Teaching about teaching geography
Developing primary student teachers’ pedagogical content knowledge for the subject of geography

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1. Introduction
When I ask my student teachers at the start of their training what they think about geography, they tend to give answers like: ‘It’s a really neat subject, I’ve always been interested in topography’, ‘difficult but interesting’, ‘difficult and not interesting’ or ‘not that enjoyable, I wasn’t good at it’. According to these student teachers, geography is the study of climate, mountains, culture, demography, topography, emigration and climate change.

Most student teachers do not seem very engaged with geography and their perception of the subject is usually knowledge-oriented. They do not see the skills they could acquire or the connections geography has to their own lives; they do not connect geography with the clothes they wear or the lunch they buy in the school cafeteria. Other teacher educators in the field of geography have confirmed my observations.

Given these observations, the question is urgent how to teach student teachers geography in such a way that they are able to give good and interesting geography lessons to primary school pupils and develop a real awareness of what geography is all about.

1.1. The key question of this thesis

Research has shown that providing quality geography lessons in primary school is a difficult and challenging task in which teachers do not always succeed (Bent, Bakx, & Den Brok, 2014; Ofsted, 2011). The central question in this thesis is how to present geography in primary teacher education in an effective and motivating way. The assumption is that we can improve the quality of geography teaching in primary teacher education. Whether this assumption is correct and how improvements may be carried out is the subject of this research. This issue has a number of complicating factors.

In the Netherlands, student teachers can enter primary teacher education after completing their secondary education (five or six years) or after their training as a teaching assistant (Senior Secondary Vocational Education). This second group of student teachers had their last geography lesson at least four to six years ago. Moreover, many student teachers didn’t take a final exam in geography and received only three years of geography in secondary education at the lower secondary level. Most student teachers are thus so called non-specialists and their knowledge of geography is fairly limited. This situation is comparable in the United Kingdom and the United States (Martin, 2000; 2008a; Catling, 2004; Jo & Bednarz, 2014). Beyond this, preparing these student teachers to teach geography in primary schools is limited by the number of training hours available (Catling, 2002; Catling & Willy, 2009; Martin, 2006a).

Moreover, no formal or organized ways exists to prepare new teacher educators for their specific role and they generally come from various backgrounds and bring very different experiences into teacher education (Berry & Van Driel, 2012). How teacher educators should prepare their student teachers to teach good geography lessons in primary schools has not been described anywhere. Although a professional standard for teacher
educators exists in the Netherlands, the described competence requirements are formulated in generic terms only (Velon, 2012; 2016) and not on subject level. Finally, no national curriculum exists for primary teacher education, so teacher educators have to develop their own courses. Altogether, this creates a challenging situation for teacher education in the Netherlands.

Currently, there are few studies focusing on the development of the knowledge, skills and attitudes towards geography that primary student teachers need to be able to provide good geography lessons in primary school. Therefore, the aim of this thesis is to deepen our understanding of ways to develop primary student teachers’ Pedagogical Content Knowledge (PCK) for the subject of geography (PCK-G) by means of a course that we call Consciously Teaching Geography (CTG), and so that they can use this PCK-G in preparing and teaching geography lessons to young children.

This leads to the main research question of this thesis:

*How can a CTG course help teacher educators develop the Pedagogical Content Knowledge for the subject of geography of first year primary student teachers?*

A number of key concepts are central in answering this question. These concepts are briefly introduced below.

### 1.2. Key concepts in this thesis

**Pedagogical content knowledge (PCK)**

This thesis builds on the concept of PCK that was introduced by Shulman (1986; 1987). PCK may be defined as the synthesis of all knowledge needed in order to be an effective teacher (Gess-Newsome, 1999). Elaborating on the work of Shulman, different conceptualizations of PCK have been made (Berry, Loughran, & Van Driel, 2008). In this thesis, we rely on Turner Bisset’s (1999) conceptualisation of PCK. Beyond Shulman’s distinction between content knowledge and pedagogical content knowledge, Turner Bisset uses pedagogical content knowledge as an overarching concept in which content knowledge components are integrated. Like Turner Bisset, we use this more comprehensive model and distinguish three components of PCK: (1) *substantive knowledge*, consisting of the facts and concepts of a discipline and the framework used to organise these facts and concepts, (2) *syntactic knowledge*, or the ways and means the knowledge must be generated or established and (3) *beliefs about the subject*, referring to the impact that personal orientation and the conceptions toward a subject have on teaching that subject. Martin (2005) further develops these three PCK components and relates them, in terms of teach-
Chapter 1

...helps young people to understand and appreciate how these places and landscapes are formed, how people and environments interact, the consequences that arise from our everyday spatial decisions, and Earth’s diverse and interconnected mosaic of cultures and societies” (International Geographical Union, 2016). In order to organise content and questions in geography education, key concepts are used.

Which geography concepts to consider as key has been suggested by different people, in different ways, at different times, and for different reasons (Taylor, 2008). According to the International Charter of Geographical Education (Haubrich, 1992) geographers ask the following questions: Where is it? What is it like? Why is it there? How did it happen? What impact does it have? How should it be managed for the mutual benefit of humanity and the natural environment?

Other authors have compiled different lists (see e.g. Gersmehl, 2008; Taylor, 2008; Catling & Willy, 2009; Favier, 2011; Bednarz, Heffron, & Huynh, 2013). Elaborating on these various lists, we use five geographic concepts in the context of Dutch primary geography education: where, why there, scale, change, and effects or pros and cons. For the purpose of this thesis, we’ve discussed these five key concepts with colleagues from the field of geography and geography teaching. Using these concepts in a framework will, in our opinion, enable the development of student teachers’ “geographic consciousness” that implies a combination of a way of thinking and a certain geographic knowledge base (Van der Vaart, 2001). Van der Vaart distinguished three key competencies: (1) knowledge about world phenomena, processes and distributions, including topography, (2) issues of place and space, such as inequality and sustainable development, and (3) geographic skills, such as map skills (Van der Vaart, 2001, p. 19). The first two competencies focus on geographic knowledge (content). The third competence refers to the skills needed to ‘do geography’: the ability to ask geographic questions, to use geographic sources of information and the application of geographic thinking skills (KNAG, 2003; 2008).
In our description of PCK-G, we mention the concept of ‘geographic drive’, which is defined as: “A certain level of geographic (enquiry) motivation, which refers to the willingness to study the characteristics, functioning and problems of the world around us” (Favier, 2011, p. 12). A geographic drive is supposed to help (student) teachers in developing the attitude (why) to support children to become responsible and active global citizens (Haubrich, 1992; Martin, 2006b; International Geographical Union, 2016). In turn, (student) teachers should realize that when building on young people’s own experiences and when combining knowledge and skills by using the key concepts in preparing their lessons they can help young people to appreciate the beauty of the earth and the way that people interact with it (International Geographical Union, 2016) and thus fascinate and inspire them.

Teaching PCK: Modelling and reflection

In order to develop student teachers’ PCK-G in the CTG course, modelling and reflection are applied. Explicitly modelling the thoughts and actions that underpin a practice has been argued to lead to more powerful teaching and learning about teaching (Loughran & Berry, 2005, p. 197). Teacher educators should therefore demonstrate or ‘model’ the behaviour that they expect their students to display (Loughran & Berry, 2005; Swennen, Lunenberg, & Korthagen, 2008). In this thesis, explicit modelling is defined as explaining the choices made while teaching by giving meta-commentary and linking those choices to relevant theory (Swennen, Lunenberg, & Korthagen, 2008). Explicit modelling combined with theoretical reflection in this context facilitates translation of the teaching methodology being modelled to the student teachers’ own practices and understanding of that methodology (Lunenberg, Korthagen, & Swennen, 2007).

1.3. Research context and research questions

This thesis was conducted in the context of Dutch primary teacher education. In the Netherlands, for the last thirty years in primary teacher education there has been a wave-like movement regarding the role and importance of subject matter knowledge.

In the 1980’s, being a competent teacher meant acquiring a broad and general knowledge base; however, over the last century, emphasis had shifted toward encouraging pedagogical skills (Onderwijsraad, 2005). In recent years, we have entered another phase in which subject matter knowledge has gained more importance yet again.

This movement back toward subject matter knowledge was partly motivated by negative statements in Dutch media about the quality of primary teacher education. Initially, the discussion focused on the poor literacy and numeracy levels of student teachers, leading to the introduction of national subject tests; gradually, however, the discussion moved onto the other school subjects as well. Commissioned by the former Secretary of Education of the Netherlands, the Dutch Association of Universities of Ap-
plied Sciences subsequently described knowledge bases for all school subjects, including geography (Meijerink, 2012). These knowledge bases were introduced in the 2011-2012 academic year.

Additionally, starting from the academic year 2015-2016, future student teachers with insufficient basic knowledge are required to take entrance exams for the subjects of geography, history and science. By setting the standard knowledge base for geography, the knowledge and skills qualified teachers should have, is formally established (Meijerink, 2012). The starting point in this knowledge base is developing geographic consciousness. The three core competencies of geographic consciousness are hereby related to eight substantive themes developed by the Dutch Institute for Curriculum Development (SLO) and Royal Dutch Geographical Society: climate and landscape, population and space, means of subsistence, rich and poor, borders and identity, forces of the earth, and sources of energy and water. Students will focus on these themes to build their worldview and acquire insight in spatial issues. Additional requirements are determined for new student teachers (Diephuis, 2013; Oorschot, 2014).

Although starting requirements are determined, no national curriculum exists for primary teacher education. Institutes are allowed to develop their own curricula depending on their vision and principles, as long as they prepare their students according to the competences of a qualified primary teacher. This leads to a wide variety of programmes, each with the challenging task of teaching about teaching geography.

In the late 1990’s, attempts were made to formulate a national curriculum for the subject of geography. The SLO developed a geography curriculum for primary teacher education accompanied by a requirement to reinforce the identity and pedagogical quality of teacher education in geography (Greven, 1996; 1998; SLO/VSLPC, 1997; Taakgroep Pabo, 1998). This curriculum has remained largely confined to two basic skills or ways of looking at the world. In this context, future primary school teachers need to be able to: (a) look at phenomena in the world from several perspectives (e.g. natural, social, political, economic, cultural) and (b) observe, explain, recognize and appreciate these phenomena.

Within these basic skills – or, when used in the context of primary geography teaching, these ‘pedagogical principles’ – the geographic key concepts of where, why there, levels of scale, and effects or pros and cons may be recognized. However, student teachers look upon these pedagogical principles and questions as ‘something one is supposed to do when teaching geography’. The experience of primary teacher educators is that student teachers just learn a trick. They don’t develop consciousness of why these principles and questions are important within the subject of geography. This is particularly true for the group of students who have had only a few years of geography education in secondary school.
The above-mentioned pedagogical principles are nevertheless embraced and incorporated into the textbooks for primary teacher education (Verheij & Notté, 2007; Hamer, Bakker, Broere, & Heck, 2007; Peters & Westerveen, 2010), and during the last fifteen years, primary student teachers have been trained by these principles. Primary school teachers themselves seem satisfied about the way they teach the subject (Notté, Van der Schoot, & Hemker, 2010). However, Bent et al. (2014) found that primary school pupils’ perceptions of their teachers’ knowledge and performance weren’t always positive.

Taken together, this leads to the conclusion that there is a need for a new approach of teaching geography in Dutch primary teacher education, an approach that enables primary student teachers to develop their PCK-G and to teach the subject in a conscious way. ‘Conscious’, in this context, means that student teachers know ‘why they do what they do’ instead of merely applying tricks and are able to think geographically themselves. The expectance is that this will increase the quality of geography lessons in primary school and will help pupils to learn to think geographically. A need for new approaches is also recognized internationally (Bednarz, Heffron, & Huynh, 2013; Jo & Bednarz, 2014) and leads to the previously formulated main research question of this thesis: How can a CTG course help teacher educators develop the Pedagogical Content Knowledge for the subject of geography of first year primary student teachers?

This main question will be answered by means of four sub-questions (see figure 1.1). First, we establish the relevance of the study by answering the question: What is the desired and achieved level of PCK-G of first year student teachers? (Q1.) Subsequently, the design of the experimental course Consciously Teaching Geography is described, answering the question: What are the characteristics of a consistent, practical and sustainable course for developing PCK-G? (Q2). Next, the effectiveness of the course is tested, addressing the question: What are the effects of the course on the PCK-G development of primary student teachers? (Q3). Finally, the learning experiences of student teachers with the course are determined answering the question: What are student teachers’ learning experiences with the course? (Q4).
1.4. Outline of this thesis

To answer the research questions, four studies are conducted (see figure 1.1).

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<th>Study</th>
<th>Analysis</th>
<th>Design</th>
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<td>1</td>
<td>What is the desired and achieved level of PCK-G of first year student teachers?</td>
<td>What are the characteristics of a consistent, practical and sustainable course for developing PCK-G?</td>
<td>What are the effects of the course on the PCK-G development of primary student teachers?</td>
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<td>2</td>
<td>Survey study</td>
<td>Design study</td>
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Figure 1.1. Graphical overview of this thesis

Survey study
Little is known about geography teacher educators’ views concerning the level of PCK-G of their student teachers and the needs of the teacher educators with regard to improvements of the geography curriculum in primary teacher education. For that reason, a survey study was conducted (research question 1, chapter 2). Data were collected through a questionnaire for Dutch primary teacher educators who teach geography.

Design research
A design study was conducted to answer the second research question (chapter 3), because no ready-made solutions to the identified problem were available. To help create a consistent design, after literature research, three successive discussion meetings with geography teacher educators and experts from the fields of geography and geography teaching were held, resulting in a first version of the geography course. Afterward, two pilot studies were conducted to help ensure the making of a practical design. Each included two teacher educators and their classes of first year primary student teachers. Seven
teacher educators finally tested the resulting definite version of a geography course called Consciously Teaching Geography (CTG) on sustainability. Measurement instruments were used in the pilot studies and adjusted to improve the reliability and validity.

**Quasi-experimental research design**

Subsequently, the CTG course was tested for its effectiveness (research question 3, chapter 4) by means of a quasi-experimental research design with control groups and pre/post testing. The nearly 450 student teachers that participated in the study were taught in twelve classes. Six classes were assigned to the experimental condition and six classes to the control condition. The student teachers originated from seven teacher education institutes from all over the Netherlands.

**Self-reports**

In *study 4* (research question 4, chapter 5), we investigated what student teachers themselves reported about their learning experiences. To this end, we used a so-called learner report that was filled in by the student teachers after the first four meetings in the course.

Finally, chapter 6 presents the conclusions and discussion of this research project.
2. Primary teacher educators’ perception of desired and achieved pedagogical content knowledge in geography education in primary teacher training
Abstract
This paper presents the findings of a study conducted among primary geography teacher educators. The research examines the perceptions of educators of primary teacher students’ desired and achieved levels of substantial knowledge, syntactic knowledge, and beliefs about the subject of geography. The findings indicate that primary teacher educators do not view their students as having significant knowledge about geography. They believe their students have better syntactic knowledge and beliefs about the subject of geography, however. Teacher educators believe that more hours of teaching and more attention to subject knowledge could raise the quality of primary teacher training in geography.

Keywords: primary teacher education, pedagogical content knowledge, perception.

2.1. Introduction

A well-developed foundation of subject knowledge is an important prerequisite to teach a subject such as geography successfully. “Pupils cannot be taught simply to think. They have to have something to think about,” is what Lambert states in his personal opinion on subject matter (Lambert, 2009b, p. 1). In the context of the primary geography curriculum, teachers’ lack of subject knowledge has been identified as problematic for some time in the Netherlands as well as in the United Kingdom (Bell, 2005; Notté & Baltus, 2011; Ofsted, 2011). Mainly non-specialist class teachers teach the entire primary curriculum (Catling, 2004; Catling & Willy, 2009; Martin, 2006a), quite a challenging task in which not all teachers succeed. In this context the conclusion of a recent inspection of primary schools in England is that improvements in geography were often slowed down by primary teachers’ weak knowledge of geography and their lack of confidence in teaching this subject, which was attributed to insufficient subject-specific training (Ofsted, 2011).

The weak foundation of geographic knowledge of Dutch primary student teachers is reflected in the scores of an entrance test which focuses on the knowledge, skills and understanding about main geographic topics taken by student teachers at the beginning of their first year. Only about 50 percent of these student teachers pass this entrance test with an 8+ level at the beginning of the first year. Level 8+ means a slightly higher score than that of a pupil at the end of primary school (11-12 years old) (Notté & Baltus, 2011).

In the Netherlands student teachers can enter primary teacher training after completing their secondary education (5/6 years) or Senior Secondary Vocational Education (see Figure 2.1). The last group of student teachers probably had their last geography lesson several years ago, and their subject knowledge is often weak. Many student teachers only had three years of geography in secondary education at lower secondary level.

No doubt that subject knowledge is of great importance for being an effective primary teacher, and as Lambert states: “forming productive relationships with children is very important. My view is that this task is made more possible when the teacher is able to form a productive and creative relationship with the subject matter” (Lambert, 2009b, p. 2). But he adds: “This subject knowledge new teachers bring from their experiences in higher education or elsewhere has to be reworked before it can be taught effectively” (Lambert, 2009b, p. 2). Experienced teachers possess what Shulman (1986) calls Pedagogical Content Knowledge (PCK). PCK can be described as the combined knowledge, pedagogical skills, and attitude or motivation to teach a subject.
It is this combination of knowledge, skills, and attitudes that teacher educators need to develop with their student teachers. This challenging task was the starting point of this research. As a teacher educator, the first author faced the problem of not being able to bridge the gap between the desired and the achieved level of PCK for her diverse group of student teachers in a limited number of teaching hours, and she wondered whether other teacher educators faced the same problem. In the Netherlands little research has been done into the images held by primary teacher educators about PCK development in the subject of geography of their student teachers. To verify whether colleagues shared the faced problem a questionnaire was distributed among primary geography teacher educators (n=66). The main aim of this study is to obtain more insight into the desired and achieved levels of pedagogical content knowledge among primary student teachers, according to their teacher educators, and the factors that may contribute to closing the gap between desired and achieved levels of geographical PCK.
2.2. Theoretical background

2.2.1. PCK

The concept of pedagogical content knowledge (PCK) was introduced by Shulman (1986). According to Shulman PCK is about subject matter for teaching, and it includes

the most regular taught topics in a subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations and demonstrations – in a word, the ways of representing and formulating the subject that makes it comprehensible to others (Shulman, 1986, p. 9).

And it also includes

an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning (Shulman, 1986, p. 9).

Shulman distinguished seven knowledge bases of which pedagogical content knowledge is one: content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners, knowledge of educational contexts, and knowledge of educational ends, purposes, and values (Shulman, 1987). Elaborating on Shulman’s work, various scholars have proposed different conceptualizations of PCK (Berry, Loughran, & Van Driel, 2008). In a review of the literature, Van Driel, Verloop and de Vos (1998) found that there is no generally accepted conceptualization of PCK. Several scholars (Cochran, King, & DeRuiter, 1991; Grossman, 1990) e.g. argue for a more integrated concept in which knowledge components are part of PCK. However, 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. In addition, there appears to be agreement on the nature of PCK as a concept that is concerned with the teaching of particular topics and is developed through an integrative process rooted in classroom practice.

Turner-Bisset (1999) found that it was impossible to distinguish between content knowledge and pedagogical content knowledge: in the act of teaching, all knowledge was presented pedagogically in some way (Turner-Bisset, 1999, p. 42). She also proposes a more integrated concept and developed a comprehensive model of knowledge bases for teaching in which PCK is seen as an overarching base. Turner-Bisset distinguishes three types of knowledge, which pertain to content knowledge or subject matter knowledge: substantive knowledge, syntactic knowledge, and beliefs about the subject. The substantive knowledge consists of the facts and concepts of a discipline (the knowing that). Syntactical knowledge refers to the ways and means by which the knowledge has been generated and established (the knowing how). Beliefs about the subject finally refer to the impact that personal orientation and the conceptions towards a subject have on teaching.
Chapter 2

a subject (Turner-Bisset, 1999, p. 43). Martin (2005, p. 63) builds on these three bases of content knowledge and relates them, in terms of teaching, to the questions: what am I going to teach, how am I going to teach it, and why am I going to teach it in this way?

In this study we will take these three questions as a starting point for a PCK model for the subject of geography in primary education. We consider these questions the three most important questions primary teacher students should ask themselves when preparing their lessons for practice; they can also form the foundations of a curriculum model for learning to teach geography in primary education. Formulating these three related knowledge bases into questions as a conceptual framework for teaching makes the concept concrete for students and it can help students to better structure and understand what it means to learn to teach geography.

Loughran, Mulhall and Berry (2008) explicitly used the idea of PCK – as a conceptual framework – in a pre-service science teacher program and found that (student) teacher participants learned to explicitly use PCK as a way of thinking about their own teaching and learning. It gave them confidence and made them look beyond simply gathering up “activities that work.” It helped them shift their focus from teaching and managing to children and learning. Their questions transformed from: “How do I (have to) do this?” into “What do children need to learn, how might they best learn it, and why do they need to learn it in this way?” (Martin, 2005, p. 68). According to Martin a transformatory process should take place at two levels: at the student teachers’ level of understanding the subject and at the level of transforming the subject into forms suitable for teaching. Or as Lambert (2009b) stated: “They learn how to rework the subject knowledge so it can be taught effectively.”

2.2.2. PCK-G

To successfully teach the subject of geography, (student) teachers need to rework geographic content by asking themselves the three questions Martin (2005) formulated based on Turner-Bisset’s (1999) knowledge bases: what am I going to teach, how am I going to teach it, and why am I going to teach it in this way? Figure 2.2 illustrates the combination of pedagogical content knowledge and the subject of geography (PCK-G). PCK-G is the type of integrated knowledge that is unique to teachers teaching geography; it is what teaching geography is about (Cochran, King, & DeRuiter, 1991).
The International Charter on Geographic Education of the International Geographical Union gives an overview of the content (or subject knowledge, WHAT) for the field of geography should be studied. It also describes the set of knowledge, understanding, skills, attitudes, and values students should explore and develop in the course of their education (Haubrich, 1992). To shape the content ‘big concepts’ (e.g., space, place, scale, location, and interdependence) can be used (Taylor, 2008). Several authors have tried to define these concepts that form the core of geography (Catling & Willy, 2009; Taylor, 2008; Martin, 2006b; Martin & Owens, 2004; Kulke, Hemmer, & Schallhorn, 2007). In combining knowledge and skills and using big concepts to shape content, young people in general and student teachers in particular acquire control over this content and develop their geographic literacy or consciousness. Van der Vaart (2001) refers to geographic literacy as “a combination of a way of thinking and a certain geographic knowledge base.” He distinguished three key competencies: (1) knowledge about world phenomena, processes, and distributions, including topography, (2) issues of place and space such as inequality and sustainable development, and (3) geographic skills such as map skills (Van der Vaart, 2001, p. 19). The first two competencies focus on geographic knowledge, the third competency on the skills needed to do geography. These skills can start with simple map skills and develop to skills needed to establish relationships between phenomena and more general theoretical knowledge.

To actively participate in the world these knowledge and skills are needed. This active participation in the world is what Favier (2011) calls “geographic drive,” defined as: “A certain level of geographic (enquiry) motivation, which refers to the willingness to
study the characteristics, functioning and problems of the world around us” (Favier, 2011, p. 12). This geographic drive helps (student) teachers to develop the motivation and attitude (WHY) to help children to become responsible and active global citizens – which is an important aim of geography education (Haubrich, 1992; Martin, 2006b). Finally, (student) teachers transform their geographic literacy and their geographic drive into teaching skills to teach primary school pupils (HOW).

To summarize, we can distinguish three levels in geography teaching, which are illustrated in figure 2.3.

First, student teachers need well-developed geographic subject knowledge, skills, and drive (WHAT). Second, they need to transform such knowledge, skills, and drive into forms suitable for teaching (HOW): they should teach pupils how to use a map and an atlas, ask them geographic questions, and teach them to approach reality from different perspectives. Finally, student teachers must do that from the perspective of helping pupils to become responsible and active global citizens (WHY). As a result of this, pupils will develop their geographic knowledge, geographic skills, and geographic drive. Geography teacher educators have the challenging task to support the development of primary student teachers’ PCK to enable them to teach the subject of geography to their pupils. To be capable of doing this, teacher educators need excellent PCK-G.

Figure 2.3. Three levels in geography teaching

Based on the concept of PCK-G, a survey was developed with the aim to obtain more insight into what teacher educators considered as the desired and actually achieved levels of pedagogical content knowledge for their student teachers at the end of initial
teacher training and about the factors that influence these results. This has led to the following research questions:

1. What is the desired level of PCK-G for primary student teachers at the end of training, according to their teacher educators?
2. What is the achieved level of PCK-G for primary student teachers at the end of training, according to their teacher educators?
3. What are factors that promote or impede achieving the desired level of PCK-G in initial teacher training in primary education?

Answers to these questions contribute to our knowledge about the primary student teachers’ education and contribute to bridging the gap between PCK theory and teacher education practice.

2.3. Method

2.3.1. Design

A descriptive study was developed to answer the research questions. Data were collected through a questionnaire for teacher educators teaching geography, which was administered in digital form (Google docs).

2.3.2. Participants

An invitation to complete the questionnaire was sent to everyone listed in the directory of the primary teacher-training network of the Royal Dutch Geographical Society, in which at least 90% of the Dutch primary geography teacher educators are listed. After a few weeks a reminder was sent to the non-responders. The incoming data were automatically stored in a database.

Of a total of 66 addresses, 39 teacher educators (59% response) completed the questionnaire. More than two-thirds (69%) of the respondents was male. The average age of the respondents was 47, although the average age of female respondents was lower than their male colleagues. Male respondents had more years of experience in primary teacher training (Table 2.1). Female teacher educators entered more recently in primary teacher training, 82 percent of them had a university degree in geography compared to 27 percent of their male colleagues, who usually entered primary teacher training after several years of working as a primary or secondary school teacher. Over 70 percent of the teacher training institutes working method is competency based. Most geography lessons are given in the first two years of study. First and second-year students each year can achieve 0-2.5 European credits (1 European credit = 28 hours of study), and they receive 6-10 full hours each year of lectures in the field of geography in nearly half of the teacher training institutes. In the third and fourth years, the number of teaching hours for geography and the number of credits to be obtained are fewer.
Table 2.1. Characteristics of the respondents.

<table>
<thead>
<tr>
<th>A. Age group according to gender</th>
<th>gender</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>male</td>
<td>female</td>
<td>Total</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;35 years</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>35-44 years</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>45-54 years</td>
<td>10</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>&gt;55 years</td>
<td>9</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>12</td>
<td>39</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>B. Number of years working in primary teacher training according to gender</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of years</td>
<td>0-5 years</td>
<td>6-10 years</td>
<td>11-15 years</td>
</tr>
<tr>
<td>years</td>
<td>5</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>12</td>
<td>39</td>
</tr>
</tbody>
</table>

2.3.3. Instruments and data collection

A questionnaire for measuring teacher educators’ perceptions of desired and achieved levels of PCK-G was developed in several steps. A first version of the questionnaire was developed based on the literature on pedagogical content knowledge and geographic literacy. This version of the questionnaire was pre-tested among a group of researchers and methodologists. Based on their feedback, a second version was designed and tested with a panel of scientists and geography educators, focusing on usability and clarity.

The resulting questionnaire consists of 62 questions. Most questions are multiple-choice questions or closed items to be answered on a five-point Likert scale. With values: <10%, 10-40%, 41-60%, 81-90% and >90% of their students for the questions about the achieved level of PCK and values classified as: not at all necessary, not necessary, maybe necessary, necessary, and really necessary for the questions about the desired level of PCK. A few open questions were added to collect information about the perceived quality of primary teacher training which might explain the discrepancy between desired and achieved levels of PCK-G. The questionnaire contains questions about the achieved and desired levels of pedagogical content knowledge in the subject of geography of primary student teachers at the end of the four year-course, according to their teacher educators. (Research questions one and two).

First, questions were included about content knowledge (WHAT questions, 12 items). These were based on the attainment targets for the subject knowledge and skills (geographic literacy) of Dutch primary school teachers. All questions were asked in the form of statements. These statements are included in table 2.2 Student teachers who
possess a well-developed mental map, e.g., are able to outline the distribution of human and natural activities in the world. This includes an active map image. Student teachers who have an understanding of spatial issues can describe and explain for example environmental problems, spatial inequality, and global climate change.

Second, questions are included about syntactic knowledge (HOW questions, 14 items). In these questions teacher educators were asked whether their student teachers were able to transform their own geographic knowledge and skills into forms suitable for teaching and whether, e.g., they can teach pupils to use maps and atlases and ask them geographic questions.

In order to measure beliefs about geography (WHY questions, 10 items), questions were asked about the interest of the student teachers in the subject and the connection with primary school practice, their curiosity about the world around them, and whether students recognize the fact that many decisions in daily life are geographic in nature.

To find an answer to research question 3, the questionnaire included questions about factors that promote or impede work on the quality of teacher training (8 questions). For instance, questions about innovations in higher education, the number of geography lessons during teacher training, and the motivation of students for the subject of geography. These questions were developed in expert meetings with colleague teacher trainers.

To gain more insight into the organization of teacher training, questions were asked about the number of teaching hours devoted to the subject of geography and the attention to subject matter knowledge (9 questions). Finally, there were questions that collected some background characteristics of the respondents (6 questions).

2.3.4. Analyses
The collected data were summarized in descriptive results. Means and standard deviations were calculated. Internal consistency of the scales was tested, and items were only analysed as scales if Cronbach’s alpha > 0.7.
2.4. Results

Table 2.2 shows the results of the closed items of the questionnaire expressed in terms of average percentages (achieved level) and mean scores (desired level).

2.4.1. The desired and achieved levels of substantial knowledge

Teacher educators believe it is essential that student teachers have a geographic worldview and can explain the spatial expression of issues such as climate change, environmental problems, global migration flows, and the process of globalization (mean between 4 and 5 on a five-point Likert scale).

Nonetheless, according to these teacher educators, only 47 percent of their primary student teachers can indicate features such as climate, landscape areas, population distribution, poor and rich areas on a world map at the end of training, while only 30 percent of their student teachers can indicate the 300 topographic names on a map at the end of training, which is compulsory in Dutch education.

Concerning the explanation of the spatial expression of issues, teacher educators think that an average percentage of 35-40 percent of the student teachers is able to do this at the end of training.

2.4.2. The desired and achieved levels of syntactic knowledge

Again, teacher educators believe that it is necessary (mean between 4 and 5 on a five-point Likert scale) that their student teachers possess syntactic knowledge at the end of training.

Teacher educators are more positive (although scores are quite low) about the achieved level of syntactic knowledge of their student teachers at the end of training than they are about the student teachers’ content knowledge. This may reflect the fact that more attention is paid to syntactic knowledge in teacher training. They are most positive about the ability of their student teachers to ask pupils geographic questions (64%), to teach pupils to approach the world around them from different perspectives (61%), and to use maps and atlases during their practice in primary school (60%). The teacher educators view the ability of their student teachers less favourably in their ability to evoke the imagination of pupils about phenomena and places (58%) or to use the goals for the field of geography when designing their lessons (55%). Teacher educators were most sceptical about their student teachers’ use of map skills in the lessons in primary school (45%) and about the ability of student teachers to teach pupils to approach the world around them at different levels of scale (46%).
Table 2.2. Achieved and desired levels of PCK-G at the end of training according to their teacher educators.

<table>
<thead>
<tr>
<th>N= 39</th>
<th>Achieved level (Average percentage)</th>
<th>Desired level (Mean score)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Substantial knowledge at the end of training (WHAT)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mental map</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Students can indicate on a world map features such as climate, landscape areas, population distribution, poor and rich areas.</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>- Students can indicate on a map all 300 topographic names from the topography list (used in the Netherlands)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>- <strong>Students can explain the following spatial issues:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- <em>(these spatial issues are part of the Dutch secondary curriculum)</em></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Climate change</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Environmental problems</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Global migration flows</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>The process of globalization</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td><strong>Syntactic knowledge at the end of training (HOW)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Students can ask pupils geographic questions.</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>- Students teach pupils to approach the world around them from different perspectives.</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>- Students use atlases and maps where possible during their practice.</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>- Students can evoke the imagination of pupils about phenomena and places.</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>- Students use the goals for the field of geography when designing their lessons.</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>- Students teach pupils to approach the world around them at different levels of scale.</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>- Students can apply all map skills during their lessons.</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td><strong>Beliefs about the subject of geography at the end of training (WHY)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Students are motivated about the subject of geography during teacher training if there is a connection to primary school practice.</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>- Students are motivated about the subject of geography during teacher training.</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>- Students are interested in the subject of geography during teacher training.</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>- Students are curious about the world around them.</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Students recognize that many decisions in daily life are geographical in nature.</td>
<td>34</td>
</tr>
</tbody>
</table>
2.4.3. The desired and achieved levels of beliefs about the subject of geography

With regard to beliefs about the subject of geography at the end of training, teacher educators believed that it is necessary (mean score 4.0) that student teachers be motivated and interested in the subject of geography at the end of training. However, they believed that only 50-51% of their student teachers is interested in and motivated about the subject of geography during teacher training. According to the teacher educators, this motivation is higher when there is a connection to primary school practice (68%). Even less satisfied were teacher educators about the curiosity of student teachers about the world around them (47%), a competence teacher educators find essential for primary school teachers (mean score 4.5). Finally, table 2.2 shows that teacher educators think that only 34% of their student teachers recognizes that many decisions in daily life are geographic in nature.

2.4.4. Factors that may promote or impede achieving the desired level of PCK-G in initial teacher training in primary education

Respondents were asked to comment on a number of statements on promoting and impeding factors, and to answer some open questions. They also gave their opinion on a number of quotes on the quality of geography teaching at their institutions that may provide explanations for the discrepancy between the desired and achieved levels of PCK-G in teacher education.

More than 40% of the teacher educators believe that the quality of primary teacher education deteriorated after 2000, the moment at which the new system of competence-based teaching was introduced at most teacher education institutes in the Netherlands. The main reasons for this, according to the teacher educators, are the reduction in the number of hours in the educational program spent on geography and the reduced focus on subject matter in general at their institution. According to more than 50% of the respondents, the number of hours spent on geography at their institution after 2000 was reduced. They find it difficult to prepare student teachers to provide good geography lessons at primary school in this limited number of hours. Also, more than 50% of the respondents state that the focus on subject matter in general at their institution was reduced after 2000. Teacher educators expected that more hours of teaching and a greater focus on substantial knowledge (WHAT) could diminish the discrepancy between desired and actually achieved levels of PCK-G in primary teacher training. Respondents see substantial knowledge as a prerequisite for syntactic knowledge (HOW). As one of the respondents put it: “Pedagogical skills cannot develop if there is too little subject matter baggage.” Both kinds of knowledge are essential.
Besides too few teaching hours and too little focus on subject matter, respondents mention the limited and also widely varying knowledge base of the students when they enter teacher education as important impeding factors affecting the quality of geography education. This makes it even more difficult to develop a relevant program for all student teachers within the limited number of teaching hours. Respondents are also critical about their own role and the fact that there is little agreement on the appropriate teaching strategy for primary education. Teacher educators should become better organized as a professional group. Respondents also believe the primary school in which students do their internship does not always provide a good example; the subject of geography often has no priority and the mostly textbook-based lessons turn many geography lessons into reading comprehension lessons.

Although motivation was mentioned only a few times as a relevant factor for explaining discrepancies between intended and achieved levels of PCK-G, respondents agree with the statement that student teachers who are motivated to teach the subject of geography provide better geography lessons in primary school. Associated with motivation, the respondents also reviewed their own role as teacher educators. According to the respondents, the quality of teacher educators should also be improved. Teacher educators should be excellent and passionate. They should: "be able to bring about the magic of geography." Some respondents blame the problem on the shift in Dutch higher education towards competence-based learning.

Finally, respondents were asked to indicate three actions the Minister of Education should take to improve geography education in primary teacher training. The actions most often mentioned were: more attention to subject knowledge, higher demands on the entry level, the possibility of different levels in the outflow of students, promotion of research, higher demands on the quality of trainers, and improvement in the position of the subject of geography in primary school.

### 2.5. Conclusions and discussion

Although primary teacher educators believe that all aspects of PCK-G are really necessary, their opinions on the achieved level of PCK-G of their student teachers at the end of initial training varies. What stands out is that they have a negative view of the substantive knowledge of their students, and especially about their students’ ability to indicate topographic names on a map and to explain spatial issues, but they have a more positive opinion about the ability of their students to indicate spatial phenomena on a world map.

To indicate topographic names on a map, student teachers should be able to read maps or have a good memory. Simple map reading skills help students to describe or name localized objects (facts). To identify spatial phenomena such as population distributions on a map, students need to organize and order objects (concepts), which is a somewhat more complex skill. When student teachers explain spatial issues such as migration
flows, they have to establish relationships between phenomena and more general theoretical knowledge, which is the most complex skill (Van der Vaart, 2001). Table 2 showed that teacher educators think the easiest skill is achieved by the lowest percentage of their students. A remarkable finding, which relates to the way students and pupils learn facts. Recent research shows that the topographic knowledge of pupils at the end of primary school is highly unsatisfactory, although a great deal of time is spent on it (Notté, Van der Schoot, & Hemker, 2010). The main reason for this can be found in the fact that topographic names are learned as individual facts and not offered in a functional context. In the course of primary (and secondary) education, primary student teachers have learned topographic names in this way and, just as primary school pupils tend to do, they forgot many of those names. This can explain the fact that their teacher educators think that only 30% of their students will be able to indicate all the 300 topographic names on a map. Therefore, it is recommended that primary student teachers - as part of their PCK-G development - learn topographic names in a functional context themselves, and subsequently learn how to teach primary school pupils topographic names in this way.

The question we have to ask about student teachers learning of all elements of geography is: from what perspective do teacher educators look at the achieved level of PCK? Do experts, such as teacher educators, not always expect a higher level of PCK-G of their student teachers than they eventually reach? Results from recent inspections in primary education show a similar trend. Many pupils stay behind the desired level formulated in the standards (Notté, Van der Schoot, & Hemker, 2010; Ofsted, 2011).

As an outcome of the debate on the level of subject knowledge of primary student teachers, the Minister of Education of the Netherlands ordered formulation of knowledge bases for all school subjects that capture the final level for these subjects (Van Bijsterveldt-Vliegenthart, 2008). In a recent recommendation by the Netherlands Association of Universities of Applied Sciences (HBO-raad), five actions were proposed to improve the subject knowledge of (future) primary teachers. One of them is to set requirements (students should meet at least a level of (in our case geographic) knowledge equivalent to the level reached after three years of secondary education) on the intake of students (Meijerink, 2012). These actions may (partly) improve the quality of primary school teachers as the experiences in Finland suggest, a country with high scores on the PISA rankings. Primary school teachers in Finland need to earn at least a master’s degree in education, in addition to a bachelor’s degree in one or more content areas. Besides that, to enter teacher education, candidates must have good scores and excellent interpersonal skills as well as a deep personal commitment to teaching and working in schools (Sahlberg, 2011). It is a pity that we cannot realize the ‘Finnish model’ in the Dutch educational system within a few years. The main constraint is the recruitment of enough good teachers.

A higher level of substantial knowledge, according to the teacher educators in our study, is a prerequisite for syntactic knowledge. Both forms of knowledge are needed to
provide meaningful and challenging education, but there is no agreement (in the Netherlands) about the appropriate teaching method for the subject of geography within the mostly competence-based primary teacher education programs, according to the respondents.

Concerning this subject several studies (Martin, 2000; Martin, 2005; Corney, 2000; Catling, 2004; Alkis, 2009; Morley, 2012; Lane & Coutts, 2012) suggest that it is important to take into account the preconceptions, images of geography, and teaching of student teachers because they influence their thinking about teaching and classroom practice. Martin’s study of the knowledge bases for effectively teaching primary geography (Martin, 2008b) describes the influences affecting student development as teachers of primary geography. She makes a distinction between formal school learning and informal everyday learning and states that a barrier exists between the informal geographical experiences in the world (the everyday self as a learner) and the student (self) as a teacher. She believes it is the teacher educator’s responsibility to find ways of removing the barrier that currently appears to prevent student teachers from utilizing the everyday self as learner base. She states that it seems necessary to develop a way of conceptualizing geography that (1) enables students to recognize the value of their everyday experience and that they are already thinking geographically in their everyday lives, and (2) is suited to the context that the students are working in – that of primary school – and this is a paradigm she refers to as ‘everyday’ or ‘ethnogeography’.

Teacher education should enable student teachers to make connections between their everyday experiences and the way geographers make sense of the world by means of geographical imagination: a lens through which to make sense of the world using the big ideas of geography, such as place, connectedness, scale, process, and skills (Martin, 2008b, p. 36). Catling and Martin (2011) recognize both forms of knowledge as powerful. They introduce a model based on Young (2010) in which, other than Young who valorises the academic knowledge above the everyday knowledges, both the everyday perspectives and the academic perspectives are seen as powerful and where the dialogue between these two forms of knowledge provide the most effective base from which to act as an effective teacher of primary geography. It would be interesting to conduct more research on the connection between everyday knowledge and academic knowledge as appropriate teaching strategy for developing student teacher PCK-G.

Little research has been done on the image that primary teacher educators have of their students. This study just gives information about some views of primary teacher educators in the specific situation of the Dutch educational system. It would be interesting to conduct a similar study in a more international context and on a larger scale, with more information about the ability of primary student teachers in developing good geography lessons and student teachers views to contrast them with that of the teacher educators.
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.

![Geographic Analysis Model](image)

Figure 3.1. The geographic analysis model.

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</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>
<td></td>
</tr>
<tr>
<td>Step 2 Describe, what/ where?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3 Zooming in and out.</td>
<td></td>
<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></td>
<td></td>
</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 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>Arguments from the three rounds of panel discussions (the adaptions are in italics)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In the elaboration of the course (e.g. in an instruction manual) it is important to emphasize ...</strong></td>
</tr>
</tbody>
</table>
| **Preconceptions** | ... 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. |
| **Everyday geography** |  |
| **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. |
| **Geographic analyses model** |  |
| **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.  
Build up the framework step by step. This stimulates discussion and active learning. |
| **Gradual expansion** |  |
| **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

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Where is it?</td>
<td>Describe what you see and where you see it, preferably using, e.g., a map, an atlas, a globe etc.</td>
</tr>
<tr>
<td>2. Why is it there?</td>
<td>Explain what you see (through the relationship between man and nature).</td>
</tr>
<tr>
<td>3. What do I see if I zoom in or out?</td>
<td>At other levels of scale, you may see different things. Zooming provides a different picture.</td>
</tr>
<tr>
<td>4. How does it change over time?</td>
<td>Describe the situation in the past and/or in the future.</td>
</tr>
<tr>
<td>5. What are the consequences, advantages and disadvantages?</td>
<td>The effects (or pros and cons) are viewed from different angles.</td>
</tr>
</tbody>
</table>

### Instructional key questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. How can I start the lesson in a motivating way?</td>
<td>The lesson starts in a way that challenges pupils to participate in class (using an everyday spatial problem).</td>
</tr>
<tr>
<td>7. How can I end the lesson in a way that promotes transfer? (Discuss the special and the general)</td>
<td>At the end of the lesson, there is a discussion about the usefulness of knowing something about the subject of the lesson.</td>
</tr>
</tbody>
</table>

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 clothes for names of 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) (Step 6 from figure 3.6) This is the geographic question ‘where’? The map and atlas are used to determine where an area is located. (Step 1 from figure 3.6)</td>
</tr>
<tr>
<td>The teacher asks: Why are those clothes 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?’ (Step 2 from figure 3.6)</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. (Step 3 from figure 3.6)</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. (Step 4 from figure 3.6)</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. (Step 7 from figure 3.6)</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 become 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 (Niemi, 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 colour 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.
4. Learning to teach geography for primary education: results of an experimental programme
Abstract
Students training to become primary school teachers appear to have little awareness of the core concepts of geography (teaching). To ensure that future primary school teachers are able to develop their pupils’ geographical awareness, a six-week programme was developed. The characteristics of this programme are: principles of good geography teaching, conjunction and a recurrent structure during training, modelling and reflection. The question is answered what the effects are of this programme on the development of pedagogical content knowledge (PCK). The results indicated that the programme has a positive effect on the domain-specific PCK development in the short term.

Keywords
primary teacher education, pedagogical content knowledge, geography education, modelling, reflection.

4.1. Introduction

The purpose of this study is to investigate a programme for primary student teachers that aims to develop student teachers’ pedagogical content knowledge (PCK) for the subject of geography. (Future) primary teachers need to be able to teach their primary school pupils effective geography lessons. This requires, amongst others, that they have insight into the importance of the (school) subject for children, the main geographical issues, and how children learn geography. Although student teachers and primary school teachers are usually able to give geography lessons in primary schools, primary teacher educators experience that they have little awareness of the core characteristics of geography and geography teaching (Blankman, Van der Schee, Volman & Boogaard, 2015). Additionally, they are not always convinced that geography is an important subject in primary school.

Primary teacher educators believe that it is necessary that their students develop their PCK for the subject of geography during teacher education. However, they believe that their students only partly reach the desired level of PCK at the end of teacher education, due to a limited number of teaching hours for the subject of geography, a lack of focus on subject matter, and a widely varying knowledge base of student teachers when entering teacher education (Catling, 2004; Catling & Willy, 2009; Morley, 2012; Blankman, Volman, Van der Schee, & Boogaard, 2015).

Several authors have argued (Martin, 2000; 2005; Corney, 2000; Catling, 2004; Alkis, 2009; Lane & Coutts, 2012; Morley, 2012) that it is important to take into account the preconceptions – the images of geography and teaching – of student teachers because they influence their thinking about teaching and classroom practice. Research also shows that student teachers fall back on their memories of the geography lessons they themselves were taught at school: mostly representing a knowledge-oriented and informational view and the teacher who transfers information (Catling, 2004; Bradbeer, Healey, & Kneale, 2004; Martin, 2005).

In addition to the formal, knowledge-oriented, geographic experiences at school (the academic knowledge), Martin (2008a) distinguishes another source for learning: informal geographical experiences in the world (everyday knowledge), experiences that are not recognised as geographical by most of the primary student teachers. She also suggests that a barrier exists between the formal and informal sources of learning and that it is the teacher educators’ task to remove this barrier so primary student teachers can use their everyday geographical experiences as a learner base. These everyday geographies could provide a suitable starting point from which to develop student teachers’ teaching the subject of geography in primary school.

In this study a programme was designed and evaluated that promotes the development of pedagogical content knowledge of geography in primary teacher education. The programme develops Martin’s (2008b) ideas about the potential of everyday geographical experiences for teaching into a set of design principles by integrating them with...
basic principles of good geography teaching and teacher education. The programme with characteristics as explicit modelling, reflection and transfer aims to give student teachers insight into the characteristics of good geography lessons and tools to design and practice these lessons.

4.2. Theoretical Background

4.2.1. PCK

To successfully teach a subject (e.g. geography) in primary school, (student) teachers need pedagogical content knowledge (PCK) (Shulman, 1986; 1987). PCK is concerned with subject matter for teaching and consists of two main components: (1) domain knowledge that is transformed so it becomes comprehensible to students and (2) knowledge about student conceptions and preconceptions and common student learning difficulties.

Although the PCK framework has become an accepted framework, there is no generally accepted conceptualisation (Berry, Loughran, & Van Driel, 2008; Van Driel, Verloop, & De Vos, 1998; Depaepe, Verschaffel, & Kelchtermans, 2013). PCK is a dynamic concept that is defined in different ways by educational researchers. Several scholars (Cochran, King, & DeRuiter, 1991; Grossman, 1990; Turner-Bisset, 1999) argued for a PCK-concept in which knowledge components are more explicitly part of PCK. Turner Bisset (1999) e.g. developed a comprehensive model of knowledge bases for teaching in which PCK is seen as an overarching base. She distinguishes three types of knowledge relating to content knowledge or subject matter knowledge: substantive knowledge, syntactic knowledge, and beliefs about the subject. The substantive knowledge consists of the facts and concepts of a discipline (the knowing that). Syntactical knowledge refers to the ways and means by which the knowledge has been generated and established (the knowing how). Beliefs about the subject finally refer to the impact that personal orientation and conceptions towards a subject have on teaching a subject (Turner-Bisset, 1999, p. 43).

PCK is considered the synthesis of all knowledge needed to be an effective teacher. It is the transformation of subject matter, pedagogical and content knowledge into a unique form, “the only form of knowledge that impacts teaching practice” (Gess-Newsome, 1999), p.10). It is both an external and internal construct, as it is constituted by what a teacher does, what a teacher knows and the reasons for the teacher’s actions (Baxter & Lederman, 1999, p. 158) or in other words a teacher’s use of particular teaching procedures (how) with particular content (what) for a particular reason (why) (Loughran, Berry, & Mulhall, 2012).

Comparable to the previous and building on Turner Bisset (1999), Martin (2005) formulated three questions (student) teachers need to ask themselves: what am I going to teach, how am I going to teach it, and why am I going to teach it in this way? In this
way (student) teachers learn how to rework the subject knowledge so it can be taught effectively (Lambert, 2009b).

In this study, we take these three questions as a starting point for a PCK model for the subject of geography in primary education: (1) what am I going to teach (substantive knowledge): the geographic knowledge, skills and drive to be taught, (2) how am I going to teach it (syntactic knowledge): the teaching skills needed to help children learn geography and (3) why am I going to teach it in this way (beliefs about the subject): the attitude to help children become responsible and active global citizens. This last question has a normative interpretation widely accepted in the field of geography (Haubrich, 1992; Geography Education Standards Project, 1994; Bednarz, Heffron, & Huynh, 2013).

We consider these questions the three most important questions student teachers should ask themselves when preparing their geography lessons for practice. They also form the fundamentals of a curriculum model for learning to teach geography in primary education.

4.2.2. PCK-G: the integrated knowledge needed to teach geography

PCK-G (Figure 4.1) is the type of integrated knowledge that is unique to teachers teaching geography; it is what teaching geography is about (Cochran, King, & DeRuiter, 1991).
Geography (what) can be described as 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). Geography, in other words, is concerned with space and place (Gersmehl, 2008), and geographic key questions usually begin with or relate to Where is it? What is it like? Why is it there? How did it happen? What impact does it have? (Haubrich, 1992). Authors have added the concept of change and the key question: How does it change? (Van der Schee, 2000), and the key concept of perspective: Who is saying what? (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 (zooming in or out provides a different picture).

To be able to answer the geographic questions above, students need geographic literacy or consciousness. Van der Vaart (2001) used the concept ‘geographic consciousness’ to refer to “a combination of a way of thinking and a certain geographic knowledge base.” He distinguishes three key competencies: (1) knowledge about world phenomena, processes and distributions, including topography, (2) issues of place and space, such as inequality and sustainable development, and (3) geographic skills, such as map skills (Van der Vaart, 2001, p. 19). The first two competencies focus on geographic knowledge (content). The third competency refers to the skills needed to ‘do geography’: the ability to ask geographic questions, to use geographic sources of information and to apply geographic thinking skills (KNAG, 2003; 2008). The US Joint Committee on Geographic Education distinguishes the same competences (Joint Committee on Geographic Education, 1984).

In the literature also the concept of “geographic drive,” is used, defined as: “A certain level of geographic (enquiry) motivation, which refers to the willingness to study the characteristics, functioning and problems of the world around us” (Favier, 2011, p. 12). A geographic drive is supposed to help (student) teachers to develop the attitude (why) to support children to become responsible and active global citizens (Haubrich, 1992; Martin, 2006b). (Student) teachers in turn should realize that knowledge, skills and drive must be taught in conjunction and in a recurring structure when the aim is to develop a geographic worldview and knowledge and understanding of spatial issues in pupils (how).

Based on the above-described concepts, in this study we use a framework of seven characteristics of good geography teaching, as shown in figure 4.2. First, there are five geographic core questions that help to investigate phenomena and processes on planet earth as a geographer (What / substantive knowledge): Where is it? Why is it there? What do I see if I zoom in or out? How does it change in time? and What are the consequences, advantages and disadvantages? These five interconnected characteristics are based on geography education literature (Gersmehl, 2008; Taylor, 2008; Van der Schee, 2000). In addition, there are two instructional characteristics, not unique to the subject of geography.
phy (How / syntactic knowledge): *How can I start the lesson in a motivating way?* and *How can I end the lesson in a way that promotes transfer?* Starting from an everyday geographic problem (a motivating start), pupils and their interests are the starting point for learning (Dewey, 1897). In this inductive way pupils are challenged to join the lesson (Martin, 2006a; Gersmehl, 2008; Catling & Willy, 2009). After this start the geographic questions are discussed and finally, each lesson ends by reflecting on the subject. In this way student teachers help their pupils to become conscious of the essential aspects of the lesson, a situation that promotes transfer to new situations (Korthagen & Vasalos, 2005; Korthagen & Kessels, 1999).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic characteristics (What)</td>
<td></td>
</tr>
<tr>
<td>1. Where is it?</td>
<td>Describe what you see and where you see it, preferably using, e.g., a map, an atlas, a globe etc.</td>
</tr>
<tr>
<td>2. Why is it there?</td>
<td>Explain what you see (through the relationship between man and nature).</td>
</tr>
<tr>
<td>3. What do I see if I zoom in or out?</td>
<td>At other levels of scale, you may see different things. Zooming provides a different picture.</td>
</tr>
<tr>
<td>4. How does it change over time?</td>
<td>Describe the situation in the past and/or in the future.</td>
</tr>
<tr>
<td>5. What are the consequences, advantages and disadvantages?</td>
<td>The effects (or pros and cons) are viewed from different angles.</td>
</tr>
<tr>
<td>Instructional characteristics (How)</td>
<td></td>
</tr>
<tr>
<td>6. How can I start the lesson in a motivating way?</td>
<td>The lesson starts in a way that challenges pupils to participate in class (using an everyday spatial problem).</td>
</tr>
<tr>
<td>7. How can I end the lesson in a way that promotes transfer? (Discuss the special and the general)</td>
<td>At the end of the lesson, there is a discussion about the usefulness of knowing something about the subject of the lesson.</td>
</tr>
</tbody>
</table>

*Figure 4.2. Characteristics of a geography lesson*

### 4.2.3. Teaching PCK-G in primary teacher training

Designing a programme in which attention must be paid to the development of PCK for the subject of geography, within a limited number of hours, is a challenge. We discuss a number of design principles on which, according to the literature, such a programme could be based.

**Modelling and reflection**

Different from other forms of higher education, teachers in teacher education teach about teaching. Implicitly or explicitly, they are their own models that show certain teaching principles during their classes (Swennen, Lunenberg, & Korthagen, 2008). “*How they teach is the message*” (Russell, 1997). Teacher educators therefore should demonstrate
or ‘model’ the behaviour that they expect their students to show in practice (Loughran & Berry, 2005; Swennen, Lunenberg, & Korthagen, 2008). Swennen et al. (2008), use the term ‘congruent teaching’, referring to a teaching methodology of the teacher educator that is in accordance with the teaching methodology that he or she wants to promote in the student teachers. Congruent teaching, however, does not merely entail modelling, it combines modelling, explaining the choices made while teaching by giving metacommentary and linking those choices to relevant theory (Swennen, Lunenberg, & Korthagen, 2008). (Explicit) modelling combined with theoretical reflection facilitates translation of the teaching methodology that is being modelled to the student teachers’ own practices and understanding of that methodology (Lunenberg, Korthagen, & Swennen, 2007).

Explicitly modelling the thoughts and actions that underpin the practice has been argued to lead to more powerful teaching and learning about teaching (Loughran & Berry, 2005, p. 197). Moreover, this may contribute to closing the gap between theory and practice. Student teachers are encouraged to consciously reflect on what they have learned and to apply their knowledge and skills in their practice in primary school (Loughran & Berry, 2005; Lunenberg, Korthagen, & Swennen, 2007; Korthagen, Loughran, & Russell, 2006; Swennen, Lunenberg, & Korthagen, 2008).

Connecting everyday and academic knowledge
Catling and Martin (2011) make a plea for courses in initial teacher education that engage student teachers to connect with their personal or everyday geographies. They distinguish between everyday geographical knowledge (practice) and academic geographical knowledge (theory), in which everyday geographical knowledge refers to the knowledge pupils and primary student teachers take to school. Both forms of knowledge (the everyday and the academic) need to be included in the curriculum. The dialogue between these forms of knowledge deepens and improves the understanding of both (Catling & Martin, 2011).

In the programme that is evaluated in this study, the following design principles are therefore central:

a. principles of good geography teaching are integrated in a framework which is used during each session, the characteristics are trained in conjunction and in a recurrent structure.

b. explicit modelling is applied to explain the teaching approaches and to link them to relevant theory (Swennen, Lunenberg, & Korthagen, 2008).

c. reflection is used to link practical knowledge about geography teaching to theory and thus to promote transfer (Lunenberg, Korthagen, & Swennen, 2007).
d. *everyday geographical knowledge* is connected to academic geographical knowledge by starting each session from an everyday/personal geographical example (Catling & Martin, 2011).

According to our opinion, this offers opportunities for the development of the PCK of primary student teachers for the subject of geography.

4.2.4. Research question

Based on the design principles described above, a programme was developed for primary student teachers named Consciously Teaching Geography (CTG). Its aim is to develop student teachers PCK for geography through stimulating the conscious use of the characteristics of good geography teaching by means of explicit modelling and reflection and by connecting everyday and academic geographical knowledge. We expect that students who attended this programme will be better prepared to teach geography in primary school.

This leads to the following research question:

*What are the effects of the programme Consciously Teaching Geography on the development of the PCK components: Substantial knowledge (what), Syntactic knowledge (how), and Beliefs about the subject (why) of first year students in primary teaching?*

4.3. The intervention

The core of the intervention is made up of the experimental programme Consciously Teaching Geography, including sample lessons, an instruction manual and a training session to prepare the teacher educators to be able to appropriately conduct the programme.

4.3.1. The programme

The programme Consciously Teaching Geography was developed and piloted in close collaboration with other teacher educators. The design principles were discussed in three focus group meetings. Once the programme was developed, it was tested and adjusted in two pilot rounds.

Over the programme of five 90-minute meetings, first year primary student teachers work on developing their PCK for the subject of geography (see Figure 3.8). At the start of the programme, the activities focus on raising student teachers’ awareness of their own image of geography and their preconceptions. Thereafter, these conceptions are compared with the geographies reflected in everyday activities (Martin, 2008a), e.g. their journey from home to school or the breakfast they ate that morning. Each meeting subsequently starts with an everyday spatial problem. During the meetings all seven characteristics of a good geography lesson are paid attention to (see Figure 4.2). The
framework of the seven characteristics is used to help student teachers to make the connection between everyday geographic experiences and the core academic concepts of geography. Each meeting the teacher educator models the characteristics of a geography lesson step by step, in a sample lesson (Figure 3.7 gives a sample lesson from the programme), by providing meta-commentary through which a translation to the student teachers’ own practice takes place, and a connection is created between exemplary behaviour and theory.

4.3.2. Preparation
Seven geography teacher educators conducted the programme. They received a four-hour training. During this training participants first were informed about the theoretical background of the intervention. Subsequently they experienced a sample lesson from the course, followed by a discussion that focused on the characteristics of the programme and the role of the teacher educator in it. Thereafter a lesson was built up together with the participants, starting from an everyday geographic issue and using the seven characteristics (see Figure 4.2) as a tool. Also attention was paid to how to model the several steps. Finally, the participants were set to work designing a lesson themselves. In this way participants get used to the method of the programme.

4.4. Method

4.4.1. Design
To find an answer to the research questions a quasi-experimental research design with control groups and pre-post testing was used. First a pre-test was taken to measure student teachers PCK for geography prior to the intervention. Next, the experimental groups followed the CTG programme (the intervention), and the control groups followed the regular geography lessons. In both types of classes (experimental and regular) the same topics were taught, such as how to ask geographic questions, how to use maps, atlases and geographic textbooks during classroom practice. Only the approaches differed. To measure the development of PCK two post-tests were taken. The first post-test took place directly after the course. The second post-test was a retention test two months after the programme had finished (see Figure 4.3).

Prior to the intervention a meeting was organised in which all teacher educators who participated in the study (of the experimental and control groups) were instructed in the purpose and the design of the intervention.
Figure 4.3. Design of the study

4.4.2. Instruments

To measure the effects of the experimental module a combination of a mixed-and multi-method study (Teddle & Tashakkori, 2009; Greene, Caracelli, & Graham, 1989) was conducted. Quantitative analyses were applied to partially qualitative data and quantitative methods of data collection and analysis were used to examine complementary aspects of the same phenomenon: students’ PCK (Figure 4.4).

<table>
<thead>
<tr>
<th>What is measured</th>
<th>Name of the instrument</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Personal characteristics</td>
<td>Biographical Questionnaire</td>
<td>T1</td>
</tr>
<tr>
<td>2. Substantial WHAT and syntactic HOW - knowledge Understanding of the concept of a good geography lesson</td>
<td>Test Review Lesson Plans Test Own Lesson Design</td>
<td>T1, T2, T3</td>
</tr>
<tr>
<td>3. Beliefs about the subject WHY Consciously using the concept of a good geography lesson</td>
<td>Test Own Lesson Design</td>
<td>T2, T3</td>
</tr>
</tbody>
</table>

Figure 4.4. Instruments used in the study.

1. **Personal characteristics**: to collect some background information, a *Biographical Questionnaire* was answered by all students at the pre-test (T1) (age, gender, final exam in the subject of geography, interest in geography). In this way we were able to compare the experimental and control groups.

2. The *substantial knowledge (WHAT)* and *syntactic knowledge (HOW)* are measured together, based on the principle that both forms of knowledge are interrelated in a lesson. These forms of knowledge are combined in the seven characteristics of good geography teaching (see Figure 4.2). Two tests were used to measure this: the *Test Review Lesson Plans* (pre- and post-test) and the *Test Own Lesson Design* (post-test only).
In the *Test Review Lesson Plans* student teachers had to comment on five short lesson plans and to note which two aspects should be added to the lesson to make it a good geography lesson. Each aspect that was correctly listed resulted in one point (maximum score: 10 points). Figure 4.5 gives an example of such a lesson plan. The test was conducted in the pre-test (T1) as well as in the post-test (T2). The test is developed together with colleague researchers and is consistent with the intended goals, the development of substantive knowledge (WHAT) and syntactic knowledge (HOW). The content validity of the test was tested and approved during the pilot phase of the study.

**Lesson plan Europe: Which country is on your dish today?**

At the table of the teacher lies a pizza. The teacher asks the pupils if they know from which country a pizza originates.

The teacher asks one of the pupils to locate Italy on a map of Europe.

During a visit to the supermarket pupils look for products originating from other European countries.

Pupils discuss in groups whether their grandparents could buy those products in the Netherlands when they were kids.

To conclude the lesson, the teacher and the pupils talk about why it is useful to know something about importing products from other countries.

**Task for the students:**

Here you see a lesson plan for a geography lesson for age group 10-12. Two elements of a good geography lesson are missing. Please write down those two things.

(The two elements that are missing are: *why is it there?* (Why do we import products from foreign countries?) and the consequences (What are the pros and cons of importing products from foreign countries?))

*Figure 4.5. Example of a lesson plan from the test ‘Review Lesson Plans’*

The substantial and syntactic knowledge of the student teachers was also measured by means of the *Test Own Lesson Design*. In this test student teachers had to design a lesson on a given everyday geographic issue. In designing this lesson, they had to use a format in which they had to answer three questions for each phase of the lesson: what does the teacher do, what do the pupils do and why do we do that in this way? (Figure 4.6). With the first two questions we aimed to measure the use of the characteristics of a good geography lesson, or – in other words – the substantial and syntactic knowledge (What and How). This test was conducted after finishing the geography course (T2) and was repeated after two months (T3). The quality of the instrument was tested and improved during two pilot rounds.

Therefore, both the *Test Review Lesson Plans* and the *Test Own Lesson Design* measured substantive and syntactic knowledge. The *Test Review Lesson Plans* was used
to measure whether student teachers were able to recognize quality in the work of others; the Test Own Lesson Design shows their ability to apply characteristics of good geography lessons themselves. We in other words looked at two complementary aspects (Greene, Caracelli, & Graham, 1989), with the aim to gain a better and more complete picture of the PCK development of student teachers.

3. **Beliefs about the subject (WHY)** are measured by the Test Own Lesson Design. If students could answer the question Why do we do that in this way? (Figure 4.6) they did demonstrate the conscious use of the characteristics of good geography teaching.

<table>
<thead>
<tr>
<th>Subject:</th>
<th>Lesson is meant for year:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning objectives:</td>
<td></td>
</tr>
<tr>
<td>1. What does the teacher do?</td>
<td>2. What do the pupils do?</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 4.6. Scheme for developing a geography lesson*

The degree of completeness with which the seven characteristics were applied in the Test Own Lesson Design was checked. If a characteristic was used (the first two columns are filled in adequately – we called this ‘sufficient use’), it was awarded one point. If a characteristic was used consciously (column 3 is also filled in adequately), an extra point was awarded. In total fourteen points could be obtained. In figure 4.7 a short example is provided.

<table>
<thead>
<tr>
<th>1. What does the teacher do?</th>
<th>2. What do the pupils do?</th>
<th>3. Why do we do that in this way?</th>
</tr>
</thead>
<tbody>
<tr>
<td>I ask one of the pupils to point on a map of the Netherlands where the river Rhine flows.</td>
<td>The pupil point to the river Rhine on the map</td>
<td>It is important to localise because it helps pupils to develop a geographic worldview.</td>
</tr>
<tr>
<td>sufficiently used</td>
<td>used consciously</td>
<td></td>
</tr>
<tr>
<td>1 point</td>
<td>1 point</td>
<td></td>
</tr>
</tbody>
</table>

*Figure 4.7. Part of a lesson plan (characteristic Where is it?) about rivers in the Netherlands including the awarded points*

Initially approximately 5% of the almost 400 Tests Review Lesson Plans and Tests Own Lesson Design were rated by two reviewers on the basis of a correction format. Both reviewers were involved in primary teacher training and familiar with the experimental programme. The scores of both reviewers for the tests were compared. Based on a number of discussion points, the correction format was further detailed and decision points
were formulated. This cycle was repeated (in which another 5% of the tests was rated), after which 100% agreement was reached. Afterwards one reviewer corrected the remaining 90% of the tests. In the appendix the rubrics for both tests can be found.

4.4.3. Participants

Primary teacher educators listed in the directory of the primary teacher educators’ network of the Royal Dutch Geographical Association (of which nearly all Dutch primary geography teacher educators are members) were invited to take part in the study. Fifteen teacher educators volunteered to participate. Eleven teacher educators were selected to participate in the study and assigned to the experimental and control condition, based on the following criteria:

The programme should be organised into the regular programme of the institute so regular assessments could take place (prerequisite).

Experimental and control groups were matched in terms of student population (age, gender, former education, final exam in geography and interest in the subject) and matched as well as possible in terms of the urban character and ethnic diversity at the locations of the institutes. In this way, we aimed at forming comparable groups.

Eventually, almost 450 first year primary student teachers at the beginning of their training participated in the study: six experimental groups were formed with seven geography teacher educators and in total 248 student teachers, and six control groups were formed with five geography teacher educators and in total 201 student teachers.

4.4.4. Characteristics of the participating student teachers

Table 4.1 shows that the experimental group and the control group were broadly comparable. More than 80% of the student teachers were female, more than 40% took a final exam in geography at secondary school and more than half of the student teachers think geography is an interesting subject. The majority of the student teachers entered primary teacher training after five years of secondary education (senior general secondary education). On average, the student teachers in the experimental group (mean age 18.7 years, range 1.8 years) were somewhat older than the student teachers in the control group (mean age 18.4 years, range 1.3 years). This difference is significant, \( t = -2.533, \text{ df } 173.29, \ p <0.05 \). Therefore, age was included in the analyses as a covariate.

4.4.5. Data analysis

First, descriptive analyses were performed: means and standard deviations were calculated. Subsequently, analyses were conducted to answer the research questions.

Students in groups (classes) that were taught by different teacher educators followed the CTG programme. Therefore, it was expected that the results of students from the same group who were taught by the same teacher would be more similar to each other than to
the results of students from different groups. In other words, it was expected that the observations of individual students would not be independent of each other. A determination of the intraclass coefficient of the dependent variables involved (for the measurement moments separately) showed that the teacher educator indeed had a strong influence on the variable PCK-G WHAT/HOW as measured by the Test Review Lesson Plans and on the variables PCK-G WHAT/HOW and WHY as measured by the Test Own Lesson Design. Therefore, the analyses were carried out as a multi-level analysis with the teacher educator as a cluster.

Table 4.1. Characteristics of the respondents

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>% within exp. group</th>
<th>% within control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female students</td>
<td>83</td>
<td>82</td>
</tr>
<tr>
<td>Final exam in Geography</td>
<td>43</td>
<td>41</td>
</tr>
<tr>
<td>Geography is an interesting subject</td>
<td>52</td>
<td>53</td>
</tr>
<tr>
<td>Former education:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- MBO (Senior secondary vocational education, e.g., teaching assistants)</td>
<td>31</td>
<td>28</td>
</tr>
<tr>
<td>- HAVO (senior general secondary education, 5 years)</td>
<td>63</td>
<td>65</td>
</tr>
<tr>
<td>- VWO (university preparatory education, 6 years)</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Average age in years *</td>
<td>18.7</td>
<td>18.4</td>
</tr>
</tbody>
</table>

* = sign: $t = -2.694; \text{df} 415,470; p<0.05$

The effects of the intervention on the development of primary student teachers’ PCK (as measured by Test Review Lesson Plans and Test Own Lesson Design,) were determined by using a regression analysis. In this way, it was examined whether there was a significant difference between the participants in the experimental and control groups in the degree to which they were able to apply the characteristics of good geography teaching in a sufficient and a conscious way. The short-term effect was determined by a comparison of the experimental and control group test results just after the intervention. The long-term effect was determined by a comparison of the experimental and control group two months after the intervention ended.

Because the T-test showed that a significant difference in age existed between the experimental and control group, age was initially included as a covariate in both analyses. Where age did not show effect, it was removed from the final model.
4.5. Results

In the following section the effects of the CTG programme on the several aspects of PCK will be described.

4.5.1. The effects of the programme CTG on the PCK development

Table 4.2 gives an overview of the scores for the two tests that measure the PCK development of the experimental and control groups. The experimental group on average has higher scores on the post-test (T2) of the Test Review Lesson Plans than the control group. This is also true for the scores on the post-tests (T2 and T3) for the Test Own Lesson Design. What is striking is that the mean scores are relatively low for both tests and both groups. While there are some student teachers that score the maximum number of points (10 points for the Test Review Lesson Plans and 14 points for the Test Own Lesson Design), the scores for the majority of the student teachers are much lower.

| Table 4.2. Descriptive statistics Test Review Lesson plans and Test Own Lesson Design |
|---------------------------------|-----|-----|-----|-----|-----|-----|
|                                 | T*  | Group | N   | Min | Max | Mean | SD. |
| Test Review Lesson Plans**     |     |       |     |     |     |      |     |
| T1 Exp                         | 248 | Exp   |     | 0   | 7   | 1.2  | 1.10|
| Contr                         | 201 | Contr |     | 0   | 5   | 1.4  | 1.11|
| T2 Exp                         | 248 | Exp   |     | 0   | 10  | 3.3  | 2.29|
| Contr                         | 201 | Contr |     | 0   | 4   | 1.2  | 1.12|
| Test Own Lesson Design         |     |       |     |     |     |      |     |
| Sufficiently used***           |     |       |     |     |     |      |     |
| T2 Exp                         | 231 | Exp   |     | 0   | 6   | 3.0  | 1.46|
| Contr                         | 173 | Contr |     | 0   | 6   | 2.2  | 1.35|
| T3 Exp                         | 141 | Exp   |     | 0   | 6   | 2.7  | 1.54|
| Contr                         | 75  | Contr |     | 0   | 5   | 2.3  | 1.06|
| Test Own Lesson Design         |     |       |     |     |     |      |     |
| Consciously used***           |     |       |     |     |     |      |     |
| T2 Exp                         | 231 | Exp   |     | 0   | 7   | 2.0  | 1.59|
| Contr                         | 173 | Contr |     | 0   | 6   | 1.2  | 1.14|
| T3 Exp                         | 141 | Exp   |     | 0   | 6   | 1.7  | 1.42|
| Contr                         | 75  | Contr |     | 0   | 4   | 1.3  | 1.20|

*T1= pre-test, T2= post-test 1, directly after the course, T3= post-test 2, two months after the course

**Max. score = 10 points, *** Max. score = 7 points
4.5.2. The effects of the programme CTG on the development of Substantive and Syntactic knowledge in the short term measured by the Test Review Lesson Plans

Table 4.3 shows that at T=2, directly after the program, there is an interaction effect between T=2 and the experimental group: $b = 2.30$, $t (627) = 12.00$, $p > .05$ at the Test Review Lesson Plans. This effect is significant; at T=1 no significant effect was found. Also the experimental group had higher scores on the Test Review Lesson Plans ($t=8.96$, $p<.001$). The results of the test thus show that the experimental programme has a significant effect on the development of the substantive and syntactic knowledge (WHAT and HOW) of first year student teachers for the subject of geography.

Table 4.3. Predictors of substantive and syntactic knowledge measured by the Test Review Lesson Plans

<table>
<thead>
<tr>
<th>Predictor</th>
<th>b</th>
<th>SE</th>
<th>df</th>
<th>t</th>
<th>p</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.23</td>
<td>.41</td>
<td>481</td>
<td>10.28</td>
<td>&lt;.001</td>
<td>3.42 5.04</td>
</tr>
<tr>
<td>Experimental group</td>
<td>2.26</td>
<td>.25</td>
<td>28.47</td>
<td>8.96</td>
<td>&lt;.001</td>
<td>2.78 1.75</td>
</tr>
<tr>
<td>Time</td>
<td>2.15</td>
<td>.13</td>
<td>647.17</td>
<td>16.61</td>
<td>&lt;.001</td>
<td>2.40 1.89</td>
</tr>
<tr>
<td>Time * experimental group</td>
<td>2.30</td>
<td>.19</td>
<td>626.61</td>
<td>12.00</td>
<td>&lt;.001</td>
<td>1.92 2.68</td>
</tr>
<tr>
<td>Age</td>
<td>-.048</td>
<td>.02</td>
<td>827.78</td>
<td>-2.41</td>
<td>.016</td>
<td>-.09 -.01</td>
</tr>
</tbody>
</table>

Note. $b =$ unstandardized regression coefficient; $p =$ two-sided; $LL =$ lower limit; $UL =$ upper limit.

4.5.3. The effects of the programme CTG on the development of Substantive and Syntactic knowledge and Beliefs about the subject in the short and long term measured by the Test Own Lesson Design

Table 4.4 shows that at T=2, the experimental group had higher scores on the Test Own Lesson Design - sufficient use (of characteristics of good geography teaching) than the control group. This difference is significant ($t = 2.48$, $p = .030$). There is no significant difference in score on the Test Own Lesson Design - conscious use (of characteristics of good geography teaching). As no pre-test was taken, no interaction effect could be included in the model.
Chapter 4

Table 4.4. Occurrence of characteristics of good geography teaching in the short term (T2)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Parameter</th>
<th>b</th>
<th>SE</th>
<th>df</th>
<th>t</th>
<th>P</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sufficient use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intercept</td>
<td>2.91</td>
<td>.28</td>
<td>11.19</td>
<td>10.41</td>
<td>&lt;.001</td>
<td>2.31</td>
</tr>
<tr>
<td></td>
<td>Experimental group</td>
<td>1.00</td>
<td>.42</td>
<td>11.41</td>
<td>2.48</td>
<td>.030</td>
<td>1.95</td>
</tr>
<tr>
<td></td>
<td>Conscious use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intercept</td>
<td>1.84</td>
<td>.29</td>
<td>11.46</td>
<td>6.43</td>
<td>&lt;.001</td>
<td>1.22</td>
</tr>
<tr>
<td></td>
<td>Experimental group</td>
<td>.84</td>
<td>.42</td>
<td>11.68</td>
<td>1.97</td>
<td>.071</td>
<td>1.77</td>
</tr>
</tbody>
</table>

Note. b = unstandardized regression coefficient; p = two-sided; LL = lower limit; UL = upper limit

Table 4.5 shows that on the second post-test (T=3) the experimental group did not score significantly higher on the Test Own Lesson Design - sufficient use and conscious use.

Table 4.5. Occurrence of characteristics of good geography teaching in the long term (T3)

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Parameter</th>
<th>b</th>
<th>SE</th>
<th>df</th>
<th>t</th>
<th>P</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sufficient use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intercept</td>
<td>1.15</td>
<td>.79</td>
<td>189.38</td>
<td>1.46</td>
<td>.147</td>
<td>.41</td>
</tr>
<tr>
<td></td>
<td>Experimental group</td>
<td>.52</td>
<td>.49</td>
<td>9.36</td>
<td>1.06</td>
<td>.318</td>
<td>1.63</td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>.09</td>
<td>.04</td>
<td>255.19</td>
<td>2.38</td>
<td>.018</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td>Conscious use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intercept</td>
<td>1.81</td>
<td>.22</td>
<td>9.83</td>
<td>8.16</td>
<td>&lt;.001</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>Experimental group</td>
<td>.50</td>
<td>.37</td>
<td>9.43</td>
<td>1.38</td>
<td>.200</td>
<td>1.32</td>
</tr>
</tbody>
</table>

Note. b = unstandardized regression coefficient; p = two-sided; LL = lower limit; UL = upper limit

Results show that the experimental programme had a significant positive effect on the use of the characteristics of a good geography lesson in the short term, that is, on the substantial (WHAT) and syntactic (HOW) knowledge of first year student teachers immediately after the course. In the long term (two months after completion of the course), the programme had no significant effect.

There is no significant positive effect of the programme on the conscious use of the characteristics of a good geography lesson, that is, the beliefs about the subject (WHY). This is true both in the short term (immediately after completion of the course) and in the long term (two months after the end of the course).
4.6. Conclusion and discussion

This study adds to our knowledge about how to enhance first year primary student teachers’ development of PCK for the subject of geography. So far this is the first study into effects of the repeated application of characteristics of good geography teaching to help primary student teachers develop their PCK for the subject of geography. In this way it contributes to the research on characteristics of effective geography teaching.

The study shows that it is possible to develop student teachers’ substantive and syntactic knowledge (WHAT and HOW) for the subject of geography by means of a short intervention with design principles like modelling and reflection, everyday geography and integrated characteristics of good geography teaching embedded into existing programs in primary teacher education. According to Rogers (2003) this embedding contributes to the usefulness of such interventions. In the long term, the effect of the programme on PCK development seems to fade away, which is not surprising, because no follow-up was given and subsequent classes were taught using the conventional method.

The programme had no significant effect on student teachers’ beliefs about the subject (WHY). More time and practising seem to be needed before students are able to (consciously) use the characteristics of good geography teaching and to develop their PCK for the subject of geography in a more extended way. This is in line with Van Driel et al. (1998) who suggest that PCK is developed through an integrative process rooted in classroom practice, which implies that beginning teachers usually have little or no PCK at their disposal.

This study shows that the short intervention is a promising beginning. At the same time more is needed in terms of time, support and research in order to realize more sustainable results in teacher education. More research is needed, mainly in primary school practice, which is left aside in this study. Furthermore, it was found among secondary geography teachers that they are willing to adopt new strategies for learning as they become familiar with them through a hands-on process and with the opportunity to discuss the pros and cons of those strategies with colleagues (Leat et al., 2005). These authors also stress that, to make lasting changes, substantial support has to be offered by the school and the wider system. Swennen et al. (2008) emphasize that, besides knowledge and skills concerning congruent teaching, also a language is necessary in which teacher educators can discuss (congruent) teaching strategies with colleagues.

To summarise, and in connection with the course CTG, teacher educators should be given more time to practice e.g., in a hands-on course with opportunities for discussion with colleagues, the characteristics of the course and their knowledge and skills in congruent teaching. Furthermore, support from the teacher training institutes is needed to provide opportunities to integrate the characteristics of the course in the whole of the (geography) curriculum so students can become more experienced in using the characteristics of good geography teaching and apply them in practice.
Our results suggest it is crucial to offer primary school teachers courses for continuous professional development in which they train in hands-on sessions to develop their PCK for the subject of geography and familiarise themselves with new scientific insights on geography teaching. This would give student teachers opportunities to see ‘the good example’ during their primary school practice and bridge the gap between theory and practice.
5. Learning experiences of primary student teachers in a geography programme
Abstract

This study aims to provide insight into learning experiences reported by first-year primary student teachers in a geography course. This course focused on the development of pedagogical content knowledge (PCK) for the subject of geography. Learning experiences were measured by means of learner reports. The course aimed to develop primary student teachers’ PCK for the subject of geography (substantive and syntactic knowledge), but the student teachers in the sample reported relatively little learning of geographic facts, concepts, principles and skills (substantive knowledge). However, the student teachers did report having learned about how to teach geography (syntactic knowledge). The learning experiences they described only incidentally reflected geographic thinking or making connections between educational principles and geography. More domain-specific pedagogies and more time devoted to subject methodology may be needed to develop into teachers of primary geography.

Keywords:
primary teacher education, geography, learner report, learning experiences, pedagogical content knowledge
5.1. Introduction

This study focuses on the learning experiences of student teachers in a course designed to develop their pedagogical content knowledge (PCK) of geography. The development of student teachers’ PCK is the subject of many studies (Jo & Bednarz, 2014; Nilsson, 2008; Martin, 2008b; Dolan, Waldron, Pike, & Greenwood, 2015). In PCK research, however, little is reported about what student teachers themselves think they have learned. Therefore, the purpose of this study is to gain insight into what first-year primary student teachers believe they have learned while participating in an experimental geography course.

Students’ perspectives

Insight into students’ learning experiences provides valuable information about how students perceive and learn from an implemented curriculum and educational practice (Thijs & Van den Akker, 2009). So to improve classroom processes and instruction, it is important to listen to students as learners to discover how they interpret their learning experiences (Levin & Wadmany, 2006; Cook-Sather, 2002; Cushman, 2014; McIntyre, Pedder, & Rudduck, 2005).

How learners’ perspectives can inform our understanding of effective educational practice is the subject of multiple studies (Cushman, 2014; McIntyre, Pedder, & Rudduck, 2005). The focus of many studies is to involve students in the design of education. In the context of implementing new technologies into the classroom Levin and Wadmany (2006) argue that the implementation is incomplete if the students’ voices have not been heard. They cite Shuell (1996), who claims that ultimately it is not the intent of the teacher but the students’ perceptions and behaviours that determine the impact of teaching on student learning. Van Kesteren (1993) emphasizes the student role in assessment and states that one type of knowledge in particular cannot be assessed adequately by any objective method, nor by any person other than the concerned student, namely self-knowledge. Self-knowledge in the context of this study can be defined as the knowledge or understanding of one’s own capabilities to learn about teaching geography.

With respect to geography and geography teaching, there are several studies that report on the perceptions of students and student teachers regarding the subject of geography and the teaching of the subject (Hopwood, 2009; Catling, 2002; Morley, 2012; Bent, Bakx, & Den Brok, 2014; Waldron, et al., 2009; Dolan, Waldron, Pike, & Greenwood, 2015; Martin, 2008a; Preston, 2014). However, in these studies, we find little attention devoted to students’ personal learning experiences, particularly those related to educational settings. However, we contend that such a focus might reveal how student teachers can actually learn to teach primary geography.
Learning to teach geography

In regards to teaching a subject such as geography in primary education, a solid knowledge base is necessary (Bransford, Brown, & Cocking, 2003). However, recent findings (Bednarz, Heffron, & Huynh, 2013; Blankman, Van der Schee, Volman, & Boogaard, 2015; Ofsted, 2011; Bell, 2005) suggest that student teachers lack sufficient content knowledge of geography. Moreover, it is also argued that even if their knowledge of geography would be at a sufficient level, it still would not guarantee the successful teaching of the subject because content knowledge has to be reworked before it can be taught effectively (Lambert, 2009b).

Therefore, an important aim of teacher education programmes is to develop student teachers’ PCK. The concept of PCK was introduced by Shulman (1986; 1987) and is defined as the synthesis of all knowledge needed to be an effective teacher (Gess-Newsome, 1999). PCK then requires the transformation of pedagogical and content knowledge into a unique form, “the only form of knowledge that impacts teaching” (Gess-Newsome, 1999, p. 10). PCK enables teachers to use particular teaching procedures (how), with particular content (what), for a particular reason (why) (Loughran, Berry, & Mulhall, 2012).

Geographic content or substantive knowledge (what) can be divided into geographic facts, geographic concepts, geographic principles and geographic skills (Gersmehl, 2008; Catling & Willy, 2009; Vankan, 2009; Van der Schee, 2000; Taylor, 2008). A geographic fact is a statement in which an object is linked to another object (e.g. many jeans are made in China). A geographic concept refers to a class of objects (China is a low income country), or a relationship between objects. A geographic principle refers to a relationship between concepts (many clothes are made in low income countries). Finally, geographic skills refer to a subject-specific way of thinking (Van der Schee, 2009; Van der Vaart, 2001) as it is reflected in asking geographical questions, such as ‘where’ and ‘why there’, using geographical sources of information and applying geographical thinking.

To develop student teacher’s use of particular teaching procedures (how), basic concepts of geography and geography teaching (Gersmehl, 2008; Catling & Willy, 2009; Haubrich, 1992; Van der Schee, 2000) can be translated into questions that student teachers can ask themselves as they prepare their geography lessons (see Figure 5.1). Such a lesson includes four core elements, as Van Gelder et al. (1972) distinguish in their didactic model: the starting situation, the goals of the lesson, the learning process and the evaluation of the lesson.

Regarding beliefs (why), several authors emphasize the influence of students’ thinking and attitudes about the teaching and the classroom practices (Alkis, 2009; Bradbeer, Healey, & Kneale, 2004; Catling, 2004; Corney, 2000; Martin, 2005; 2008a; Lane & Coutts, 2012).
Developing these three aspects of PCK requires a step-by-step process. Findings indicate that, at the beginning of their teaching career, student teachers are often more focused on pedagogical aspects of teaching and classroom management, simply because they have to survive everyday classroom teaching (Korthagen, Loughran, & Russell, 2006). Martin (2005) came to similar conclusions but she also identified certain differences in the development of PCK between a student with a geography degree (a specialist) and a non-specialist student teacher. While the geography specialist, parallel to the growth of his teaching experience, increasingly proved being capable of incorporating his geographical knowledge into the practice of teaching, the non-specialist did not demonstrate such improved capability because of a lack of content knowledge.

<table>
<thead>
<tr>
<th>Characteristics in CTG</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Geographic characteristics (What: substantive knowledge)</strong></td>
<td></td>
</tr>
<tr>
<td>1. Where is it?</td>
<td>Describe what you see and where you see it, preferably using, e.g., a map, an atlas, a globe etc.</td>
</tr>
<tr>
<td>2. Why is it there?</td>
<td>Explain what you see (through the relationship between man and nature).</td>
</tr>
<tr>
<td>3. What do I see if I zoom in or out?</td>
<td>At other levels of scale, you may see different things. Zooming provides a different picture.</td>
</tr>
<tr>
<td>4. How does it change over time?</td>
<td>Describe the situation in the past and/or in the future.</td>
</tr>
<tr>
<td>5. What are the consequences, advantages and disadvantages?</td>
<td>The effects (or pros and cons) are viewed from different angles.</td>
</tr>
<tr>
<td><strong>Instructional characteristics (How: syntactic knowledge)</strong></td>
<td></td>
</tr>
<tr>
<td>6. How can I start the lesson in a motivating way?</td>
<td>The lesson starts in a way that challenges pupils to participate in class (using an everyday spatial problem).</td>
</tr>
<tr>
<td>7. How can I end the lesson in a way that promotes transfer? (Discuss the special and the general)</td>
<td>At the end of the lesson, there is a discussion about the usefulness of knowing something about the subject of the lesson.</td>
</tr>
</tbody>
</table>

*Figure 5.1. Characteristics of a good geography lesson in CTG*

**Research context**

To develop student teachers’ PCK, we designed an experimental course called Conscious-ly Teaching Geography (CTG) for first-year student teachers to take at the beginning of their training. Central to the course, which consisted of five 90-minute meetings, was a framework with characteristics of a good geography lesson (see Figure 5.1). During the meetings of the course the characteristics were applied in different contexts.

At the start of the course, activities focused on raising student teachers’ awareness of their own beliefs and preconceptions about geography and the teaching of geography. Thereafter, students’ concepts were discussed in the context of geography as reflected in everyday activities, such as their journey from home to school or the breakfast they ate. These ‘everyday geographies’ could, according to Martin (2008a), provide a suitable start-
ing point from which student teachers’ competences in teaching the subject of geography can be developed. Thus, each class meeting began with an everyday spatial issue.

Each meeting the teacher educator modelled, step-by-step, the characteristics of a geography lesson by means of a sample lesson, by providing meta-commentary through which a translation to the student teachers’ own practices takes place and by creating a connection between exemplary behaviour and theory.

This study

The above-described CTG course, was taught by seven teacher educators to their first-year student teachers and was found to be effective in that it developed primary students’ PCK, at least in the short term (Blankman, Schoonenboom, Van der Schee, Boogaard, & Volman, 2016).

The learning outcomes as perceived by the learners are the subject of this study. Insights into these experienced learning outcomes are important as they provide greater understanding of the impact of teaching on student learning. This leads to the following research questions:

1. To what extent do student teachers believe they acquired subject knowledge and skills (substantive knowledge)?
2. To what extent do student teachers believe they acquired pedagogical knowledge and skills (syntactic knowledge)?
3. To what extent do student teachers believe they acquired insight in their own subject knowledge and their pedagogical knowledge and skills (self-knowledge)?
4. To what extent do student teachers, who were taught by different teacher educators, differ in their experiences concerning acquired subject and pedagogical knowledge and skills and self-knowledge?

We answer these questions by analysing learner reports (De Groot 1978; Van Kesteren 1993), wherein student teachers articulated their learning experiences.

5.2. Method

5.2.1. Participants and data collection

Approximately 250 first-year primary student teachers at the beginning of their training participated in the CTG course. Seven teacher educators, each with his/her own teaching style, from six teacher-training institutes located in various regions of the Netherlands, each with its own couleur locale, conducted the course. This means that, even though the same intervention was performed at all teacher-training institutes, the implementation could have varied in detail. We choose this approach to reflect the reality of everyday
educational practice in the Netherlands, where no national curriculum for teacher education exists.

At the end of the first four meetings, the student teachers completed learner reports, and during the fifth meeting, they evaluated the programme. All in all, 1179 learner reports were available for analysis. Table 5.1 displays the distribution of the learner reports per teacher educator and per lesson. On average, approximately 80% of the student teachers were female, and the average age of the student teachers was 18.7 years.

<table>
<thead>
<tr>
<th>Teacher Educator</th>
<th>Total</th>
<th>Lesson 1</th>
<th>Lesson 2</th>
<th>Lesson 3</th>
<th>Lesson 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>421</td>
<td>111</td>
<td>91</td>
<td>109</td>
<td>110</td>
</tr>
<tr>
<td>2</td>
<td>108</td>
<td>28</td>
<td>30</td>
<td>26</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>83</td>
<td>17</td>
<td>21</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>4</td>
<td>213</td>
<td>54</td>
<td>57</td>
<td>48</td>
<td>54</td>
</tr>
<tr>
<td>5</td>
<td>37</td>
<td>n.a.</td>
<td>21</td>
<td>n.a.</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>71</td>
<td>17</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>7</td>
<td>246</td>
<td>59</td>
<td>67</td>
<td>62</td>
<td>58</td>
</tr>
</tbody>
</table>

5.2.2. Instrument: Learner reports

The learner report (Van Kesteren, 1993; Janssen & Rijlaarsdam, 1996; De Groot, 1978) is an open approach to measure learning effects in which students report what they have learned in an educational setting. A learner report is a form of self-report or self-evaluation whereby students are considered to be the experts on what they have learned. It is perceived as an appropriate tool for formative evaluations of educational situations (Van Kesteren, 1993). After a pilot study, we decided to use an adapted version of De Groot’s (1978) original learner report. Our learner report contained four sentences for students to complete: (1) I have learned that..., (2) I have learned how ..., (3) I have learned that I... and (4) I have learned how I... (see Figure 5.2)

The first domain (I have learned that) addresses substantive knowledge, i.e., geographical facts and concepts and geographical principles and geographical skills. The second domain (I have learned how) measures syntactic knowledge, i.e., what they have learned about the way to teach geography. In the domains I learned that I and I learned how I students report on their self-knowledge regarding substantive and syntactic knowledge.
Write what you learned from the geography course today. Please be as precise and specific as possible about the things you learned. As this report is about your personal learning experiences, there are no right or wrong answers. Try to complete all phrases and write as many sentences as possible.

<table>
<thead>
<tr>
<th>I have learned that...</th>
<th>I have learned how...</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have learned that I...</td>
<td>I have learned how I......</td>
</tr>
</tbody>
</table>

**Figure 5.2. The learner report used during the CTG course**

To ensure that student teachers reported as truthfully as possible, the learner reports were completed anonymously, and it was emphasized that the reports were not intended as either a summative or a formative test but rather that the reports were part of the research project.

### 5.2.3. Coding labels and interrater reliability

To analyse the learner reports, a coding scheme was developed in which we labelled student teachers’ statements based on our theoretical principles of PCK. A first version of the coding scheme was refined and supplemented with example statements of the student teachers after 12 learner reports were analysed by two researchers. This cycle was repeated three times, whereupon the coding scheme was then finalized. In addition to the aspects derived from theory (Figure 5.2), for each domain, a residual category (Other) was added. Subsequently, 50 learner reports were analysed by two researchers, and based on the outcomes, additional instructions were established. When another 50 learner reports were analysed by both researchers, 100% consensus was reached. The remaining learner reports were then analysed by one researcher (Figure 5.3).

After coding and analyses, the teacher educators were asked to comment on the results, thus helping us to interpret the data from different perspectives.

### 5.2.4. Analyses

All statements made by student teachers in their learner reports were coded corresponding to one of the theoretically based categories (Figure 5.3). The number of statements students made differs, both in total and per measurement moment. The learning experiences were coded within the category the students assigned them themselves.

After coding, descriptive analyses were performed on the total of all learning reports and per teacher educator. For all variables, frequencies were calculated, as well as percentages of the student teachers who mentioned a specific aspect. In addition to this, qualitative analyses were conducted. We studied, in detail, a random selection of 50
learner reports to determine precisely what student teachers noted with respect to their substantive and syntactic knowledge. In the descriptions of the results, we use these qualitative data to clarify the quantitative outcomes.

5.3. Results

5.3.1. Acquired substantive, syntactic and self-knowledge experiences of student teachers

Table 5.2 provides a summary of the percentages – over all measurement moments – of student teachers who mentioned a specific aspect of substantive and syntactic knowledge, as well as aspects of self-knowledge about both types of knowledge (see Figure 5.3 for examples of student teacher statements). Table 5.2 also offers insight into the extent to which student teachers experienced that their PCK has evolved. In an indirect manner the results indicate strengths and weaknesses of the experimental CTG course, which was meant to stimulate student teachers PCK for the subject of geography.

Table 5.2. Percentage of student teachers who mentioned specific aspects of PCK-development (based on 1179 learner reports)

<table>
<thead>
<tr>
<th>Aspect</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substantive knowledge</td>
<td></td>
</tr>
<tr>
<td>Geographic facts and concepts</td>
<td>19.0</td>
</tr>
<tr>
<td>Geographic principles</td>
<td>17.4</td>
</tr>
<tr>
<td>Geographic skills</td>
<td>19.0</td>
</tr>
<tr>
<td>Other</td>
<td>11.7</td>
</tr>
<tr>
<td>Self-knowledge about substantive knowledge</td>
<td></td>
</tr>
<tr>
<td>Geographic knowledge and skills</td>
<td>27.3</td>
</tr>
<tr>
<td>Syntactic knowledge</td>
<td></td>
</tr>
<tr>
<td>Start</td>
<td>10.0</td>
</tr>
<tr>
<td>Learning process</td>
<td>69.2</td>
</tr>
<tr>
<td>Evaluation</td>
<td>1.4</td>
</tr>
<tr>
<td>Other, including statements about (the analyses) of geography text books</td>
<td>18.1</td>
</tr>
<tr>
<td>Self-knowledge about syntactic knowledge</td>
<td></td>
</tr>
<tr>
<td>Initial situation and learning goals</td>
<td>12.9</td>
</tr>
<tr>
<td>Learning process</td>
<td>67.7</td>
</tr>
<tr>
<td>Evaluation</td>
<td>2.0</td>
</tr>
<tr>
<td>Other</td>
<td>41.7</td>
</tr>
<tr>
<td><strong>Aspect</strong></td>
<td><strong>Examples of statements</strong></td>
</tr>
<tr>
<td>----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Substantive knowledge (I have learned ....)</strong></td>
<td></td>
</tr>
<tr>
<td>Geographic facts and concepts</td>
<td>.. where volcanoes occur</td>
</tr>
<tr>
<td></td>
<td>.. how a volcano works</td>
</tr>
<tr>
<td></td>
<td>.. that China has a dessert</td>
</tr>
<tr>
<td></td>
<td>.. that Flevoland (a province in the Netherlands) is a polder</td>
</tr>
<tr>
<td></td>
<td>.. what chocolate is made from</td>
</tr>
<tr>
<td></td>
<td>.. that Japan has a large number of volcanoes</td>
</tr>
<tr>
<td>Geographic principles</td>
<td>.. that cacao beans grow in a tropical climate</td>
</tr>
<tr>
<td></td>
<td>.. where volcanoes occur and why they occur there</td>
</tr>
<tr>
<td></td>
<td>.. why Flevoland is pumped dry</td>
</tr>
<tr>
<td></td>
<td>.. that tourism also has disadvantages</td>
</tr>
<tr>
<td>Geographic skills</td>
<td>.. that you can zoom in and out in different ways</td>
</tr>
<tr>
<td></td>
<td>.. how to use maps</td>
</tr>
<tr>
<td></td>
<td>.. that it is important to examine from different perspectives</td>
</tr>
<tr>
<td></td>
<td>.. how you can ask geographic questions</td>
</tr>
<tr>
<td>Other</td>
<td>.. that geography is an important subject</td>
</tr>
<tr>
<td></td>
<td>.. how I must learn about landscapes</td>
</tr>
<tr>
<td><strong>Syntactic knowledge (I have learned how...)</strong></td>
<td></td>
</tr>
<tr>
<td>Start of the lesson</td>
<td>.. to use examples</td>
</tr>
<tr>
<td></td>
<td>.. to start a lesson in a motivating way</td>
</tr>
<tr>
<td></td>
<td>.. I can use movie images for an introduction</td>
</tr>
<tr>
<td></td>
<td>.. I can formulate lesson goals</td>
</tr>
<tr>
<td>Learning process</td>
<td>.. I can give a good geography lesson using experiences and the news</td>
</tr>
<tr>
<td></td>
<td>.. I can explain certain things about volcanoes to the students</td>
</tr>
<tr>
<td></td>
<td>.. to involve students by asking questions</td>
</tr>
<tr>
<td></td>
<td>.. to use the seven characteristics of a geography lesson</td>
</tr>
<tr>
<td></td>
<td>.. I have to use a map or an atlas in every lesson</td>
</tr>
<tr>
<td>Evaluation of the lesson</td>
<td>.. I should conclude a lesson</td>
</tr>
<tr>
<td>Other</td>
<td>.. there are many different geography textbooks</td>
</tr>
<tr>
<td>(including statements about (the analyses) of geography textbooks)</td>
<td>.. to determine whether a textbook is good/useful</td>
</tr>
<tr>
<td></td>
<td>.. to examine geography textbooks in a critical way</td>
</tr>
<tr>
<td></td>
<td>.. to evaluate a geography textbook based on seven characteristics</td>
</tr>
<tr>
<td>Aspect</td>
<td>Examples of statements</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Self-knowledge about substantive knowledge</strong> (I have learned that I...)</td>
<td>.. have much to learn to give a good geography lesson</td>
</tr>
<tr>
<td>About geographic knowledge and skills</td>
<td>.. need subject knowledge to give a good lesson</td>
</tr>
<tr>
<td></td>
<td>.. know more about geography than I thought</td>
</tr>
<tr>
<td></td>
<td>.. have to ask myself where is it.</td>
</tr>
<tr>
<td></td>
<td>.. am good at reading maps</td>
</tr>
<tr>
<td><strong>Self-knowledge about syntactic knowledge</strong> (I have learned how/that I...)</td>
<td>.. how I still have a hard time formulating good lesson objectives</td>
</tr>
<tr>
<td>About initial situation and learning goals</td>
<td>.. that I find it difficult to come up with a nice introduction</td>
</tr>
<tr>
<td></td>
<td>.. how I can create a motivating start with a topic</td>
</tr>
<tr>
<td></td>
<td>.. how I can construct good learning objectives</td>
</tr>
<tr>
<td>About the learning process</td>
<td>.. can prepare a good geography lesson</td>
</tr>
<tr>
<td></td>
<td>.. can give a good and meaningful geography lesson</td>
</tr>
<tr>
<td></td>
<td>.. can apply theory to practice</td>
</tr>
<tr>
<td></td>
<td>.. can teach a good geography lesson that includes all aspects</td>
</tr>
<tr>
<td>On the evaluation of the lesson</td>
<td>.. how important the closure is and how to do it</td>
</tr>
<tr>
<td>Other</td>
<td>.. that I like to collaborate while preparing a lesson</td>
</tr>
<tr>
<td></td>
<td>.. that I play a key role as teacher</td>
</tr>
<tr>
<td></td>
<td>.. how I can involve children well</td>
</tr>
<tr>
<td></td>
<td>.. how to teach this lesson to children</td>
</tr>
<tr>
<td></td>
<td>.. how I can analyse textbooks</td>
</tr>
</tbody>
</table>

*Figure 5.3. Coding scheme including statements made by student teachers*

**Substantive (self-) knowledge**

The various aspects of substantive knowledge are relatively equally cited: approximately 17% of the students mention geographical principles, 19% cite geographical facts, concepts and skills, and 27% report about self-knowledge regarding geographical knowledge.

The geographical facts, concepts, principles and skills students report on are closely related to the topics treated in the lessons in which they participated. For example, one student reports, *I have learned how dikes and polders function* after a lesson about the Dutch landscape. Another student reports, *I have learned why many clothes are produced in China* after a lesson about globalization. Yet another comments, *I have learned how to analyse and interpret a map* after a lesson on map skills.
Chapter 5

Syntactic (self-) knowledge

Though student teachers report learning experiences for all aspects of PCK, the majority of their statements relate to teaching skills \textit{(syntactic knowledge)}, particularly with regard to the learning process with almost 70\% of the students citing this in their learner reports. Furthermore, with regard to self-knowledge, most statements relate to the learning process (67.7\%). Upon closer examination, we find that, in approximately 50\% of their statements, student teachers implicitly refer to the seven characteristics of good geography teaching but rarely state them explicitly. Zooming in and out is the most frequently mentioned aspect. Other statements regarding \textit{syntactic knowledge about the learning process} are connected to (content) aspects of geography and the use of maps and atlases.

Many students mention aspects related to the learning process in all four sections of the learner report but make no statements regarding substantive knowledge. Their writings are, for the most part, rather superficial. Two examples are:

\begin{quote}
I have learned how to gain the attention of the children.
I have learned how to create a good lesson.
\end{quote}

A few students (less than 10\%), however, demonstrate having gained some deeper understanding. Some examples:

\begin{quote}
I have learned that I must start close to home to keep it understandable for children.
I have learned how to deliver a good geography lesson and what steps must be taken. Also, I have learned that it is important for all age groups to begin near home and ask whether a particular event can happen here, and why.
I have learned that I can apply this lesson to other topics, such as the fabrication of jeans.
\end{quote}

While the first student demonstrates some understanding about the use of everyday geographical examples, the second student (implicitly) makes a connection to the characteristics \textit{where, zooming (can it happen here) and why there} and the third student demonstrates awareness that the knowledge can be applied to other situations.

Little is reported on the start of the lesson, with only 10\% of the students mentioning this aspect. Much the same is true for their self-knowledge about this aspect, as approximately 13\% discuss it in their writings. However, the least reported aspect of syntactic knowledge is the evaluation of the lesson (1.4\%). Student teachers also exhibit little evidence of self-knowledge regarding this aspect (2\%).

Finally, more than 40\% of the students report on other aspects of syntactic self-knowledge, such as the insights they gained regarding their knowledge about geography textbooks.
5.3.2. Differences between teacher educators

The overall results show that a high percentage of the student teachers reported on (self-) knowledge about the learning process, while a low percentage reported on the evaluation of the lesson. When we separated the learner report statements by teacher educator, however, we found major differences in the type of PCK-aspects students indicated (see Table 5.3). More than 80% of the students who were taught by teacher educators 1 and 2 reported knowledge of the learning process, while 50% or fewer of the students taught by teacher educators 3, 5 and 6 did so. In these groups, (teacher educators 3, 5 and 6), a relatively high percentage of students reported learning experiences related to geographical facts, concepts and principles.

Table 5.3. Percentage of student teachers who mentioned a particular aspect per teacher educator

<table>
<thead>
<tr>
<th>Aspect Substantive knowledge</th>
<th>Teacher educator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic facts and concepts</td>
<td>Mean</td>
<td>19,0</td>
<td>8,3</td>
<td>4,6</td>
<td>36,1</td>
<td>14,1</td>
<td>37,8</td>
<td>42,3</td>
</tr>
<tr>
<td>Geographic principles</td>
<td></td>
<td>17,4</td>
<td>8,6</td>
<td>6,5</td>
<td>50,6</td>
<td>8,6</td>
<td>48,6</td>
<td>49,3</td>
</tr>
<tr>
<td>Geographic skills</td>
<td></td>
<td>19,0</td>
<td>21,6</td>
<td>21,3</td>
<td>2,4</td>
<td>8,9</td>
<td>18,9</td>
<td>18,3</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>11,7</td>
<td>7,8</td>
<td>7,4</td>
<td>6,0</td>
<td>22,1</td>
<td>13,5</td>
<td>29,6</td>
</tr>
<tr>
<td>Self-knowledge about substantive knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geographic skills and knowledge</td>
<td></td>
<td>27,3</td>
<td>30,2</td>
<td>17,6</td>
<td>10,8</td>
<td>16,9</td>
<td>18,9</td>
<td>40,8</td>
</tr>
<tr>
<td>Syntactic knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start</td>
<td>Mean</td>
<td>10,0</td>
<td>2,9</td>
<td>17,6</td>
<td>22,9</td>
<td>18,3</td>
<td>2,7</td>
<td>15,5</td>
</tr>
<tr>
<td>Learning process</td>
<td></td>
<td>69,2</td>
<td>86,0</td>
<td>84,3</td>
<td>50,6</td>
<td>69,5</td>
<td>48,6</td>
<td>31,0</td>
</tr>
<tr>
<td>Evaluation</td>
<td></td>
<td>1,4</td>
<td>0,2</td>
<td>8,6</td>
<td>4,2</td>
<td>0,3</td>
<td>0,3</td>
<td>1,6</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>18,1</td>
<td>12,6</td>
<td>18,5</td>
<td>10,8</td>
<td>25,4</td>
<td>21,6</td>
<td>25,4</td>
</tr>
<tr>
<td>Self-knowledge about syntactic knowledge</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start</td>
<td>Mean</td>
<td>12,9</td>
<td>4,8</td>
<td>23,1</td>
<td>31,3</td>
<td>24,4</td>
<td>2,7</td>
<td>14,1</td>
</tr>
<tr>
<td>Learning process</td>
<td></td>
<td>67,7</td>
<td>77,9</td>
<td>75,9</td>
<td>71,1</td>
<td>62,9</td>
<td>73,0</td>
<td>62,0</td>
</tr>
<tr>
<td>Evaluation</td>
<td></td>
<td>2,0</td>
<td>1,9</td>
<td>1,9</td>
<td>2,4</td>
<td>3,3</td>
<td>2,7</td>
<td>1,2</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>41,7</td>
<td>37,8</td>
<td>40,7</td>
<td>45,8</td>
<td>39,0</td>
<td>37,8</td>
<td>54,9</td>
</tr>
</tbody>
</table>

* Seven teacher educators taught the course. Each worked at a teacher training institute in a different region of the Netherlands, with the exception of teacher educators 5 and 6, who worked at the same institute.

The teacher educators were asked to comment on the results as reported in Table 5.3. Teacher educators 1 and 2 placed greater emphasis on teaching methods than on the
content, although they integrated the substantive examples (e.g. volcanoes, globalization) in their lessons following the seven characteristics of good geography teaching. Teacher educator 3 explicitly focused on formulating learning goals, which explains the rather high percentage of students who reported on the aspect ‘start’ (syntactic knowledge). Teacher educator 5 mentioned that he conducted the course within the context of the theme ‘Dutch landscape’, a subject that was also tested on an exam by the student teachers. This may have caused a stronger focus in his group of students on geographical facts, concepts and principles.

5.4. Conclusion and discussion

This study is about teaching a specific subject, in this case geography, an issue for which little research has been conducted to date (Berry & Van Driel, 2013). We designed a course, Consciously Teaching Geography, focusing on the development of student teachers’ PCK. Using student reflections, as recorded in learner reports, we investigated what the approximately 250 student teachers themselves reported about their learning experiences in the CTG course, more specifically we asked them to complete four sentences related to two main aspects of PCK: substantive (what) and syntactic knowledge (how). Both were also elements that were emphasized throughout the course and integrated into the lessons.

The completed learner reports provide valuable information on how student teachers experience the CTG course and the implemented curriculum. They reveal that what students mainly learned from the course were the elements related to the learning process (syntactic knowledge/ how), i.e. the elements of a lesson in which they learn primary school pupils geography. Although substantive knowledge was integrated into the course, the student teachers did not seem to realize this.

We also found differences between students taught by different teacher educators. For example, in classes where there was stronger emphasis on content knowledge and where this knowledge was assessed, students reported more substantive knowledge. This can be explained by the fact that the intervention (the CTG course) was implemented within several teacher-training institutes, each with their own colour locale, and was conducted by seven teacher educators, each with their own teaching style. This means, as stated earlier, that even though the same intervention has been implemented in all teacher-training institutes, the implementation may vary in detail, and the way in which the course is conducted may influence what student teachers report about the course.

We used an open form of the learner report (Van Kesteren, 1993). A further refinement of the instrument might provide deeper insights. It would be particularly interesting to obtain more insight into the third element of the PCK beliefs (why). In the learner report we used it in this study, we didn’t explicitly invite students to make notes about this aspect.
What this study reveals (despite its limitations) is that at the beginning of their teaching career, student teachers are more focused on pedagogical aspects of teaching and classroom management than on subject-based learning. Moreover, they hardly seem to be aware of links between subject content and subject pedagogy. This may be because they have to survive everyday classroom teaching.

Another reason may be the reduction of subject-specific teaching hours, after the introduction of competency-based education (Blankman, Van der Schee, Volman, & Boogaard, 2015). Dolan et al. (2015) conclude that to ensure student teachers reach a level where they integrate subject knowledge and pedagogical knowledge, more domain-specific pedagogies and more time devoted to subject methodology are needed rather than more time spent on generic teaching skills. This enables them, as Martin (2008b) suggests, to develop themselves from learners of geography to teachers of primary geography and that is what this programme proposed.

As the period during which the student teachers could practice in the CTG course was short, no large effect was expected (Hattie, 2009). Further research should examine whether the described method (the CTG course) combined with increased practice in different contexts leads to primary student teachers’ greater understanding of geographical concepts and their ability to integrate these concepts into their lessons, whereby they develop into teachers of primary geography.
6. Conclusions and discussion
6.1. Introduction

This thesis offers insight into how to teach primary student teachers to teach geography lessons and thus contributes to the improvement of geography education in primary (teacher) education. Quality geography education is important. “Geography is a vital subject resource for 21st century global citizens, enabling us to face questions of what it means to live sustainably in an interdependent world” (International Geographical Union, 2016, p. 3).

We designed and tested an approach termed Consciously Teaching Geography (CTG) to develop the pedagogical content knowledge for the subject of geography (PCK-G) of first-year primary student teachers. In this thesis, PCK-G is defined as the synthesis of substantive, or content knowledge (what); syntactic knowledge, or knowledge of the use of particular teaching procedures (how); and beliefs regarding geography, or the reason to teach it (why).

The main research question of this thesis is as follows:

How can a CTG course help teacher educators develop the Pedagogical Content Knowledge for the subject of geography of first year primary student teachers?

To answer this question, four sub-questions were formulated (Figure 6.1).

Figure 6.1. Studies and research questions in this thesis
6.2. Summary of main findings

Previously, little was known regarding the views of geography teacher educators concerning the PCK-G level of their student teachers and the needs of the teacher educators with respect to improvements in the geography curriculum in primary-teacher education. Therefore, a descriptive survey study was conducted. Study 1 (chapter 2) aimed at answering the following questions:

What is the desired and achieved PCK-G level of first-year student teachers, and what are factors that impede or promote achieving the desired PCK-G level?

To answer these questions, data were collected through a questionnaire administered to Dutch primary-teacher educators who teach geography. A total of 39 teacher educators (59% response) completed the questionnaire.

It appeared that primary-teacher educators in the Netherlands believe that most student teachers only partly attain the desired level of PCK-G during teacher education. For instance, they believe that many student teachers at the end of their training are unable to explain a geographical issue, such as ‘climate change’, or to apply map skills during their lessons in primary school. According to the teacher educators, this gap between the desired and the achieved level of student teacher PCK-G occurs because too few teaching hours are devoted to geography and because there is too little focus on subject matter. Additionally, they mention the diverse knowledge base of the student teachers when entering teacher education as an important impeding factor with respect to the sufficient development of student teachers’ PCK-G. The different starting levels and limited number of teaching hours make it difficult to develop an appropriate course that suits all students.

To solve this problem, in study 2 (chapter 3) a course termed Consciously Teaching Geography (CTG) was developed and tested. The following research question was leading in the development process:

What are the characteristics of a consistent, practical and sustainable course for developing PCK-G?

The course was developed according to principles of educational design research. The design process started with three successive discussion meetings with geography-teacher educators and experts from the field of geography and geography teaching. In these meetings, an initial geography-lesson framework was discussed and adjusted based on state-of-the-art scientific knowledge. Key elements were based on (a) using student teachers’ preconceptions and everyday geographic examples as a starting point of the lessons, (b) using key geography concepts in a framework, (c) using modelling and forms of reflection, and (d) using forms of active learning. This approach resulted in the first version of the CTG course. In this course a framework consisting of seven characteristics of good geography teaching is central; five geographic characteristics based on the core
Chapter 6

corresponds: where, why there, scale, change as well as effects or pros and cons and two more general pedagogical characteristics.

Two trial rounds followed. In each round, two geography-teacher educators with their groups of first-year student teachers used the course in their programmes. Their experiences and results were recorded. Subsequently, the CTG course assumed its final form. During the trial rounds, measurement instruments were developed and tested. Finally, it was evaluated whether the intended users were willing and able to apply the course in their daily teaching. To investigate this last question, seven teacher educators used the course during their regular teaching.

The results reveal that, to make the design consistent, additional design principles were necessary. Flexible use of the framework was required to accommodate the teaching style of the teacher educators and the local characteristics of their Institutes. To stimulate student 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 programme. Finally, to assure the practicality of the design, additional instruction and support in using the materials was required and provided by means of detailed guidelines for the teacher educator. In this way, teacher educators in various teacher education institutes - each with his or her own approach - were able to work with the course. This outcome suggests that the design is sustainable. This finding is important because in the Netherlands no national curriculum for primary-teacher education exists. Usually, institutes develop their own courses.

Study 3 (chapter 4) examined the effect of the CTG course on the development of the PCK-G of student teachers and answered the following question:

What are the effects of the CTG course on the development of the PCK components: substantial knowledge (what), syntactic knowledge (how), and beliefs regarding the subject (why) of first-year students in primary teacher education?

To this end, a quasi-experimental research design with a control group and pre-post testing was used. The nearly 450 student teachers who participated in the study were taught in twelve classes. Six classes were assigned to the experimental condition and six classes to the control condition. The experimental classes followed the CTG course, and the control classes used regular geography lessons. In both types of class (i.e. experimental and regular), the same topics were taught.

Central to the CTG course is a framework with seven characteristics of a good geography lesson in the form of the questions that student teachers can use when preparing a lesson. The five geographical characteristics are based on core geography concepts. The course consisted of five 90-minute meetings during which the characteristics were applied in different contexts.
Substantial knowledge (what) and syntactic knowledge (how) were measured using the Test Review Lesson Plans (pre- and post-test) and the Test Own Lesson Design (post-test only). Beliefs regarding the subject (why) were also measured by the latter. To collect background information, all students were required to complete a short biographical questionnaire.

Our results reveal that the CTG course had a significant positive effect on the substantial (what) and syntactic (how) knowledge of first-year student teachers immediately after the course, that is on the use of the characteristics of a good geography lesson, in the short term. Long-term effects (i.e. two months after completion of the course) were not found. In addition, no effect was found on the conscious use of the characteristics of a good geography lesson, that is, the beliefs regarding the subject (why). This outcome is valid immediately after completion of the course and two months after the end of the course.

Finally, in study 4 (chapter 5), we investigated what student teachers themselves reported regarding their learning experiences during the CTG course, based on the idea that learner perspectives can inform our understanding of effective educational practice. In this study, the following questions were answered:

To what extent do student teachers believe that they acquired subject knowledge and skills, pedagogical knowledge and skills and self-knowledge regarding their subject and pedagogical knowledge and skills?

To what extent do student teachers taught by different teacher educators differ in their experiences concerning acquired subject and pedagogical knowledge and skills as well as self-knowledge?

To answer these questions, we used a so-called learner report, which was completed by the student teachers after each course meeting. In total, 1179 learner reports were available for analysis. It appeared that what the first-year student teachers primarily learned from the course were elements that concern the learning process (i.e. syntactic knowledge/how). They primarily viewed the seven characteristics of a good geography lesson as a pedagogical instrument although substantive knowledge (what) and syntactic knowledge (how) were taught in an integrated manner.

However, there are differences between students who have been taught by different teacher educators. In settings in which there was a stronger emphasis on content knowledge and in which this knowledge was assessed, student teachers reported more on substantive knowledge. The large majority of the statements that student teachers provided were not domain specific.

Summarising this study provides an answer to the main research question: How can a CTG course help geography educators develop the pedagogical content knowledge for the subject of geography of first-year primary student teachers?
The different starting levels of primary-student teachers and the limited number of teaching hours for geography in primary teacher education make it difficult to create an appropriate course for developing PCK-G that suits all students. However, geography teacher educators think there is a gap to bridge between what student teachers know about geography and what they should know.

A course with characteristics that are aimed to develop PCK-G, such as (a) starting from student-teacher preconceptions and everyday geographical examples, (b) using key geography concepts in a framework, (c) using modelling and forms of reflection, and (d) using forms of active learning, is practical and sustainable as the following conditions are met:

- there is sufficient support in using the materials of the CTG course in the form of detailed guidelines for the teacher educator;
- the teaching style of the teacher educators and the local characteristics of their institutes are accommodated.

The CTG course is effective in developing substantive and syntactic knowledge of first-year primary-student teachers in the short term. Long-term effects and effects on beliefs about the subject were not found.

First-year student teachers primarily learn from the CTG course those elements that concern the learning process. They report little geographic elements. Primary-student teachers appeared to develop their PCK-G in the context of the CTG course with an emphasis on key concepts of geography and a connection with everyday geographical examples, however by means of this short CTG course, the intended goals were only partly achieved.

Additional research is required in the field of geographical thinking in primary-teacher education to get more insight into how to raise the geographical consciousness of future teachers in primary education.

### 6.3. Theoretical and methodological contributions

This thesis contributes to the discussion on how to best teach primary-student teachers geography with the aim of developing PCK-G and how we can measure PCK-G development. The CTG course operationalizes a number of theoretical principles. Thus, the usefulness of these principles was evaluated.
6.3.1. PCK
In our research, we developed a comprehensive PCK model based on Turner Bisset (1999), who distinguishes three types of knowledge related to content knowledge or subject-matter knowledge: substantive knowledge, syntactic knowledge and beliefs regarding the subject. Martin (2005) translated the three forms of knowledge into questions: (1) What am I going to teach (substantive knowledge): geographical knowledge and skills; (2) How am I going to teach this subject (syntactic knowledge): the teaching skills required to teach children geography; and (3) Why am I going to teach this subject this way (beliefs regarding the subject): the attitude of helping children become responsible, active global citizens. By asking themselves these questions, primary-student teachers are stimulated to think about the essential elements of their teaching.

6.3.2. PCK-G
This thesis demonstrates that it is difficult to teach student teachers to think geographically and to make them aware of what geography concerns. Geographical thinking is not simply knowing facts and locations, e.g., ‘Amsterdam is the capital of the Netherlands’. Geographical thinking means relating the local and the global, the near and the far, the physical and the human (The Geographical Association, 2012; KNAG, 2003; Bednarz, Hefron, & Huynh, 2013). In this thesis, we distinguished five core concepts which constitute the framework that helps primary-student teachers learn to think geographically. In our view, for primary (teacher) education, the five core concepts can help identify questions, organise information and guide an investigation.

Another important concept that we used in the CTG course is everyday geography. By starting from everyday geographic examples, we incorporate the personal experiences of the students. We show that geography also concerns the teachers themselves. These everyday experiences can be viewed as powerful sources of knowledge (Martin, 2005; Martin, 2008a; Catling & Martin, 2011).

The five core geographical concepts and the concept of everyday geography are used in the CTG course as a type of lens that can be used to think geographically and make sense of the world. Translating the core concepts into questions and placing them in a framework is a first attempt to help student teachers to systematically integrate the concepts into their lessons and in their turn help their pupils to think geographically. This strategy agrees with Jo and Bednarz (2014), who recognise the importance of using a learning tool to prepare lessons.

This research demonstrates that the CTG course achieved promising initial results in the PCK-G development of the student teachers. The course represents a first step in teaching primary-student teachers geography with the aim to develop their PCK-G. How-
ever, this research also indicates that additional attention must be paid to geographical thinking in primary-teacher education to make such thinking sustainable.

6.3.3. Design principles for developing PCK-G

Our research revealed that existing design principles were important in the context of Dutch teacher education: (1) starting from student preconceptions (Martin, 2005; Corney, 2000; Catling, 2004; Alkis, 2009; Lane & Coutts, 2012; Morley, 2012) and using everyday geographical examples as a starting point of the lessons (Martin, 2006a; 2008a), (2) using key geography concepts in a framework (Haubrich, 1992; Catling & Willy, 2009; Taylor, 2008; Van der Schee, 2000), (3) using modelling and forms of reflection (Loughran & Berry, 2005; Lunenberg, Korthagen, & Swennen, 2007; Swennen, Lunenberg, & Korthagen, 2008) during teaching, and (4) using forms of active learning (Niemi, 2002; Niemi & Nevgi, 2014; Prince, 2004).

However, the results of study 2 indicate that to make these design principles genuinely effective additional design principles are required. A flexible use of the framework is required to accommodate the teaching style of the teacher educators and the local character of their institutes. To stimulate discussion and active learning, a gradual (stepwise) expansion of the framework was necessary, and scaffolding by the teacher educator was required to add structure to the program. Finally, to assure the practicality of the design, additional support in using the materials was required and provided in the form of detailed guidelines for the teacher educator.

6.3.4. Measuring PCK-G

To measure PCK-G development, new measurement instruments were required. No ready-made tests were available. We developed and tested two new instruments that measure aspects of PCK-G (see study 3 in chapter 4).

Substantial and syntactic knowledge were measured using the Test Review Lesson Plans and the Test Own Lesson Design. In the Test Review Lesson Plans, the student teachers were asked to comment on five short lesson plans and to note which two aspects of the seven characteristics of a good geography lesson should be added to the lesson to make it a good geography lesson. In the Test Own Lesson Design, student teachers had to design a lesson on a given everyday geography issue. In designing this lesson, a format was used in which the student teachers had to answer three questions for each lesson phase: what does the teacher do, what do the pupils do and why do we do that this way? With the first two questions, we aimed to measure the use of the characteristics of a good geography lesson, i.e., substantial and syntactic knowledge. If the students could answer the question Why do we do that in this way? they demonstrated the conscious use of the characteristics of good geography teaching. In this way, we tested the third aspect of PCK-G: beliefs regarding the subject.
The *Test Review Lesson Plans* was used to measure whether student teachers could recognise quality in the work of others. The *Test Own Lesson Design* reveals the ability of the student teachers to apply characteristics of good geography lessons. That is, we examined two complementary aspects (Greene, Caracelli, & Graham, 1989). This approach provided a better, more complete view of the PCK-G development of the student teachers.

### 6.3.5. Measuring student-teachers’ learning experiences regarding their PCK-G

To enable the student teachers to report what they believed they learned from the CTG course (study 4, chapter 5), an adapted version of De Groot’s (1978) original learner report (Van Kesteren, 1993; Janssen & Rijlaarsdam, 1996) was used. Our learner report contained four sentences for students to complete: (1) I have learned that..., (2) I have learned how ..., (3) I have learned that I... and (4) I have learned how I...

The adapted learning report format, including the coding scheme, provides valuable insight into the learning experiences of the student teachers with the CTG course in addition to the insights of the effect study (study 3, chapter 4). In this way, we formed a more complete understanding of the effect of the CTG course on student teacher PCK-G development.

### 6.4. Implications for educational practice and policy

The knowledge base of student teachers has recently been the subject of debate, both nationally (Bent, Bakx, & Den Brok, 2014) and internationally (Bednarz, Heffron, & Huynh, 2013; Bell, 2005; Ofsted, 2011; Catling, 2002; Martin, 2008a). As the first study of this research project showed educators who teach geography to primary student teachers are concerned regarding the inadequate level of knowledge of their students when they leave training. Student teachers do not possess sufficient knowledge and skills (and geographic consciousness) to provide good geography lessons in primary school. The following two examples illustrate this concern.

A fourth-year student teacher in primary teacher education had to design a series of lessons on a self-chosen theme. He had to create a rich learning environment and ensure that his pupils learned about as many aspects of the theme as possible. To this end, he had to integrate subjects such as reading, arts, history, geography and mathematics into his lessons. He chose to design a theme on Vincent van Gogh. However, geography was not part of his lessons because Vincent van Gogh was only an artist and historical figure for him. Thus, he missed an important opportunity. He did not uncover the link between the landscapes that Van Gogh painted and the places he lived, and he did not ask himself geographical questions such as: *Where did Van Gogh live?* and *Why did he live there?* Are these places still like this? Are there any other places in Europe that appear
like this? That is, the geographical consciousness of this student had remained underdeveloped, and he was unable to integrate geographical knowledge and skills into lessons that he would soon present in primary school.

Here is a second example of everyday practice. A second-year student in primary teacher training offered a geography lesson at her school on eating habits in Japan. It was an interesting lesson, and the children were enthusiastic. The student was surprised when her geography teacher stated that this lesson was not a geography lesson. However geographical questions like ‘Are there differences in eating habits between regions in Japan?’ or ‘Why is it that Japan has these eating habits?’ were missing.

To realise that such questions can be asked, (future) primary-school teachers first need sufficient geographic knowledge and skills, as demonstrated by Nilsson and Van Driel (2010, p. 1316), who conclude, “The depth of subject-matter knowledge affects the ability of the teacher to ask appropriate and meaningful questions.”

Therefore, the CTG course focuses on the PCK-G of future teachers, that is, everything they require to provide quality geography lessons. The course focuses on a way of viewing the world in which not only facts are described but also explanations and effects are studied.

The effect study – described in chapter 4 – demonstrates that this CTG course has a positive effect on the PCK development of student teachers in the short term although the student teachers themselves seem not (yet) to realise that they have acquired subject knowledge in addition to pedagogical skills. This last result is the outcome of the fourth study, which is described in chapter 5. In the short period of the course (5 weeks), we did not convincingly succeed in making the students aware of why they do what they do. This type of awareness may require a longer, more comprehensive approach within the study program, during which the student teachers receive opportunities to learn about geography and geography teaching in broad learning contexts. The CTG approach must be implemented in the overall geography program in teacher education, not only during the first year but also in the other years of training. This conclusion agrees with Jo and Bednarz (2014) and Dolan et al. (2015). These authors conclude that to ensure that student teachers reach a level at which they integrate subject knowledge and pedagogical knowledge additional, domain-specific pedagogy and more time devoted to subject methodology are required instead of a focus on generic teaching skills. As Martin (2008b) suggests, this approach enables student teachers to develop from geography learners into teachers of primary geography.

Additional time devoted to subject-related lessons has implications for the overall curriculum of an institute. It represents a challenge because at most teacher-education institutes the number of subject-specific teaching hours is limited.
The results of this study can also be exploited in the community of geography-teacher educators to reflect on the best ways to educate student teachers on the subject of geography under the given conditions. This community of teacher educators can stimulate the role of teacher educators as curriculum makers (Lambert & Morgan, 2010; Brooks, 2013; Beneker, Palings, & Krause, 2015) and try to construct a bridge between a geographically relevant and robust curriculum and the preconditions imposed by the various institutes.

At the same time, the competence requirements in the professional standard for teacher educators (Velon, 2012; 2016) would have to be provided with a domain-specific knowledge base for teacher educators. In this way, we could establish the pedagogical content knowledge required for the geography teacher educator in primary-teacher education.

Because PCK is also developed through practice (Shulman, 1986; 1987; Van Driel, Verloop, & de Vos, 1998), it is important to involve primary schools as places of practice to achieve a training environment that is as complete as possible. However, often, there are conflicting ideas and expectations about domain specific issues (Dolan, Waldron, Pike, & Greenwood, 2015) between the places of practice and the teacher education institute. Student teachers are taught pedagogically grounded ideas of good, effective education at their institutes. Often, such ideas do not directly trickle down to schools for primary education. In addition, primary-school teachers themselves are generally satisfied with the way they present their geography lessons (Notté, Van der Schoot, & Hemker, 2010). Furthermore, in their supervision of teachers-in-training, mentors in primary education pay particular attention to issues of general pedagogics that involve general classroom management (Nilsson & Van Driel, 2010).

Therefore, the risk exists that educational ideas developed during teacher-education courses are ‘washed out’ during school placement (Zeichner & Tabachnick, 1981). That is, student teachers adjust to practices already established in their schools (Korthagen & Kessels, 1999; Brouwer & Korthagen, 2005), and student teachers contest the relevance of institute-based coursework in favour of the examples they receive from their mentors.

At the same time, a trend towards more training at the workplace has appeared to close the perceived gap between theory and practice. In this in-school training, teacher education institutes cooperate with primary schools, and student teachers are trained jointly by school and institute to become qualified teachers. In the United States we see the Professional Development Schools, in England school-based teacher education and in the Netherlands Opleiden in de school (i.e. Training in school).

Under these circumstances, it is crucial to offer primary-school teachers continuous professional development courses in which they train in hands-on sessions to develop their PCK-G and familiarise themselves with new scientific insights into geography teaching. In addition, primary-school teachers together with teacher educators and student
teachers could endeavour in learner communities (Beishuizen, 2008) to improve their education, e.g. by observing (geography) classes and providing feedback. In this way, (student) teachers could learn from examples of good practice. In this manner, student teachers are offered more opportunities to observe exemplary teaching during their primary-school practice and may develop “a different view” (Lambert, 2009a) to their geography lessons and create a ‘powerful’ workplace learning environment (Geldens, 2007).

The approach can also serve as a model for training programs for other subjects. For example, subjects such as history and science occupy a similar position in teacher education and just like geography; they are subjects in which the world around us is central. Based on the method described in this thesis, we hope that we can prepare student teachers better for the future (Hicks, 2010; Pauw & Beneker, 2015; Beneker & Van der Schee, 2015). If so, they can challenge their pupils in a motivating way to become flexible, responsible, socially oriented citizens (Platform Onderwijs 2032, 2016). Two main aspects in this are: (a) the CTG course aims to help student teachers prepare their pupils to develop as responsible and active global citizens, an interpretation of citizenship that is suitable for future education. Dutch young people are not only Dutch citizens but also European and world citizens. And (b) the approach to geography education outlined in this thesis helps student teachers encourage their pupils to think more critically and creatively about the future, which is another essential feature of future-oriented education according to the committee (Platform Onderwijs 2032, 2016, p. 21). Such encouragement assumes that teachers ask their pupils questions such as why certain phenomena occur in a specific place, why places change over time and what the consequences are of a phenomenon, for example, modern technology. In this way, pupils can be stimulated to imagine how choices in the present have consequences for humans and the planet in the future (Hicks, 2010).

6.5. Limitations and future research

This thesis describes the design and testing of a geography course for first-year primary-student teachers. Although the results seem promising, this study has some limitations, and more research is required.

At the first place, the CTG course has been performed only once with first-year student teachers at the beginning of their training and only short-term effects were found. Therefore, it would be interesting to research how the described method – when implemented during the other years of training – could increase the understanding and awareness of primary-student teachers in applying geographical concepts in their lessons and their development as teachers of primary geography.

A second limitation of this study is that most participating teacher educators performed the CTG course only once. The question therefore can be asked how the PCK of the teacher educators would develop when they would teach the CTG course more fre-
Conclusions and discussion

Consequently. According to Smith (2000) in her study on teaching about teaching science, research on this question will advance our understanding of teaching about teaching geography.

Research on the practice of primary education was beyond the scope of this study but represents a valuable complementary field of research. E.g. it would be interesting to research how a learner community of student teachers, teacher educators and primary-school teachers would promote the PCK-G development of the (student) teachers.

At several places in this thesis the motivational aspects of the CTG course have been raised. Motivation for geography in fact was measured by means of a geography perception test. However, the test didn’t show any effect on motivation for geography, neither for geography in general, nor for geography in primary school. This is consistent with earlier findings that effects of teaching programmes on student motivation often occur only after an extended period of time (Tessier, Sarrazin, & Ntoumanis, 2010). For practical reasons motivation is further left aside. Nonetheless this would be an interesting and relevant aspect to pay attention to during further research.

Our studies were performed in the context of teacher education in the Netherlands. It would be interesting to conduct similar studies in a more international context and on a larger scale. In this way, a broader view of the effect of the approach in different educational settings could be obtained.

Finally, using other research methods, such as class observations of students at work and focus groups using class recordings of geography lessons as input for discussion, could provide valuable information regarding the possibilities and the difficulties of using the approach and the development of geographic thinking.

6.6. Epilogue

As noted in the 2016 International Charter on Geography Education, “Geographical Education is vital to equip the next generation of people with the knowledge, skills, attitudes, values, and practices to value, care, and make reasoned decisions for the planet” (International Geographical Union, 2016). Providing (future) teachers with the PCK to be able to teach this next generation is the aim of teacher education. A sufficient level of PCK-G enables (future) teachers to motivate pupils and to challenge them to develop themselves as responsible, socially-oriented (world) citizens. This study provides insight into how this PCK-G might be developed.
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Summary
Samenvatting
Dankwoord
Summary

Context of this research
The question that is central to this thesis is how we can prepare future primary school teachers to give good, inspiring geography lessons. The assumption is that we can improve the current situation. Whether this assumption is correct and how that improvement can occur is the question of this research. This issue has a number of complicating factors.

In primary teacher education, geography is just one of many subjects. It is also a relatively small subject for which relatively few teaching hours are available.

Another important factor is that in the Netherlands, student teachers can enter primary teacher education after completing their secondary education (five or six years) with or without a final exam in geography or after their training as a teaching assistant. This second group of student teachers would have had their last geography lesson at least four years ago.

Finally, no national curriculum exists for primary teacher education. This is also true for the subject of geography. Institutes develop their own curriculum and teacher educators develop their own courses.

This combination of a limited number of teaching hours, little subject knowledge, a diverse group of students and few guidelines for educational content creates a challenging situation for teacher education in the Netherlands to prepare future primary school teachers in such a way that they are able to teach the subject of geography properly and in an inspiring way. This is a difficult task that requires informed educational choices and tools for geography educators.

In this thesis, against this background, four studies examine what is needed and possible to develop the Pedagogical Content Knowledge for the subject of Geography (PCK-G) for first-year primary student teachers. The central concept of PCK-G in this study is defined as the combination of content knowledge (what), pedagogical knowledge (how) and the consciousness of what one does, why, and how (why). The underlying, ultimate goal is to contribute to the improvement of geography education in primary teacher education with this research and thus, indirectly, improve the quality of geography teaching at primary schools.

Within this central concept PCK-G, geography can be described as the study of the Earth and the relations and interactions between people and the environment at different levels of scale (International Geographical Union, 2016). To be able to understand and explain these relations and interactions and to ask geographical questions, key concepts are used (Haubrich, 1992; Taylor, 2008). In this thesis five geographical key concepts are
presented: where, why there, scale, change and effects or pros and cons. These concepts are derived from classifications made by different authors and discussed with colleagues from the field of geography education.

Main findings
To identify the problems from the perspective of geography teacher educators, a first study is conducted. This sub-study illustrates what level of PCK-G student teachers should achieve according to their teacher educators and what level they should have reached by the end of their training. It concerns a descriptive study based on a national survey among all geography teacher educators at teacher education institutes in the Netherlands.

According to the 39 teacher educators who completed the survey, the majority of the student teachers only partially achieve the desired level of PCK-G at the end of training. The teacher educators think, for example, that many student teachers at the end of their training are not able to explain an issue such as climate change or to incorporate map skills into their lessons in primary school. The gap experienced by the teacher educators between the desired and the achieved level of the PCK-G is, according to them, mainly due to the limited number of teaching hours for the subject and a lack of emphasis on content knowledge within the programme. The teacher educators also identified the varying knowledgebase of the student teachers at the start of the programme as an important limiting factor in properly developing their PCK-G. According to the teacher educators, the differences in starting level combined with the limited number of teaching hours makes it difficult to develop suitable educational opportunities for everyone.

Sub-study two reports on the development of Consciously Teaching Geography (CTG), a course developed through educational design research for first year student teachers that is intended to address this problem. The design process started with three successive discussion meetings with geography-teacher educators and experts from the field of geography and geography teaching. In these meetings, an initial geography-lesson framework was discussed and adjusted based on state-of-the-art scientific knowledge. The discussion meetings resulted in four basic principles for the design to meet. The course should include the following:

- a) be constructed from a framework of key geographic concepts,
- b) use student-teachers’ preconceptions and everyday geographic examples as a starting point for the lessons,
- c) use proven effective teaching strategies, such as explicit modelling, by the teacher educators and various forms of active learning, and
- d) stimulate reflection to accomplish conscious learning by the student teachers.
The discussion meetings resulted in the first version of the CTG course. Subsequently, the practicality of the course was tested in two trial rounds. In each round, two geography-teacher educators with their groups of first-year student teachers used the course in their programmes. Their experiences and results were recorded. Thus, the CTG course assumed its final form. During the trial rounds, measurement instruments were developed and tested.

The results reveal that to make the design consistent, additional design principles were necessary. Flexible use of the framework was required to accommodate the teaching styles of the teacher educators and the couleur locale of their institutes.

Moreover, it proved necessary to guide student teachers stepwise in working with the framework. That led to the addition of scaffolding by the teacher educator and a stronger use of activating teaching methods. Finally, it became clear that the teacher educators needed more comprehensive training and a more detailed manual with emphasis on the underlying principles to attain a good performance.

The CTG course is a framework that defines seven characteristics of a good geography lesson. Five of these characteristics are based on core geography concepts. Each characteristic is formulated as a question that student teachers can use when preparing a lesson. The following five geographic questions resulted from the study: Where is it? Why is it there? What do I see if I zoom in or out? How does it change over time? and What are the consequences, advantages and disadvantages? In addition to those questions, two more general pedagogical questions were formulated: How can I start the lesson in a motivating way? and How can I end the lesson in a way that promotes transfer?

The complete CTG course consists of five 90-minute meetings during which the characteristics were applied in different contexts, the teacher educators use explicit modelling, and there was room for reflection.

Through improvements in the flexibility of the course and the preparation of the teacher educators, the practicality of the course was secured to a sustainable design that could be executed within different educational contexts. This is important given the lack of a national curriculum for teacher education in the Netherlands.

The next logical question was whether this sustainable design would actually be effective in stimulating the PCK-G of the intended users: first-year primary student teachers. To this end, a quasi-experimental research design with a control group and pre-post testing is used. The nearly 450 student teachers that participated in the study were taught in twelve classes. Six classes were assigned to the experimental condition and six classes to the control condition. The experimental classes followed the CTG course, and the control classes used regular geography lessons. In both types of class (i.e. experimental and regular), the same topics were taught.
To be able to measure the effect of the course on the development of the PCK-G of the student teachers, different measurement instruments were used. Substantial knowledge (what) and syntactic knowledge (how) were measured using the Test Review Lesson Plans (pre- and post-test) and the Test Own Lesson Design (post-test only). Beliefs regarding the subject (why) were also measured by the latter test. To collect background information, all students were required to complete a short biographical questionnaire.

Our results reveal that the CTG course had a significant positive effect on the substantial (what) and syntactic (how) knowledge of first-year student teachers immediately after the course, that is, on the use of the characteristics of a good geography lesson, in the short term. Long-term effects (i.e., two months after completion of the course) were not found. In addition, no effect was found on the conscious use of the characteristics of a good geography lesson, that is, the beliefs regarding the subject (why). This outcome was valid immediately after completion of the course and two months after the end of the course.

Finally, sub-study four examined the returns of the CTG course from the perspective of the student teachers. Based on the idea that learner perspectives can inform our understanding of effective educational practice, a ‘learner report’ was used in which the student teachers reported what they learned from the course.

After each course meeting, the student teachers reported their learning experiences. From the total of 1179 filled-in learner reports completed by the first-year student teachers, they mainly reported elements concerning the learning process (i.e. syntactic knowledge/how). They primarily viewed the seven characteristics of a good geography lesson as a pedagogical instrument, although substantive knowledge (what) and syntactic knowledge (how) were taught in an integrated manner.

However, there are differences between students who were taught by different teacher educators. In settings in which there was a stronger emphasis on content knowledge and in which this knowledge was assessed, student teachers reported more substantive knowledge. The large majority of the statements that student teachers provided were not domain specific.

Implications
This research shows that it is possible to develop Pedagogical Content Knowledge for the subject of geography for first-year primary student teachers and that the course Consciously Teaching Geography (CTG) proved to be an effective instrument. It appeared important for the course to be flexible enough to apply in different educational contexts and to the various teaching styles of teacher educators. It has also become clear that the teacher educators need adequate instruction and practical tools for the use of the course and that student teachers should be allowed ample opportunity to actively practice with the presented approach in different contexts.
That the CTG course proves effective is even more interesting because it only involves a short course of five lessons. In the future, it is important to investigate whether student teachers, when integrating geographical core concepts and the seven characteristics of a good geography lesson in other geography courses, eventually come to conscious knowledge and transfer, which were results the short CTG course could not achieve. In this way they - as future teachers - really know ‘why they do what they do’ in the subject of geography.

The results of this study can be used to further develop better geography education in primary teacher education and primary education. Within the community of geography-teacher educators, the approach followed in this research may be further developed to stimulate the role of teacher educators as curriculum makers. Additionally, we may try to construct a bridge between a geographically relevant and robust curriculum and the preconditions imposed by the various institutes.

Furthermore, it would be interesting to research how - e.g. in a learner community of student teachers, teacher educators and primary-school teachers - the approach of the CTG course would promote the PCK-G development of the (student) teachers.

Finally, a similar study in a more international context and on a larger scale can provide a broader view of the effect of the approach in different educational settings.

The approach can also serve as a model for training programmes for other subjects (e.g., history or science). Further research could focus on the usefulness of this method in other school subjects.
Samenvatting

Context van het onderzoek

De vraag die in dit onderzoek centraal staat is hoe we aanstaande leerkrachten basisonderwijs kunnen voorbereiden op het geven van goede en inspirerende aardrijkskundelessen in de basisschool. De veronderstelling is dat het beter kan dan nu het geval is. Of deze veronderstelling klopt en hoe die verbetering kan plaatsvinden daarover gaat dit onderzoek. Dit vraagstuk kent een aantal complicerende factoren.

Op de lerarenopleiding basisonderwijs is aardrijkskunde slechts één van de vakken die studenten volgen. Het is bovendien een relatief klein vak, waarvoor ook relatief weinig lesuren beschikbaar zijn.

Een andere factor van belang is de grote diversiteit in de vooropleiding van de groep studenten die instromt in de lerarenopleiding basisonderwijs. Studenten kunnen de opleiding beginnen als zij een havo- of vwo-diploma hebben behaald, mèt of zonder aardrijkskunde als examenvak. Studenten kunnen ook starten als zij een opleiding op MBO-4 niveau hebben afgerond. Voor die studenten is het dan zeker vier jaar geleden dat zij hun laatste aardrijkskundecurriculum kregen.

Tenslotte bestaat er in Nederland voor de lerarenopleiding basisonderwijs niet zoiets als een ‘nationaal curriculum’. Dat is evenmin het geval voor het vak aardrijkskunde. Opleidingen ontwerpen hun eigen curriculum, en docenten hun eigen onderwijsmateriaal.

In deze context van weinig onderwijsuren, weinig basiskennis, grote verschillen tussen studenten, en weinig richtlijnen voor de inhoud van het vak, staan de aardrijkskundedocenten aan de lerarenopleidingen basisonderwijs in Nederland voor de uitdagende taak om toekomstige leerkrachten tóch zo op te leiden dat zij het vak aardrijkskunde goed én tegelijk ook inspirerend kunnen geven aan leerlingen op de basisscholen. Dat is een moeilijke taak die vraagt om gefundeerde didactische keuzes én om handvatten voor aardrijkskundedocenten aan de lerarenopleidingen.

In dit proefschrift is, tegen deze achtergrond, in vier deelstudies, onderzocht wat nodig en mogelijk is om de Pedagogical Content Knowledge voor het vak Aardrijkskunde (PCK-A) van eerstejaarsstudenten van de lerarenopleiding basisonderwijs te ontwikkelen. Het centrale begrip PCK-A in dit onderzoek is gedefinieerd als: de combinatie van inhoudelijke kennis (wat), didactische kennis (hoe) en bewust zijn van wat je, waarom, en hoe doet (waarom). Het achterliggende, uiteindelijke doel is om met dit onderzoek een bijdrage te leveren aan de verbetering van het aardrijkskundeonderwijs op de lerarenoplei-
Samenvatting

dingen basisonderwijs en daarmee, indirect, ook aan de kwaliteit van het aardrijkskundeeonderwijs op de basisscholen.


Belangrijkste bevindingen

Om het probleem in kaart te brengen vanuit de beleving van de opleiders aardrijkskunde is een eerste deelstudie opgezet. Deze deelstudie brengt in beeld welk niveau van PCK-A pabostudenten bereiken volgens hun docenten aardrijkskunde, en welk niveau zij zouden moeten bereiken aan het eind van hun opleiding. Het gaat om een beschrijvende studie op basis van een landelijke enquête onder alle docenten aardrijkskunde aan de lerarenopleidingen basisonderwijs in Nederland.

Volgens de 39 opleiders die de enquête invulden, bereiken de meeste toekomstige leerkrachten slechts gedeeltelijk het gewenste niveau van PCK-A. De opleiders denken bijvoorbeeld dat veel studenten aan het eind van hun opleiding niet in staat zijn om een vraagstuk als klimaatverandering te verklaren of om kaartvaardigheden toe te passen tijdens hun lessen op de basisschool. De kloof die de lerarenopleiders ervaren tussen het gewenste en het bereikte niveau van de PCK-A is volgens de respondenten vooral het gevolg van het geringe aantal lesuren voor het vak, en van een gebrek aan aandacht voor vakinhoudelijke kennis binnen de opleiding. Ook noemen de vakdocenten het uiteenlopende niveau aan basiskennis van studenten bij de start van de opleiding als een belangrijke beperkende factor om de PCK-A van de studenten goed te kunnen ontwikkelen. De verschillen in startniveau, gecomprimeerd met het beperkte aantal lesuren maken het volgens hen moeilijk om voor iedereen een geschikt onderwijsaanbod te ontwikkelen.

Deelstudie 2 rapporteert over de ontwikkeling van een cursus voor eerstejaarsstudenten, met de naam Bewust Aardrijkskunde Onderwijzen (BAO), die bedoeld is om aan dit probleem tegemoet te komen, en over het ontwerponderzoek dat de ontwikkeling flankerde. Het ontwerpproces startte met drie opeenvolgende rondes van expertgesprekken. Deelnemers waren: aardrijkskundeprofs afkomstig van verschillende lerarenopleidingen basisonderwijs en onderwijsontwikkelers met expertise op het gebied van aardrijkskundeonderwijs. In deze gesprekken is een eerste raamwerk voor ‘een ideale aardrijkskundeleer’ uitgedacht. Het raamwerk is gebaseerd op recente wetenschappelijke kennis,
uitgebreid bediscussieerd en op grond van de discussie verbeterd. De expertgesprekken leverden een viertal basisprincipes voor het ontwerp op. De te ontwikkelen cursus moest:

a) opgebouwd zijn vanuit een raamwerk van aardrijkskundige kernconcepten,
b) aansluiten op de ervaringen, verwachtingen, voorkennis en opvattingen die studenten meebrengen over aardrijkskundeonderwijs, én deze ter discussie stellen (lessen die starten vanuit alledaagse aardrijkskundige onderwerpen vormen daarvoor een goede ingang),
c) gebruikmaken van bewezen effectieve didactische strategieën zoals expliciete modeling door de docent en verschillende vormen van actief leren,
d) uitnodigen tot reflectie opdat ook bewust leren tot stand komt bij studenten.

De expertgesprekken resulteerden in een eerste versie van de module BAO. Deze module werd vervolgens in twee pilotrondes getest op bruikbaarheid. In beide pilotrondes namen twee lerarenopleiders aardrijkskunde deel, samen met hun eerstejaarsstudenten. Na de eerste ronde werd de cursus aangepast op basis van de ervaringen. Na de tweede ronde zijn nog enkele aanpassingen uitgevoerd en kreeg de cursus zijn definitieve vorm. Tijdens de pilotrondes zijn ook de (deels bestaande, deels zelf-ontwikkelde) kwalitatieve en kwantitatieve meetinstrumenten uitgetest en gevalideerd.

De opbrengst van de pilotrondes was dat deze zichtbaar maakten dat nog enkele aanvullende ontwerpprincipes nodig waren om te komen tot een bruikbaar ontwerp, dat door de verschillende docenten kan worden uitgevoerd. Zo bleek het belangrijk dat het aardrijkskundig raamwerk van de cursus flexibel kan worden toegepast, zodat er ruimte blijft voor de eigen onderwijsstijl van de docent, en de ‘couleur locale’ van de verschillende opleidingen.

Bovendien bleek het nodig om studenten stapsgewijs te begeleiden in het werken met het raamwerk. Dat leidde tot het toevoegen van scaffolding door de docent (eerst voordoen -> dan samen doen --> tot slot zelf doen), en het sterker inzetten van active-rende werkvormen.

Ten slotte kwam naar voren dat de docenten, voor een goede uitvoering, behoefte hadden aan een uitvoeriger training met aandacht voor de achterliggende principes, en aan een meer gedetailleerde handleiding.

De definitieve versie van de cursus BAO is opgebouwd rond een centraal raamwerk van zeven kenmerken van een goede aardrijkskundeles: vijf kenmerken die geografische kernconcepten vertegenwoordigen, naast twee meer algemeen-didactische concepten. Elk kenmerk is geformuleerd als een vraag die studenten zichzelf kunnen stellen als zij een les voorbereiden. Dit resulteerde in de volgende vijf aardrijkskundige vragen:

Waar is het? Waarom is het daar? Wat zie ik als ik in- of uitzoom? Hoe verandert het in de tijd? en Wat zijn de consequenties, voor en nadelen? Daarnaast zijn twee meer
algemeen didactische vragen geformuleerd: Hoe kan ik de les op een motiverende manier starten? en Hoe kan ik de les beëindigen zodat ik transfer bevorder?

De complete cursus BAO bestaat voor studenten uit vijf bijeenkomsten van 90 minuten waarin de kenmerken worden toegepast in verschillende contexten en waarbij tijdens de bijeenkomsten door de opleiders gebruik wordt gemaakt van expliciete modelling en waarbij ruimte is voor reflectie.

Via de verbeteringen in de flexibiliteit van de module en in de voorbereiding van de docenten werd de bruikbaarheid van de cursus geborgd tot een duurzaam ontwerp dat consistent uitvoerbaar is binnen verschillende opleidingscontexten. Die duurzaamheid is van belang gezien het ontbreken van een nationaal curriculum voor de lerarenopleiding basisonderwijs.

De logische volgende vraag was of dit duurzame ontwerp ook daadwerkelijk effectief zou zijn in het stimuleren van de PCK-A van de beoogde groep studenten: eerstejaarsstudenten aan de lerarenopleiding basisonderwijs. De effectiviteit van de cursus BAO is daarom, in deelstudie 3, getest via een quasi-experimenteel onderzoek met een controlegroep en een voor- en nameting.

Bijna 450 eerstejaars studenten participeerden in het effectiviteitsonderzoek, verdeeld over een experimentele conditie (zes groepen studenten) en een controleconditie (eveneens zes groepen). De groepen in de experimentele conditie volgden de cursus BAO en de groepen in de controleconditie volgden de reguliere lessen. In de experimentele en de controlegroepen kwamen dezelfde onderwerpen aan de orde. Om het effect van de cursus op de ontwikkeling van de PCK-A van de studenten te kunnen meten is gebruik gemaakt van verschillende meetinstrumenten. De inhoudelijke (wat) en didactische kennis (hoe) werden gemeten aan de hand van twee meetinstrumenten: de Test Beoordelen Lesontwerpen (voor- en nameting) en de Test Eigen Lesontwerp (alleen nameting)

Bewust zijn van wat je, waarom, en hoe doet (waarom) werden ook gemeten door Test Eigen Lesontwerp (alleen nameting). Om achtergrondinformatie over de studenten te verzamelen, vulden alle studenten een korte vragenlijst in.

De resultaten laten zien dat de cursus BAO een positief effect heeft op de ontwikkeling van inhoudelijke (wat) en didactische (hoe) kennis van de studenten direct na afloop van de cursus. Effecten op de lange termijn (twee maanden na afloop van de cursus) werden niet gevonden. Ook werd er geen effect gevonden op het bewustzijn van wat je, waarom, en hoe doet (waarom).

Tot slot is in deelstudie 4 gekeken naar de opbrengsten van de cursus BAO vanuit het perspectief van studenten zelf. Vanuit het idee dat ook de perspectieven van studenten ons waardevolle informatie kunnen verschaffen over de effectiviteit van een interventie is door middel van 'learner reports' onderzocht wat de studenten zelf rapporteren over
wat zij geleerd hebben van de cursus BAO. Na elke les vulden studenten een learner report in waarin gevraagd werd naar hun eigen leerervaringen. Uit de in totaal 1179 ingevulde learner reports komen in hoofdzaak leerervaringen met betrekking tot didactische aspecten naar voren, zoals de elementen van een les. Studenten lijken de zeven kenmerken van een goede aardrijkskundes les centraal staan in de cursus vooral op te vatten als een didactisch instrument, alhoewel in de cursus BAO inhoudelijke en didactische kennis om een geïntegreerde manier aan bod kwamen. Slechts enkele studenten benoemden leerervaringen waaruit blijkt dat ze hebben geleerd geografisch te denken of onderwijskundige principes en geografie te verbinden. In dit opzicht zijn overigens wel verschillen zichtbaar tussen studenten die les hebben gekregen van verschillende lerarenopleiders: wanneer de docenten een sterkere nadruk legden op vakinhoudelijke kennis, en waar deze kennis ook werd getoetst, rapporteerden de studenten meer over het verwerven van vakinhoudelijke kennis. De overgrote meerderheid van de opmerkingen van de studenten waren niet domeinspecifiek.

Implicaties

Dit onderzoek toont aan dat het mogelijk is om de Pedagogical Content Knowledge voor het vak aardrijkskunde van eerstejaarsstudenten van de lerarenopleiding basisonderwijs te ontwikkelen en dat de cursus Bewust Aardrijkskunde Onderwijzen (BAO) die daarvoor werd ontwikkeld effectief is. Het bleek van belang dat de cursus flexibel genoeg is om te passen in verschillende onderwijscontexten en bij verschillende didactische stijlen van docenten. Ook is duidelijk geworden dat de lerarenopleiders voldoende instructie en praktische handvatten nodig hebben voor het gebruik van de cursus, en dat studenten de mogelijkheid moeten krijgen om veel en actief te oefenen met de aanpak in verschillende contexten.

Dat de cursus BAO effectief blijkt, is des te interessanter, omdat het slechts gaat om een korte cursus, van vijf lessen. Het is van belang om in de toekomst te onderzoeken of studenten, wanneer in de opleiding zou worden voortgebouwd op de geografische kernconcepten en de zeven kenmerken van een goede aardrijkskundes les, uiteindelijk ook komen tot bewuste kennis en transfer, resultaten die met de korte cursus BAO nu niet bereikt konden worden. Op deze wijze weten zij dan als toekomstige leerkrachten daadwerkelijk ‘waarom ze doen wat ze doen’ in het vak aardrijkskunde.

De resultaten van het onderzoek kunnen gebruikt worden voor het verder nadenken over en ontwikkelen van goed aardrijkskundes onderwijs voor de lerarenopleiding en de basisschool. Binnen de groep van Pabo lerarenopleiders aardrijkskunde kan de in dit onderzoek gevolgde werkwijze verder ontwikkeld worden, waarbij de rol van de lerarenopleider als curriculumontwikkelaar gestimuleerd wordt. Waarbij geprobeerd wordt een brug te slaan tussen een aardrijkskundig relevant curriculum en de voorwaarden daaraan gesteld door de diverse opleidingen.
Samenvatting

Daarnaast is het interessant te onderzoeken of bijvoorbeeld in de vorm van een leergemeenschap bestaande uit lerarenopleiders, leerkrachten basisonderwijs en studenten van de lerarenopleiding basisonderwijs de in dit onderzoek gevolgde werkwijze bijdraagt aan een verdere ontwikkeling van de PCK-A van studenten en leerkrachten basisonderwijs.

Ten slotte kan het uitvoeren van een vergelijkbaar onderzoek op internationale schaal een breder inzicht verschaffen over het effect van de gevolgde werkwijze in verschillende onderwijskundige settingen.

De werkwijze van de cursus BAO die uitgetest werd in dit onderzoek, zou ook toepasbaar kunnen zijn op andere schoolvakken (bijv. geschiedenis of natuur en techniek). Verder onderzoek zou zich dan ook kunnen richten op de bruikbaarheid van deze werkwijze in andere schoolvakken.
Dankwoord

Dit proefschrift draag ik op aan mijn vader Klaas. Als overtuigde vakbondsman onderken-de hij het belang van onderwijs en mocht ik zo lang leren als ik wilde, daarbij waar moge-lijk ondersteund door mijn ouders. Met dit proefschrift bereik ik een voor mij belangrijke stap in mijn leerproces.

Nadat ik eerst de mavo had afgerond en daarna mijn havodiploma had gehaald, startte ik in 1981 met een hbo-opleiding, om – na een aantal jaren gewerkt te hebben als chemisch analiste– alsnog mijn hart te volgen en te beginnen aan een universitaire studie sociale geografie. In mijn lange loopbaan door het onderwijs is mijn liefde voor het vak aardrijkskunde gewekt door mevrouw Leersen, mijn aardrijkskundedocente op het toenmalige Johannes College in Den Helder. Haar wil ik vooral bedanken voor het feit dat ze mij vragen stelde die mij nieuwsgierig maakten naar de wereld om mij heen. Het was mijn zus Helma die mij precies het zetje gaf dat ik nodig had om me in te schrijven aan de VU, voor de studie sociale geografie. Tijdens die studie leerde ik de wereld om mij heen beter kennen en kreeg ik inzicht in waarom de wereld in elkaar steekt zoals hij in elkaar steekt.

Met andere woorden: ik begon overal aardrijkskunde te zien en leerde geografisch denken.

Mijn liefde voor het aardrijkskundeonderwijs werd gewekt toen ik toch ook nog maar mijn onderwijsbevoegdheid ging halen en als stagiaire rondliep op het Eerste Christelijk Lyceum in Haarlem. De school die uiteindelijk de middelbare school werd van mijn eigen kinderen. In 1995 ging ik daadwerkelijk het onderwijs in, als docent aardrijkskunde aan de pabo Haarlem. Wat was ik teleurgesteld toen bleek dat mijn studenten aardrijkskunde lang niet allemaal het mooiste vak van de wereld vonden! Veel van hen vonden het zelfs moeilijk en saai. Tegelijkertijd begon daar voor mij de uitdaging: hoe kon ik hen zo ver krijgen dat ze goede en inspirerende aardrijkskundelessen gingen geven aan hun leerlingen op de basisschool. Juist ook die uitdaging vormde uiteindelijk de aanleiding voor het onderzoek waar dit proefschrift over gaat: Bewust aardrijkskunde onderwijzen, hoe doe je dat? Hoe zorg je dat leerlingen nieuwsgierig worden (of blijven) naar de wereld om hen heen, en dat ze de vaardigheden krijgen om die wereld van alle kanten te bekijken en leren begrijpen?

Dit proefschrift is tot stand gekomen in een roerige periode van mijn leven. Dat het er nu toch ligt, was niet mogelijk geweest zonder de hulp, steun en het vertrouwen van velen om mij heen. Mijn bijzondere dank gaat in de eerste plaats uit naar alle aardrijkskundecollega’s in het land die een bijdrage hebben geleverd aan mijn onderzoek. De collega’s die met mij meedachten tijdens de panelgesprekken hebben ervoor gezorgd dat er een mooie module tot stand is gekomen. Een module die verder verfijnd werd doordat weer andere collega’s deze uittesten met hun studenten. Heel fijn dat jullie je hiervoor
Dankwoord

openstelden! De collega’s die hebben meegewerkt aan de effectmeting ben ik dankbaar voor het feit dat ze vertrouwen toonden in mijn ontwerp, dat ze hun eigen lessen even aan de kant hebben gezet om de mijne uit te voeren. Bovendien hebben zij nog allerlei papierwerk ingevuld en geordend dat nodig was voor de dataverzameling van mijn onderzoek: logboeken, toetsen enzovoort, en hebben ze mij – en mijn videocamera – toege- laten in hun lessen. Al hun studenten ben ik dankbaar voor het trouw invullen van hun learner reports en het maken van de tests.

Dit onderzoek heeft kunnen plaatsvinden omdat Hogeschool Inholland mij vier jaar vrijgesteld heeft van een deel van mijn taken aan de pabo Haarlem. Daar ben ik de Hogeschool erkentelijk voor. Binnen de hogeschool ben ik begeleid door Marianne Boogaard. Zij heeft me door de moeilijke momenten gesleept, was altijd positief en voorzag mij van constructieve en opbouwende feedback. Marianne heel erg bedankt, zonder jou was het niet gelukt.


Binnen de Kenniskring Ontwikkelingsgericht Onderwijs van Hogeschool Inholland, is mijn onderzoeksavontuur gestart. Lector Dorian de Haan heeft mij gestimuleerd om aan dit onderzoek te beginnen, en zij gaf mij extra ruimte binnen de Kenniskring toen het niet lukte mijn onderzoek binnen de gestelde tijd af te ronden. Ik denk met plezier terug aan de vele bijeenkomsten waarin we als kennis ringleden elkaars onderzoek bespraken, aan de schrijfweek in de Blauwe Villa en het lief en leed wat we deelden. Veel dank allemaal.

Ook ben ik Wilbert Zwanenburg, mijn leidinggevende op de pabo, dankbaar dat hij me ruimte gaf om, als dat mogelijk was, mijn eigen agenda te bepalen. In het intervisie-clubje met Inholland-promovendi deelden we onze onderzoek lief en leed. Alard Joosten liet mij, als leider dit clubje, de kleine onderzoeks successen vieren.

Mijn laatste woorden van dank wil ik richten tot mijn familie en vrienden. Iedereen bedankt voor de bemoedigende woorden, de etentjes waar ik bij kon aanschuiven, de kopjes koffie en glaasjes wijn ter afleiding. Ik mocht al mee op schaatstour naar Zweden met mijn zus Ellen voordat ik mijn proefschrift had afgerond, in het vertrouwen dat het echt wel zou lukken. Lieve Bernie ik wil jou bedanken voor je hulp bij de layout en voor je geduld het afgelopen jaar. Thomas en Maaike, jullie hebben mij heel wat uurtjes achter mijn laptop zien doorbrengen. Maar dit onderzoek is ook een beetje van jullie: jullie hiel-
pen mij met het uitzoeken van de data, het invoeren in SPSS, het beoordelen van de learner reports! En daarnaast steunden jullie mij elk op je eigen wijze. Tijdens de verdediging op 9 november staan jullie naast mij als mijn paranimfen op de geboortedag van jullie opa, mijn vader.
# Appendix

## Decision rules (Chapter 4, section 4.4.2.)

### A. Decision rules Test Review Lesson Plans

In the table below the two missing characteristics in each lesson plan are listed including the rubrics for each characteristic. These decision rules are formulated after the first round of 5% of the tests.

<table>
<thead>
<tr>
<th>LESSON PLAN</th>
<th>ADJUSTMENT 1</th>
<th>ADJUSTMENT 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. WEATHER AND CLIMATE: Storm in El Salvador</td>
<td>3. Why are there tropical storms in El Salvador? <em>(Why there?)</em> Good: If called originate/ cause of a storm. Good: student teacher writes explaining.</td>
<td>7. Discuss why it is <strong>useful</strong> to know something about tropical storms. <em>(Transfer)</em></td>
</tr>
<tr>
<td>2. SUSTAINABLE DEVELOPMENT: Enough sun in the Sahel?</td>
<td>1. <strong>Motivating start</strong> using, e.g., a photo (via the digital board) of solar panels in the Sahel. Good: if it is stated that there are materials included / showed.</td>
<td>5. Will there be solar panels in the future? How did it used to be? <em>(Time/change)</em></td>
</tr>
<tr>
<td>3. CLIMATE AND AGRICULTURAL Which country is on the table today?</td>
<td>3. Why do we import products from other countries? <em>(Why there?)</em> Good: why a product comes from that place? / Why, e.g., the pizza comes from Italy. Good: student writes explanation.</td>
<td>6. What are the advantages and disadvantages of importing products from other countries? <em>(Advantages and disadvantages/effects)</em></td>
</tr>
<tr>
<td>4. AGRICULTURE IN THE NETHERLANDS: Who makes our food?</td>
<td>2. Take an atlas and find out where in the Netherlands sugar is grown. <em>(Where)</em> Good: e.g.: in which province you can find many agricultural. Good: Student writes: atlas.</td>
<td>5. Will this remain so in the future? How was it in the past? <em>(Time/ change)</em></td>
</tr>
<tr>
<td>5. LIVING IN A CITY: Do you live in a city or in a village?</td>
<td>3. Why do people live in cities? Name two different reasons? <em>(Why there)</em></td>
<td>7. Discuss why it is useful to know something about living in cities. <em>(Transfer)</em></td>
</tr>
</tbody>
</table>
In general:
An answer is scored ‘correct’ when:
• the student mentions the characteristic: e.g., Why there? Advantages and disadvantages or How does it change.
• the student describes the characteristic
Students do not need to write whole sentences.

B. Decision rules Test Own Lesson Design

I. For each characteristic it is noted whether the characteristic is:
MISSING = the characteristic is missing in the lesson plan
SUFFICIENTLY USED = in the lesson plan the characteristic is translated in a way that it is connected to the topic of the lesson. The topic of the lesson (the content) is clearly apparent in the lesson plan.
CONSCIOUSLY USED = in the lesson plan it is also justified why the aspect is treated in this way. Why the topic of the lesson is precisely developed in that way comes forward.
Student teachers don’t have to write down complete sentences.

II. After the first correction round of 5% of the tests, the correction format was further detailed with the below formulated decision rules.
DECISION RULES:
• If the student teacher describes what he does (in column 1 and 2) linked to the topic of the lesson and subsequently lists the characteristic in column 3 (e.g., Where is it? Why is it there? Etc.), then the characteristic is consciously used.
• If the student teacher (in column 1 and 2) notes down activities that correspond, e.g., with locating: names where it is, takes a map or an atlas to look it up, then the characteristic where is it is sufficiently used. If this is subsequently (in column 3) coupled to the question Where is it? then the characteristic is consciously used.
• If the student teacher already in column 1 (or 2) describes/mentions why he does what he does, then the characteristic is consciously used.
• Simply stating for a certain characteristic: “this is the characteristics of a good geography lesson” means the characteristic is not consciously used (= applying the trick).
Appendix

- A sentence in the lesson design can only be counted to one characteristic, unless the word is clearly used or if it is an enumeration.
- If the student teacher mentions, “where else can we see this?” then it is zooming.
- If the student teacher writes down Explaining, then this is not the same as a motivating start.
- If the student teacher writes down Introduction of the subject (in column 3), then the characteristic motivating start is not consciously used.
- If he writes: Watching a movie (in column 1) then the characteristic motivating start is sufficiently used. And if subsequently, in column 3, the student teacher notes down: Introducing the subject, then the characteristic.
Bijdrage van de promovendus per artikel

Dit proefschrift bestaat uit een bundeling van 4 artikelen, die gepubliceerd zijn of aangeboden zijn aan verschillende wetenschappelijke tijdschriften:


Voor alle artikelen geldt dat de promovendus verantwoordelijk is geweest voor:

a. Het achterliggende onderzoeksdesign, dataverzameling, analyse en rapportage;

b. De opzet en uitwerking van het artikel.

De co-auteurs hebben feedback geleverd op het onderzoeksdesign, analyse en rapportage van de resultaten en conceptversies van de artikelen.

Prof. Dr. J. Schoonenboom heeft een bijdrage geleverd bij de analyse en interpretatie van de data waarvan de resultaten gepresenteerd zijn in artikel 2.