consciously reflect on what they have learned and apply their knowledge and skills in their practice in primary school.

To achieve a metacognitive approach to instruction, active forms of learning are also needed. Recent research emphasizes learners’ active impact and involvement in the learning process (Niemi, 2002; Niemi & Nevgi, 2014; Prince, 2004). Active learning engag-
es students in the learning process by means of meaningful learning activities and makes them think about what they are doing (Prince, 2004). In the context of learning (to teach) and the subject of geography, active learning is also important from another perspective: geography is about the world around us, a quickly changing world in which learning facts is not enough. Students (including student teachers) must construct knowledge by actively participating in the world (Vankan, 2000), thereby making sense of it. In other words, learning geography is an active and constructive process in which people search for meaning with each other’s help (Van den Berg, 2009), or as Roberts (2013) states: “Geographical knowledge is a construction rather than something existing ‘out there’ simply to be found” (p. 17).

Figure 3.2. Tentative design principles.

Summarizing, we distinguish four tentative design principles for our course, as shown in figure 3.2. We will take into account the preconceptions of the students, use everyday geographical examples as the starting points of the lessons, present key concepts of geography in a framework and apply modelling, active learning and reflection during teaching.

3.3. Context of the study and research questions

This study aims to investigate the characteristics of a geography course for first-year primary student teachers that develops their Pedagogical Content Knowledge (PCK) for the
subject of geography. It does so by testing the consistency, practicality and sustainability of such a course.

In a needs analysis, it became clear that primary teacher educators in the Netherlands believe that most student teachers only partly reach the desired level of PCK-G (PCK for the subject of Geography) during teacher training. For instance, they think that many student teachers are unable to explain a spatial issue like ‘climate change’ or apply map skills during their lessons in primary school (Blankman, Van der Schee, Volman, & Boogaard, 2015). According to teacher educators, this gap between the desired and the achieved level of student teachers’ PCK-G is because there are too little teaching hours for the subject of geography, and there is too little focus on subject matter. Moreover, they mention the diverse knowledge base of the student teachers when entering teacher training as an important impeding factor for developing student teachers’ PCK-G correctly. These different levels of knowledge of the student teachers make it difficult to develop a relevant course for all students within the limited number of teaching hours (Blankman, Van der Schee, Volman, & Boogaard, 2015).

To meet the problem - as described above - we developed a course and tested it for consistency, practicality and sustainability. This leads to the following research questions:

1. What is a consistent design for an introductory PCK-G course in primary teacher training?
2. Are teacher educators able to work with the introductory PCK-G course? (practicality)
3. Are teacher educators willing and able to apply the introductory PCK-G course in their daily teaching? (sustainability)

In the remainder of the paper, we describe the design process of the new course. The process consisted of three phases: the design phase (Q1), the pilot phase (Q2) and the implementation phase (Q3) (see Figure 3.3).

3.4. Method

The study was conducted according to principles of educational design research (Plomp, 2013; Smits, Voogt, & Van den Akker, 2013; Van den Akker, Gravemeijer, Mckenney, & Nieveen, 2006; Barab & Squire, 2004). This research approach was chosen because no ready-made solutions were available to meet our need for a geography course that develops the PCK for the subject of geography among first-year primary student teachers. The aim of this approach is to develop a research-based solution for a (complex) problem in educational practice.
3.4.1. The design phase

In this phase of the study, the focus was on the first research question: What is a consistent design for an introductory PCK-G course? This design phase started with three successive discussion meetings with geography teacher educators and experts in the field of geography and geography teaching. They were selected from a directory of the primary teacher-education network of the Royal Dutch Geographical Society. The major criterion for selection was their scientific state of the art knowledge about primary teacher education.

The discussion meetings focused on a first framework to construct a geography lesson in primary teacher education (see Figure 3.4) based on the four tentative design principles that were derived from the literature. Together these discussions resulted in the first concept of a geography lesson series for primary teacher education, including some example lessons. Topics of conversation through the meetings were whether working with the framework would stimulate geographical thinking and motivate student teachers, and whether teacher educators would be able to work with the course and the underlying concepts of the framework. In this way, the construct validity of the course was tested.

In each three-hour expert meeting, three different experts participated. The first author of this article chaired the meetings while a colleague researcher, who did not participate in the conversation, took notes. In addition, the discussions were recorded. Major conclusions from the discussions were summarized. These were discussed with colleague researchers and led to adjustments in the framework. Each revised framework became the basis for the next expert meeting. In preparation for the meetings, the participants received a note containing the theoretical background of the framework and a
summary of the needs analysis. Based on the results of the design phase two researchers developed a first version of a geography course for primary student teachers.

Framework used in primary teacher training to construct a geography lesson for primary education

<table>
<thead>
<tr>
<th>Steps (With the student teachers)</th>
<th>Why is this geography? Use key concepts (with the student teachers)</th>
<th>Modelling/ what do I do and why? (for the teacher educator, to make student teachers conscious of the choices made)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 Start.</td>
<td>Start the lesson from an everyday geographic subject/ Engage student teachers in the learning process.</td>
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<tr>
<td>Step 2 Describe, what/ where?</td>
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<td></td>
</tr>
<tr>
<td>Step 3 Zooming in and out.</td>
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<td></td>
</tr>
<tr>
<td>Step 4 Explain/ why there?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 5 Effects.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 6 Reflection: how does the lesson fit in the geographic analysis model?</td>
<td>Explanation By following the steps the teacher educator together with the students (active learning) builds up an example lesson for primary education starting from an everyday geographic problem. During this process the teacher educator models each step by asking the students questions. Key questions are: What makes this step special for the subject of geography, and: Why is this step an important one? How is it related to (one of the) key concepts of geography? In the last step a connection is made to the geographic analysis model (reflection). In this way students are made conscious of the choices made.</td>
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</tr>
</tbody>
</table>

Figure 3.4. First version of the framework, including explanation.

3.4.2. The pilot phase

In the next phase of the study, the central question was: Are teacher educators able to work with the introductory PCK-G course? The first version of the course was tested on (actual) practicality in a pilot study. This study consisted of two trial rounds. In each round, two geography teacher educators participated with their groups of first-year student teachers.

Two experienced teacher educators participated in the first round. They were selected because of their experience in primary teacher education and their innovative ideas in primary teacher education. The teacher educators kept a log during the course, answering questions about their experiences with the course. The questions focused on the practicality of the course; such as Did you really do what the course prescribes? Was the proposed course feasible? How do you know whether the objectives have been achieved? In addition to this, the first author of this paper visited each teacher educator twice and interviewed her using her own observations as well as the log reports as a starting point. The detailed reports of the interviews were reported back to the teacher educators.
educators for authorization and comments. Based on the experiences of the teacher educators in this first trial round, the course was adjusted (how it was adjusted will be reported in the results section). This resulted in a second version of the course, which was used in the second trial round by two new teacher educators: one with a few years of experience in primary teacher training and one starting teacher educator. We expected them to provide feedback that could complement the comments from the more experienced teacher educators. Using the same procedure as in the first trial round, the course was conducted and evaluated. This resulted in a final version of the course (the adjustments made will be discussed in the results section).

3.4.3. The implementation phase

In the last phase of the design study, we evaluated whether the intended users (teacher educators) were willing and able to apply the course in their daily teaching - not simply as a pilot – or in other words whether the intervention is sustainable (Plomp, 2013). The central research question in this phase was: Are teacher educators willing and able to apply the new introductory PCK-G course in their teaching?

Seven teacher educators, each with 2-12 years of experience in primary teacher education, worked with the course during a field test. They were selected from a list of teacher educators who completed a questionnaire whose results are described in section 3 (see also: Blankman, Van der Schee, Volman, & Boogaard, 2015) and indicated that they were willing to participate in further research. Two important requirements were that the regular assessment of the educational institute should remain possible and that this institute gave permission for the teacher educator to participate.

The teacher educators received a four-hour training session in using the course and its characteristics. While working with the course, the teacher educators were once again asked to keep a log with open questions. The format included questions such as Are the lessons carried out as described in the manual, and if not, why not? Do you have the impression that the objectives have been achieved? Two lessons of each teacher educator were attended and filmed by the first author of this article. The researcher and the teacher educator discussed the lessons afterwards. After completing the course, an evaluation interview took place on the basis of the completed logs and focused on questions concerning the sustainability of the course.

Eighteen months after the end of the course a second, written evaluation was conducted. In this evaluation, teacher educators were asked whether they still used the key principles of the course in their everyday teaching and why or why not. The collected data were analysed on the use of the key principles.
3.5. Results

3.5.1. Design phase
The results of the discussion meetings are summarized in figure 3.5, which contains an adaption of and additions to the design principles for an introductory PCK-G course. Major adaptions are the translation of the key concepts of good geography teaching into key questions and an elaboration of the geographic analysis model. Moreover, three new design principles were added concerning the flexibility of the framework, the way the framework of key concepts should be built up with students, and the need for scaffolding.

Based on the design principles described in figure 3.5, a pilot version of a geography course for first-year primary student teachers was developed. Every meeting of the course starts from an everyday geographic example (motivating start), contains the key concepts of geography that are translated into five geographic questions, and ends with a question about the conclusion of the lesson (to stimulate reflection and transfer).

The core of the course is the framework of ‘seven characteristics of a geography lesson in primary education’ (see Figure 3.6) translated into key questions. The teacher educator uses these key questions during the meetings of the course to build up example lessons together with the student teachers. These example lessons subsequently serve as inspiration for the student teachers during their teaching practice in primary school. In figure 3.7, such an example lesson is elaborated.

As a means of reflection, and for students to become aware of the choices made, at the end of each meeting student teachers are encouraged to draw the sample lesson in the geographic analysis model (see Figure 3.1). A special animation is developed to provide an example. The corresponding instructional manual explains to the teacher educators how they can build up the meetings together with the student teachers (gradual expansion), how they can model the several steps, and how they can provide scaffolding during the meetings of the course. The course description is accompanied by background information that underpins the choices made.
### Design principles

<table>
<thead>
<tr>
<th>Preconceptions</th>
<th>Arguments from the three rounds of panel discussions <em>(the adaptations are in italics)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>In the elaboration of the course <em>(e.g. in an instruction manual)</em> it is important to emphasize ...</td>
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</tr>
</tbody>
</table>
| **Everyday geography** | ... that the course starts with the question: What is geography (about)? In this way, it becomes clear what conceptions student teachers already have about the subject of geography.  
... that a lesson/meeting starts from an everyday geographic example. This is important to show student teachers that geography is connected with their own experiences in life. In this way, it is also a means to motivate them about the subject. *At the same time student teachers can use this as a starting point for their own lessons in primary school.* |
| **Key concepts of geography** | ... that an explanation should be given for why these key concepts are chosen.  
The key concepts should be translated into key questions. |
| **Modelling and reflection/transfer** | ... that modelling is important to make student teachers conscious of why they do what they do and to make clear what geography is about.  
... that the geographic analysis models can be used as a way for student teachers to come to reflection and knowledge transfer e.g., by drawing the sample lesson in the model.  
The model is too abstract; a more concrete elaboration should be added. |
| **Active learning** | ... that it is important to adjust an active learning strategy by means of meaningful learning activities and to make student teachers think about what they are doing. Learning geography is an active and constructive process. |
| **Additional design principles** | **Flexibility of the framework (and sample lessons)**  
A flexible use of the framework is desirable, so it can leave room for the individual teaching styles of the teacher educators and the couleur locale of their institutes.  
**Gradual expansion**  
Build up the framework step by step. This stimulates discussion and active learning.  
**Scaffolding**  
Add structure to the program, consisting of showing, sharing and doing it themselves. |

*Figure 3.5. Adapted and additional design principles as outcome of the panel discussions.*
Geographical key questions

1. Where is it? Describe what you see and where you see it, preferably using, e.g., a map, an atlas, a globe etc.

2. Why is it there? Explain what you see (through the relationship between man and nature).

3. What do I see if I zoom in or out? At other levels of scale, you may see different things. Zooming provides a different picture.

4. How does it change over time? Describe the situation in the past and/or in the future.

5. What are the consequences, advantages and disadvantages? The effects (or pros and cons) are viewed from different angles.

Instructional key questions

6. How can I start the lesson in a motivating way? The lesson starts in a way that challenges pupils to participate in class (using an everyday spatial problem).

7. How can I end the lesson in a way that promotes transfer? (Discuss the special and the general) At the end of the lesson, there is a discussion about the usefulness of knowing something about the subject of the lesson.

Figure 3.6. Resulting framework of a geography lesson in primary education: key concepts of geography by means of key questions

3.5.2. Pilot phase

This first version of the geography course was the starting point for the pilot phase of the study. As explained in section 3.4.2, in this phase, four teacher educators tested the practicality of the course during their lessons. These teacher educators were able to work with the course but asked for some small adjustments and additions.

The design principles from earlier stages of the design therefore were confirmed and gave the course its final form, the structure of which is shown in figure 3.8. One new design principle was added: Detailed guidelines for the teacher educator.

The final course manual therefore was elaborated in greater detail. In particular, clear instructions for explicit modelling and scaffolding were added, thus raising student teachers’ awareness about ‘why they do what they do’. Additionally, an extra tool was developed in the form of an interactive PowerPoint presentation to give teacher educators assistance while connecting the everyday geographic examples to the seven characteristics. Furthermore, a pre-instruction was developed. In this four-hour program, teacher educators were trained in the characteristics and the structure of the course, the theoretical background, the materials and the use of the course.

The final version of the course is called Consciously Teaching Geography (CTG). This version was evaluated in the fourth phase of this design study, the implementation phase.
**Learning Objective:** Students acquire a geographic image of the textile industry.

<table>
<thead>
<tr>
<th>What does the (student) teacher do?</th>
<th>What do the students do?</th>
<th>Why do ‘we’ do that in this way?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The teacher hangs some jeans in front of the classroom and wonders aloud where and how this clothing is made. The teacher asks: where is this clothing made?</td>
<td>The students search for the origin of clothing. They study the labels in their cloths for names of those areas and search for those areas on a map.</td>
<td>A motivating start is important. Make a connection with the world of the students. (Everyday geography) <em>(Step 6 from figure 3.6)</em> This is the geographic question ‘where’? The map and atlas are used to determine where an area is located. <em>(Step 1 from figure 3.6)</em></td>
</tr>
<tr>
<td>The teacher asks: Why are those cloths made there?</td>
<td>The students together think about explanations such as a large labour force and low wages.</td>
<td>This is the geographic question ‘why there?’ <em>(Step 2 from figure 3.6)</em></td>
</tr>
<tr>
<td>The teacher asks: From which country does most clothing come? The teacher takes, e.g. China as an example country because many jeans are produced in China and asks: Where and how are those clothes produced in China? The teacher shows a video clip (e.g. China Blue) of a clothing factory.</td>
<td>The students count common locations on clothing labels and view the video clip of China.</td>
<td>This is zooming in and out. On another scale, you can see other things. On a global scale, you see that some countries have a larger clothing industry than others. Zooming in on China shows that China has many textile factories but only in certain parts of China. <em>(Step 3 from figure 3.6)</em></td>
</tr>
<tr>
<td>The teacher asks: What are the advantages and disadvantages of the textile industry in China?</td>
<td>The students think of the advantages and disadvantages for the government, the workers, the consumers in and outside China, the people living near the factory, etc.</td>
<td>These are effects of the textile industry. On the one hand, there are benefits such as work and income. On the other hand, there are disadvantages such as environmental pollution and poor working conditions. It is therefore important to examine an issue from different perspectives. <em>(Step 4 from figure 3.6)</em></td>
</tr>
<tr>
<td>The teacher asks: What did you do with the knowledge that you have learned in this lesson?</td>
<td>The students ask themselves which clothes they (should) buy. Students wonder if other production is similar to that of clothing.</td>
<td>This is to reflect on behaviour and knowledge transfer. <em>(Step 7 from figure 3.6)</em></td>
</tr>
</tbody>
</table>

*Figure 3.7. Example of a sample lesson on globalization: Where are your jeans made?"
<table>
<thead>
<tr>
<th>M</th>
<th>Content</th>
<th>Why is this done</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brainstorm in groups: What is geography?</td>
<td>In this way students show their perception of the subject. Do they only focus on geography as a school subject or do students mention everyday experiences as well?</td>
</tr>
<tr>
<td></td>
<td>Demonstration of a geography lesson: Where did you go on holiday?</td>
<td>This is an everyday geographic example; the course starts just after summer holidays. Such an example shows that geography has to do with the students own life.</td>
</tr>
<tr>
<td></td>
<td>Linking the 7 characteristics of good geography teaching, which form the heart of the course (see figure 3.6), to the example lesson.</td>
<td>Giving meta-commentary and being explicit (modelling).</td>
</tr>
<tr>
<td></td>
<td>Developing with the students a lesson about volcanoes based on the 7 characteristics.</td>
<td>Modelling the 7 steps</td>
</tr>
<tr>
<td></td>
<td>Conclusion of the lesson: what did we learn today and what do we take to practice?</td>
<td>By looking back at the way they have approached the lesson, at the usefulness of knowledge building around a particular subject and by building a bridge to practice, students are stimulated to consciously think about applying learning in new situations (reflection and transfer).</td>
</tr>
<tr>
<td>2</td>
<td>Sample lesson about chocolate: what was on your bread this morning (together with the students) based on the 7 characteristics.</td>
<td>Motivating students to start with another everyday geographic example. Modelling the 7 steps.</td>
</tr>
<tr>
<td></td>
<td>Students in pairs develop a geography lesson with the title: Can your school flood?</td>
<td>Apply the 7 characteristics on a new subject.</td>
</tr>
<tr>
<td></td>
<td>Conclusion of the lesson: what did we learn today and what do we take to practice?</td>
<td>Reflection and transfer.</td>
</tr>
<tr>
<td>3</td>
<td>Together with the students: sample lesson about globalization (where were your jeans made?) based on the 7 characteristics.</td>
<td>Motivation begins by means of an everyday geographic example. Modelling.</td>
</tr>
<tr>
<td></td>
<td>Seven characteristics and a geography textbook: which characteristics of good geography teaching are applied in the chosen chapter?</td>
<td>Students research a chapter from a geography textbook.</td>
</tr>
<tr>
<td></td>
<td>Conclusion of the lesson: what did we learn today and what do we take to practice?</td>
<td>Reflection and transfer.</td>
</tr>
<tr>
<td>4</td>
<td>Seven characteristics and maps: how can we apply the 7 characteristics while working with a map or an atlas? Example: Flevoland.</td>
<td>Modelling the 7 steps.</td>
</tr>
<tr>
<td></td>
<td>Conclusion of the lesson: what did we learn today and what do we take to practice?</td>
<td>Reflection and transfer.</td>
</tr>
<tr>
<td>5</td>
<td>Evaluation</td>
<td>During the evaluation, student teachers are asked to formulate what they found to be the most important learning point from the course. They share these points with their student teacher colleagues.</td>
</tr>
</tbody>
</table>

*Figure 3.8. Structure of the course Consciously Teaching Geography*
3.5.3. Implementation phase

In the last phase of this design study, we evaluated whether the seven teacher educators were willing and able to apply the course CTG in their daily teaching, in other words, whether the course is sustainable (Plomp, 2013).

First, the results show that the teacher educators roughly performed the sessions as intended. They started their lessons from an everyday geographic example; most of them chose their own examples that were a better fit for the local context (e.g. the flooding of a nearby river), the expertise of the teacher educator (a recent holiday event) or because the programme of the institute made it necessary (a nearby found mammoth tooth as starting point for the origin of the Dutch landscape, a topic that was central to the programme).

Second, the teacher educators did indeed start from the example lesson and elaborated the seven characteristics together with the students while making their behaviour explicit by means of modelling.

Third, teacher educators experienced working with the seven characteristics as an asset, a new educational framework that provides guidance for student teachers preparing lessons for primary school children.

Fourth, most of the teacher educators found the geographic analysis model (see Figure 3.1) – in which the key concepts of geography are organized in a conceptual framework as a way to come to reflection and transfer – too abstract for their student teachers. Only one of the teacher educators used it every meeting; four of them only used it occasionally, and two did not use it at all.

Two of the seven teacher educators more explicitly paid attention to the formulation of learning objectives, which was not directly formulated in the user’s instructions.

In summary, for most teacher educators, the course suited their own teaching styles and, with slight adjustments, fit the couleur locale of the different institutes. To clarify this, the way of working and the experiences of two teacher educators, Maaike and Thomas, are described in more detail.

Maaike is an experienced teacher educator. After spending approximately 15 years in secondary education, she has been working in primary teacher education for more than ten years. She regularly uses teaching strategies that encourage reflection and transfer, e.g. Thinking Through Geography work forms (Leat, 1998; Leat, Van der Schee, & Vankan, 2005). Maaike is given great freedom by her institute to perform her lessons the way she wants. She performed the module as described with the addition of her own examples and teaching strategies. She also used the geographic analysis model at the end of each lesson as a way to stimulate reflection and transfer. She is a good example of a teacher educator capable of using the approach in a flexible way. When asked what she found most valuable about participating in the intervention, she said: “It forced me to think about my own way of teaching and to reflect on the essence of my education.”
Thomas entered primary teacher education more recently. After several years of teaching in secondary education and development work in educational materials, he has been working as a teacher educator for two years. He had to integrate the course into a more subject-based module about the Dutch landscape. He managed to do this through the use of his own qualities as a teacher: he can explain concepts in an inspiring way and each time, step by step, he connects examples about the Dutch landscape to the seven characteristics. In doing so, he explicitly models his behaviour.

When asked what was most valuable for him about participating in the study, he stated: “I – through my teaching – always try to make my student teachers enthusiastic about the subject of geography and the profession as a teacher. By naming this now, and by consciously following the teaching principles of the course, this becomes more valuable. I tend to use frontal teaching, but the structure of the course made me more aware of that, and stimulated me to bring more variety into my teaching methods.”

It is remarkable that while working with the course, both teacher educators, regardless of their experience, became – on different levels – more conscious about their own teaching and their roles as teacher educators. The experienced teacher educator deepened her vision on teaching, and the starting teacher educator began to use a greater variety of teaching methods.

Eighteen months after the end of the course, five of the seven teacher educators still are involved in primary teacher education. All of them still use the seven characteristics of geography teaching in primary education during their lessons. One of the teacher educators integrated the characteristics in the examples she uses during her classes and asks the student teachers to explicitly state why and how they use the characteristics in their lesson plans. Another teacher educator includes the seven characteristics during lessons. She demonstrates, explains why she does it, and why it makes good geography education. Later in the year, the students must apply the characteristics regularly, for example, when designing the lessons they perform in practice. She also explicitly uses the geographical analysis model to explain what is the purpose of the meeting at the beginning of class and to let student teachers reflect and substantiate why this was an example of a good geography lesson at the end of class. Another teacher educator further implemented the seven characteristics in the second and third year of training; in the third year, the geographic analysis model is used as a means of reflection for the student teachers.

3.6. Conclusion and discussion

This design study focused on ways to improve part of the geography curriculum in primary teacher education, in this case, an initial course within the programme for first-year primary student teachers. Although several scholars have reported on principles for teacher education programmes (Darling-Hammond, 2006; Korthagen, Loughran, & Rus-
sell, 2006; Korthagen, 2010; Loughran, 2013), little is known about effective ways to prepare primary student teachers to teach geography in primary school. Based on state-of-the-art scientific knowledge (Bransford, Brown, & Cocking, 2003), we designed a course using design principles (1) starting from students’ preconceptions (Martin, 2005; Corney, 2000; Catling, 2004; Alkis, 2009; Lane & Coutts, 2012; Morley, 2012) and using everyday geographic examples as a starting point of the lessons (Martin, 2006a; 2008a), (2) using key concepts of geography (Haubrich, 1992; Catling & Willy, 2009; Taylor, 2008; Van der Schee, 2000) in a framework, (3) using modelling and forms of reflection (Loughran & Berry, 2005; Lunenberg, Korthagen, & Swennen, 2007; Swennen, Lunenberg, & Korthagen, 2008) during teaching, and (4) making use of forms of active learning (Niem, 2002; Niemi & Nevgi, 2014; Prince, 2004) (see Figure 3.9).

In order to make the design consistent, new design principles proved to be necessary. A flexible use of the framework was required to leave room for the teaching style of the teacher educators and the coulour locale of their institutes. To stimulate discussion and active learning, a gradual expansion of the framework was necessary, and scaffolding by the teacher educator was required to add structure to the program: both adaptations were made. Finally, to assure the actual practicality of the design, additional support in using the materials was required and provided by means of detailed guidelines for the teacher educator.

The combination of exemplary lesson materials (the framework and the example lessons) on the one hand and concrete and specified guidelines for the teacher educators on the other, gave the course potential - as Thijs & Van den Akker (2009) stress - to be an effective innovation. This combination is new in primary geography teacher education, where apart from the geography handbooks for primary student teachers, no concrete materials exist for primary teacher educators.

The course described above is performed in teacher education in the Netherlands, where no national curriculum exists, and teacher educators therefore develop their own courses, resulting in a variety of approaches and courses. Although teacher education institutes all have the same goal, namely, to educate student teachers to become qualified teachers, the way they work to achieve this goal varies. Despite these differences, this study demonstrated that teacher educators in various teacher-training institutes were able to work well with this new course. This shows that the design is sustainable. The possibility of embedding the course into existing programmes may, according to Rogers (2003), contribute to the usefulness of the intervention.
Phase | Research question | Participants | Design principles | New design principles
--- | --- | --- | --- | ---
Earlier studies/theory | State of the art scientific knowledge |  | -Preconceptions & everyday geography  
-Framework of key concepts of geography teaching  
-Modelling and reflection  
-Active learning | 

Design phase | What is a consistent design for an introductory PCK-G course in primary teacher training? | Teacher educators and stakeholders (3 rounds of panel discussions) | -Flexibility  
-Gradual expansion  
-Scaffolding | 

Pilot phase | Are teacher educators able to work with introductory PCK-G course? (Practicality) | 4 teacher educators with 4 groups of students in 2 pilot rounds | (Detailed) guidelines for the teacher educator | 

Implementation phase | Are teacher educators willing and able to apply the introductory PCK-G course in their daily teaching? (Sustainability) | 7 teacher educators with 7 groups of students | Confirmation of the existing and new design principles | 

Figure 3.9. Overview of the design process

This study adds to our knowledge about ways to stimulate learning to think geographically and contributes to the discussion about what are the best geographic key concepts for primary education. Of these key concepts various lists exist (Gersmehl, 2008; Haubrich, 1992; Taylor, 2008; Favier, 2011; Catling & Willy, 2009; Van der Schee, 2000). Central to understanding geography’s way of thinking we used an integrated set of five key concepts (see Figure 3.6), within a total of seven characteristics of good geography teaching. The importance of the key concepts chosen in this study for primary geography education is an interesting question for future research in the light of establishing new theory.

A relatively small group of teacher educators was involved in the study, but because it was a small group, we were able to learn about their experiences in depth. In addition, focus group discussion at the end of the design process with the teacher educators and student teachers could have helped to further improve the course or to gain more insight into an optimal design.
At this time, we do not yet know what student teachers actually learn from participating in a course like ‘Consciously teaching geography’. Future research should focus on the learning outcomes of primary student teachers who participate in such a course and determine whether this intervention is effective in terms of the attained curriculum (Van den Akker, 2010; Goodlad, 1979). (Quasi-) experimental research is needed to answer this question.