Envisioning Futures in School Geography

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ENVISIONING FUTURES IN SCHOOL GEOGRAPHY

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Chapter 1. Introduction

1.1. Futures Education in School Geography: A Faltering Innovation

"Robots might outsmart us", "Solar panels will get cheaper after upscaling", "Cities will rule, outside cities you'll find no man's land" and "More housing for one-person households". Over time, students have expressed a wide range of thoughts about futures during my geography lessons at secondary level in the Netherlands. Even though thinking ahead often concerns a single time perspective, 'the future', this wide range of student thoughts illustrates that multiple futures are present in people's minds, plans and visions. In this thesis, therefore, the term futures is used, when referring to future times. Interestingly, students often initially react by stressing their powerlessness to influence futures. They, for example, say: "How should I know?" or "I have no influence on the future anyway". On the one hand, such dismissive students' reactions might be influenced by adolescents' limited inclination to think ahead (Jolles, 2016) and by futures' inherent uncertainty and complexity, which can be overwhelming (Rogers & Tough, 1996). On the other hand, is it correct to assume futures are out our hands? Might it not be essential to recognize our potential ability to influence futures, maybe even more so for adolescents who will inhabit these futures?

A good example of such influence comes from a group of students who, since 2018, have been expressing their worries about futures. With 'school strikes for climate' organized on 'Fridays for future' they have been following the example of the Swedish Greta Thunberg. Thunberg, 15-years-old at the time, started the strike initiative to demand that governments and other stakeholders take action against climate change. As an educator, students' reactions to futures made me wonder how mainstream geography education deals with the future times perspective. Are futures being explored?

Students who worry about futures might benefit from explorative education that explicitly studies different options for futures. For many educators, however, teaching about futures is uncommon (Bishop, 2014) or even problematic, as it is considered too abstract and not easily categorized as part of a specific school subject (Hicks, 2012a). Morgan (2006) argues that: "The future – preparing young people for adult life – is arguably what all education is for, yet remarkably little attention is paid to it overtly throughout the curriculum in classrooms and schools" (p. 276).

Current times, however, might bring change, since there is an increased awareness of discontinuity that urges futures thinking, including in education (Dorling & Lee, 2016; Hicks, 2017). Scientists, governments and businesses frequently publish about global challenges such as climate change, migration, poverty and virus pandemics. Such complex issues are characterized by an unprecedented rate of change (De Miguel González, Bednarz & Demirci, 2018; Wals, Weakland & Corcoran, 2017). It is becoming more and more clear that past performances are not necessarily a guide to the future (Organization for Economic Co-operation and Development, 2018; United Nations Educational, Scientific and Cultural Organization, 2015). Challenging global issues require forward-looking responses. "With the future arriving ever faster with an ever-increasing need for adequate, timely responses to a rapidly changing world, and with the future increasingly the result of human actions, foresight is more important today than ever before" (Bell, 2009, p. xxiii).

Unfortunately, in earlier times when societal attention for futures peaked, this did not result in structural improvements towards more futures-oriented education. An important early call for a focus on futures came, for example, in the 1960s and 1970s. Then, several scholarly

publications drew attention towards futures, such as '*Silent Spring'* (Carson, 1962), '*The Tragedy of the Commons'* (Hardin, 1968), '*The Limits to Growth'* (Meadows, Meadows, Randers & Behrens, 1972) and '*Future Shock'* (Toffler, 1970). The report '*The Limits to Growth'*, published by the interdisciplinary 'Club of Rome', concluded that growth trends in world population, industrialization, pollution, food production and depletion of resources could reach planetary limits within a century. One way to address the future environmental and socio-economic challenges listed by the Club of Rome was through the invention of the new concept of 'sustainable development' (World Commission on Environment and Development, 1987), referring to development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 16).

For education, a response to the problems listed by the Club of Rome was outlined in the study '*No Limits To Learning'* (Botkin, Elmandjra & Malitza, 1979). It concerned an empowering approach for teaching about a global, dynamic 'world problematique'. One of the key concepts was 'innovative learning', complementary to maintenance learning. The authors already saw great potential in what humans can do if they are not taken by surprise but instead understand the situation at hand: "The first prerequisite of innovative learning is understanding" (p. 20). With knowledge as a point of departure, they pledged to use it in futures thinking. "To be a good educator necessarily implies that a teacher be future-oriented. Increasingly, the best teachers are those who have developed and can communicate a sense of the future" (p. 27).

The above-mentioned publications illustrate that future times, to a certain extent, have been the subject of monitoring and planning over the last half century (e.g., Meadows, Randers & Meadows, 2005; UN General Assembly, 2015). Also in education, conceptual frameworks and projects concerning futures were developed, in particular in the United Kingdom, Australia and the United States (Gidley, Bateman & Smith, 2004). At the same time, however, it remains doubtful whether futures are seriously taken into account in society and education (Huckle & Wals, 2015). Ultimately, the tension between human demands and planetary constraints is still a very problematic challenge in the 21st century world (Martin, 2011; Meadows et al., 2005; Roberts, 2011; UN Environment, 2019). Also in education, enduring attention for futures on the curricular level is hardly seen (Hicks, 2012a). Even successful futures education initiatives often lack long-term support and do not seem to get beyond the level of individual schools (Slaughter, 2004).

1.2. Research Question

As it appears to be difficult for future times to receive enough lasting consideration in education, this raises the following questions: What are the hurdles that inhibit successful projects to become permanently embedded? Why is conceptual thinking about futures in education not yet part of curriculum debates? And how can this be improved? The aim of this research is to discover how attention for futures in education can be enlarged.

The main research question of this thesis is:

How can students' envisioning of futures in school geography be enhanced?

Envisioning concerns an explorative process of study, imagination and evaluation of futures (Hicks, 2012a; Wals et al., 2017). The focus of the thesis is on envisioning futures in school geography in upper secondary education in the Netherlands.

This study draws upon theoretical expertise from two main fields: futures education and geography education. These fields will be explored in the next two sections, with a brief description, a look at their research agendas, and a selection of their key concepts. This is followed by a short section with key concepts from the educational sciences and a final section with an overview of the studies that will be presented in this thesis.

1.3. Futures Education

The field of futures education offers expertise for exploring multiple global futures as a context for making choices. Futures education is a subfield of the academic discipline of futures studies (Bell, 2009) which:

> came into being because people of good will and intelligence in many different cultures began to realize that the future was no longer something that would unproblematically unfold from the past and present. As humanity became more self-aware, more numerous and equipped with increasingly powerful technologies, the future became the result of human perception, responsibility and action. (Slaughter, 2009, p. 18)

Futures education translates concepts from the futures field, such as forecasting and predicting (Bell, 2006), into learning experiences that take students away from outdated industrial era worldviews into integrated forward-looking worldviews (Gidley & Hampson, 2005; Hicks, 2012a). Since its introduction in the 1960s (Slaughter, 1987), the field of futures education has known periods of bloom, with prolific publications and promising projects, such as the British Global Futures Project (Hicks, 1991) and the American Future Problem Solving Program (Slaughter, 2002). Despite these successes, futures education has not yet had the impact or staying power that futures researchers aim for (Gidley & Hampson, 2005). Hicks and Gidley (2012) distinguish three main constituent parts that have developed in the field:

1) Youth futures, focused on the views and visions of the future that young people hold. Much of the early futures education research focused on youth futures. In general, students appear more confident about personal futures than about national or world futures (Eckersley, 1997; Hutchinson, 1996);

2) Futures *in* education, referring to the teaching of futures concepts and processes in schools. Its key aim is to develop long-term thinking and to envision multiple futures instead of one short-term scenario (Bell, 2009; Inayatullah, 2008). Major contributions to futures in education, both on a conceptual and applied level, came from Hicks and Slaughter (Beare & Slaughter, 1993; Hicks, 2006; Hicks, 2012a; Slaughter, 2008a).

3) Futures *of* education, reflecting on how education at all levels could and should develop in the future. Researchers in this part of the futures field criticize the dominant 'business as usual' model of education (Milojevic, 2005; Slaughter, 2008a). They advocate for a more innovative educational philosophy.

This research focuses on the second constituent part mentioned above: the study, imagination and evaluation of futures *in* education, by thinking ahead about geographical issues and challenges (e.g., climate change, urbanization). "The notion here is that we cannot move towards a future we prefer, unless we are able to imagine it" (Hicks, 2012a, p. 55).

Futures education is a young and inviting field with a broad research agenda, containing a wide range of creative and innovative research questions (Gidley & Hampson, 2005). Quite a number of these research questions relate to the present study: for example, because of their focus on young people's capacities to imagine futures or on whether the futures education field can provide strategies to better support innovative teachers (Gidley & Hampson, 2005). Intervention studies do not seem to be part of the futures education agenda, as described by Gidley & Hampson (2005). However, an intervention study can be considered complementary to the current research agenda, as it may clarify the feasibility and the results of futures education in practice. This study aims to make such a contribution, by using and testing existing concepts and approaches for futures *in* education.

The currently available conceptual and practical materials within the field provide a rich basis for design research in secondary schools. Especially the contributions made by Hicks (Hicks, 2007, 2012) and Slaughter (Slaughter, 2008a; Slaughter & Beare, 2011) have been plentiful. The key concepts focused on in this dissertation are:

- *multiple futures,* to stress futures' openness (Bell, 2009; Van Steenbergen, 2005). It can concern probable, possible, and preferable futures (Bell, 2009; Hicks, 2007) that are studied, imagined and evaluated;

- *trends* (Hicks, 2007; Slaughter & Beare, 2011) to study developments that are expected to be influential in futures;

- *scenarios* (Hicks, 2007; Slaughter, 2002) as narratives based on trends, in order to study and compare multiple futures.

1.4. Geography Education

Futures education literature explicitly refers to geography education as suitable for futures exploration (Hicks, 2007; Hicks & Gidley, 2012). This suggestion does not surprise, since *change* – so closely related to futures education – is one of the key concepts in geography education (International Geographical Union Commission on Geographical Education [IGU-CGE], 2019; Van der Schee, 2007; Taylor, 2008).

The geography education literature offers concepts and innovative approaches for futures-oriented geography teaching and learning (Béneker, 2013a; Lambert & Morgan, 2010; Morgan, 2006; Roberts, 2011; Taylor, 2008). For example, the transatlantic collaborative GeoCapabilities project, which provides a framework for understanding the purposes and values of geography education (Solem, Lambert & Tani, 2013), explicitly incorporates futures. The project posits a threefold arrangement of geographical knowledge: "a deep descriptive 'world knowledge'; a theoretically-informed relational understanding of people and places in the world; and a propensity and disposition to think about alternative social, economic and environmental futures" (p. 215).

School geography primarily aims at teaching students not to dread but to expect change (Lambert & Morgan, 2010). Geography knowledge and skills can help students to analyze and better understand change, from local to global (IGU-CGE, 2019) and concerning multiple dimensions (Commissie Aardrijkskunde Tweede Fase, 2003). Also, imagining and anticipating futures is increasingly acknowledged as a task for school geography (Béneker & Van der Schee, 2015; Morgan, 2015; Roberts, 2011). An example of innovative and futures-oriented education at school level is the Dutch Geo Future School initiative: a network of

schools that organizes futures exploration in cooperation with companies, governmental and science institutions. Students analyze, imagine and evaluate futures of complex and real challenges in society (Adriaens, 2018), such as responsible tourism or sustainable housing. Despite these valuable examples of innovative, futures-oriented geography education, mainstream geography classes are frequently still characterized by 'business as usual' maintenance learning, directed at remembering and understanding facts and concepts, because this is what is required in mandatory national exams (Bijsterbosch, 2018; Krause, Béneker, Van Tartwijk, Uhlenwinkel & Bolhuis, 2017; Wertheim, Edelsohn & The Road Map Project Assessment Committee, 2013). Accountability and tight curriculum prescriptions put pressure on teachers and students in schools (Bijsterbosch, Van der Schee & Kuiper, 2017; Mitchell, 2016). The focus on facts and concepts leaves less time for a contemplative, holistic view of complex global issues, let alone of the futures of these issues. This might explain why students' views on futures are not so innovative, explorative or imaginative (Hicks, 2007; Béneker & Wevers, 2013). Instead, students often express simple, stereotypical, scenarios such as a future in which technology fixes all problems or a sustainable future in which human demands put no pressure on natural constraints (Hicks, 2007).

Moreover, research into these points of improvement for futures in geography education is not mentioned in two authoritative geography education research agendas: the American '*Road Map for 21st Century School Geography*' (Bednarz, Heffron & Huynh, 2013) and the global '*International declaration on Research in Geography Education'* (IGU-CGE, 2015). When the future is mentioned in these two agendas, it concerns future research needs, topics and intentions, none of which explicitly focuses on futures exploration. The reference in the Road Map that comes closest to futures education mentions "Change" as one of geography's main crosscutting themes, related to geography's core idea that: "Geography can help to interpret the present and plan for the future" (Bednarz et al., 2013, p. 50). The Road Map derived both the cross-cutting theme and the core idea from the '*Geography for life National Geography Standards'* (Heffron & Downs, 2012). The IGU-CGE Research Declaration also refers to futures education indirectly, as it states its support for the International Charter on Geographical Education, which was published by the same Commission in 1992 and revised in 2016 and 2019. This charter stresses the relevance of geography education for "the present and future world" (IGU-GCE, 2019, p. 1) and mentions "futures education" (p. 6) as an example of a relevant research theme. Hence, in conclusion, although the research agendas do not specifically refer to research about futures in education, they do acknowledge that educating about future times is part of school geography. An empirical study that focuses on how to tackle hurdles for futures education in school geography can complement these geography education research agendas.

The available conceptual and practical materials published by geography education researchers provide an extensive basis for a study of futures-oriented geography in secondary schools. The key geographical concepts focused on in this study are:

- *Humans and nature* (IGU-CGE, 2019), as geography studies how humans and nature shape environments (Geographical Association, 2012). School geography looks at how natural/ecological, economical, socio-cultural and political processes interplay and in what future environments this interplay may result (Koninklijk Nederlands Aardrijkskundig Genootschap, 2017);

- *Local and global* (IGU-CGE, 2019), as geography looks at futures on different scales, as well as at their interconnections (Jackson, 2006; Van Ginkel, 2002);

- *Place and space* (Commissie Aardrijkskunde Tweede Fase, 2003; Fögele, 2017) in order to develop sight into the specific characteristics of locations and regions, as well as into their positioning in a larger, interconnected world, including in futures (Lambert & Morgan, 2010);

- *Diversity and interaction* (Taylor, 2008) in order to include the differences within and between locations and to understand their interrelatedness (Van der Schee, 1987; Smith, 2015; Van der Vaart, 1991), both currently and in futures;

- *Change* (Taylor, 2008) which drives human and natural processes. Analyzing changes in environments, from the past to the present, can inform students about ways to anticipate futures (Krause, Smit & Béneker, 2019; Roberts, 2013);

- *Perception and representation* (Taylor, 2008), since a geographical way of understanding takes a range of different perspectives on the world into account. Personal perceptions of the world vary and can affect people's representations of current and future worlds (Massey, 2006; Bosschaart, 2019).

1.5. Educational Sciences

In addition to the literature on futures education and geography education, this study also uses insights from the educational sciences. It concerns, for example, literature about educational design research (e.g., Van den Akker, Gravemeijer, McKenney & Nieveen, 2006) educational neurosciences (e.g., Jolles, 2016), and student creativity (e.g., American Psychological Association, 2015). The key concepts focused on are:

- *Learners' voice* (Eisner, 1982; Hicks & Gidley, 2012; Hopwood, 2011; Robertson & Burston, 2015), referring to the views and ideas that students express. Especially for the imagining of future worlds, new, creative voices are needed (Hajer, 2017; Robertson, 2016). Working with learners' voices enables the use of students' "natality" (Arendt, 1958, p. 9), which refers to students' ability to start new, unpredictable initiatives (Hermsen, 2014);

- *Teachers' adapted support*, which is tuned in to the learner's present state of understanding. Adapted support is also referred to as "contingent support" (Van de Pol, Volman & Beishuizen, 2010, p. 275). An example of adapted support is differentiated feedback on students' futures thinking. The future is not fixed (Slaughter & Beare, 2011), and by giving adapted, differentiated feedback, teachers can avoid the transmission of a delusive, knowable future. At the same time, the future is not completely open (Dator, 2002), and feedback can teach students not to believe that 'anything goes' in futures thinking. Teaching is, in other words, a balancing act (Nabers, 2016; Hermsen, 2013) between conservation and innovation. Adapted support can assist in finding such a balance.

1.6. Overview of and Relation Between the Studies in This Thesis

This thesis is based on four studies, of which three have been published as scientific journal articles. The first two studies, presented in Chapters 2 and 3, have an exploratory character: they examine the problem of the future time as a missing perspective in geography education and explore the literature about the existing approaches of futures in education. The final two studies, presented in Chapters 4 and 5, concern the design of an intervention and its results.

Data for these two studies were gathered in the highest track of upper secondary education in the Netherlands. The conclusion summarizes and interprets the main findings. Each chapter will be briefly introduced here.

In Chapter 2, the status of futures approaches in Dutch geography education in secondary school will be examined and outlined. The aim was to determine the initial situation that was intended to be improved. The study used a mixed-method approach. The chapter first describes different types of educational materials, from visionary documents to school exams in a quantitative analysis. It then reports on the discussion of the findings with various stakeholders, using a qualitative approach.

In Chapter 3, the scope will be broadened, by means of a wide-ranging study of documents from different countries concerning futures in education. The aim of this study was to determine the position and the potential of school geography concerning educating about futures. By close reading and analysis, insight was gained into existing approaches to futures education in geography. Existing approaches were evaluated to determine strengths and weaknesses. This has shed light on the possibilities for enhancing futures-oriented school geography, by incorporating concepts and pedagogical ideas from the studied discourses.

In Chapter 4, an Educational Design Research phase will be described that resulted in design principles and a lesson series. Based on the key concepts and pedagogies deduced from the fields of futures education and geography education, two prototypes were designed and tested. The aim was to enhance students' envisioning of futures by finding the right balance on two accounts: the balance between the use of knowledge and the use of imagination, as well as the balance between students' self-guidance and teacher guidance.

Chapter 5 will report on students' ability to envision scenarios of urban futures after a lesson series based on futures education. It shows whether students' ability improved after the lesson series and also discusses what students' scenarios for urban futures actually show. This study used a mixed-method approach. First, in a quantitative analysis, students' scores were studied before and after the lessons. The scores concerned different aspects of futures thinking, such as application of knowledge about trends, creative scenario design, and critical scenario evaluation. After that, the students' scenarios were analyzed, using a qualitative approach. The analysis focused on students' ability to combine knowledge and creativity.

In Chapter 6, the Conclusion and Discussion sections return to the research question and summarize and interpret the most important results. The limitations of the study are also reported, and, finally, suggestions for further research are made.

Chapter 2. A Futures Perspective in Dutch Geography Education

This chapter is based on the following publication:

Pauw, I., & Béneker, T. (2015). A futures perspectives in Dutch geography education. *Futures, 66,* 96-105.

Abstract

Geography education offers many possibilities for futures education. In the Netherlands, a future perspective is obvious in the vision behind the curriculum for secondary education, but this perspective becomes thinner and less open when elaborated in the syllabus, textbooks and examinations. From an intended ideal curriculum with challenging future relevant issues and a call for scenario thinking, it changes into a presentation of a fixed and often negative future in the perceived implemented curriculum. In a focus group meeting with stakeholders of the geography educators community there is recognition of the importance of a futures perspective. But there is also uncertainty and unfamiliarity, when it comes to implementing a futures perspective in geography education. Moreover, the institutional constraints, with an output testing regime, prevent the geography educators from making substantial room in their implemented curriculum for futures education. To enable geography teachers to implement or improve a futures perspective in their education, more clarity about the function and form is necessary. By researching and supporting good teaching practice, the expertise needed can be built, extended and used to empower a lobby advocating a more supportive national policy.

Keywords: *futures education, geography education, curriculum, innovation, Netherlands*

2.1. Introduction

Although the importance of a futures perspective in education is broadly acknowledged, the implementation of a futures dimension in schools is far from easy (Hicks, 2012a; Slaughter & Beare, 2011). Even where futures education pilots and experiments were successful (e.g., in the US and Australia in the 1990s), it proved to be complicated to give the future perspective a structural place in curricula and classroom practices (Slaughter, 2008a). As a reason, current neoliberal societies' tendency to be short-sighted in terms of time is often mentioned (Slaughter, 2008a). The Dutch situation clearly fits this pattern. In the case of geography education, a Vision Document (Commissie Aardrijkskunde Tweede Fase, 2003) published in 2003 for a new geography curriculum in upper secondary schools, mentions a stronger futures orientation as an intended innovation. However, the implemented new curriculum that came out of this, from 2007 onwards, only weakly reflects this intended innovation. This study researches the process of the 'thinning' of this innovative futures oriented intention from the intended curriculum to actual school examinations. The process is detected and analyzed in Sections 2.3 to 2.5, after a brief introduction of the key ideas in futures education related to geography (Section 2.2). Moreover, in Section 2.6, we present an explanation for the limited effects of this innovation so far, based on discussions with an expert panel. Section 2.7 discusses what we can learn from this research.

2.2. Futures Education and Geography Education

On the relevance of futures education, Slaughter (Beare & Slaughter, 1993) asks the important question: "Why bother? Why ask anyone to think ahead when there are so many pressing demands in the here-and-now*?"* (p. 107). The answers of futurists (Bell, 2009; Bussey & Inayatullah, 2008; Hicks, 2007) to this central 'why' question share the ambition of enlarging our 'steering capacity' concerning future developments. Also in publications on the relevance of futures perspectives and pedagogies in school geography (Lambert & Morgan, 2010; Morgan, 2006; Roberts, 2003, 2011; Smith, 2013) we see this pledge for more conscious action. Every day we scan the near future, mostly unconsciously, when we plan our daily life. We should also utilize this capacity in less trivial cases and on a larger scale. This might bring great advantages in terms of avoiding crisis management. Change and its effects are accelerating in speed, impact, and scope, making it even more necessary to deal with our influence in a more conscious way. Bussey and Inayatullah (2008) argue for 'a critical distance from the present' when thinking about more innovative and creative responses to challenges. Geography, with its focus on features and processes of our world at various scales and from different angles, offers many opportunities for taking such a distance. The point of studying geography or studying futures is not to control or predict, but to recognize the influence of the assumptions we have about the world and the future and to understand alternatives as a context for choice. Slaughter and Hicks, among many futurists, call for choices towards a sustainable future (Botkin, Elmadjra, & Malitza, 1979; Hicks, 2012a; Slaughter, 2010).

Futurists are not the only ones to be concerned. Young people in Western countries express fear for the future when asked about their idea of the national or global future (Reynié, 2011). They seem to expect a grey or even black continuation of current national or global issues (Hicks & Holden, 2007). Often, simplified stereotype images of the future dominate Western (young) people's minds. Most common are four future images: 'business as usual', where the future contains issues similar as today; 'technological fix', where solutions come from technological developments; 'edge of disaster', where more catastrophes will appear; and, finally, least common, 'sustainable development', requiring a fundamental change towards a

more ecological, holistic world view (Béneker & Wevers, 2013; Hicks, 2001; Hutchinson, 1996). The media seem to influence and reinforce negative images (Van Ginneken, 1998), and the main questions are whether and how education can support young people to create richer and more positive images.

In current educational practice, the future is mostly addressed implicitly and in general, 'taken for granted' terms (Bateman, 2012; Gough, 1988). In contrast to this, futures education invites students to literally 'explore the future' (Hicks, 2001): to look at futures critically and creatively, obviously on the basis of relevant knowledge and skills. Hicks (2007) suggest to use the classification often used by futurists which distinguishes between possible, probable, and preferable futures (Bell, 2009, p. 73). Hicks' advice is to focus on the latter two futures in classrooms: *probable futures* − images of what is most likely to come about − and *preferable futures* − versions people would like best, based on underlying values and beliefs. A clear notion of one's preferable future may give direction to actions in the present. While exploring and envisioning alternative future images, students become aware of the factors underlying future images: how they vary between people, and why they do; how they differ in consequences for future generations; and how they affect priorities in the present. In terms of content, futures education covers global and local issues of sustainability, wealth and poverty, peace and conflict, and human rights. These issues are part of geography curricula all over the world. Futures perspectives on such issues help students to become more adaptable and proactive to change (Hicks, 2001). As Lambert and Morgan (2010) phrase it in a capabilities approach: geography is a subject that can contribute to young people's "propensity and disposition to think about alternative social, economic and environmental futures"(p. 65).

Rogers and Tough (1996) describe what the process of learning for the future requires. In a first, rational phase, students obtain information, knowledge or theories on future issues. This cognitive exploration of the future will often evoke an emotional reaction. Considering the complexity of global future issues and the uncertainty and risks involved, this affective reaction is often negative (e.g., fear, denial, retreat, and passivity), functioning as a protective defence mechanism. Teaching and learning processes unfortunately often stop here. But for futures education, it is of great importance that teachers help students move beyond such first, unconstructive reactions to an existential phase of reflection in which they recognize and articulate their own images of the future. This 'personal lens' is vital, because it relates to a person's value orientation, just as images of the future do (Van Egmond & De Vries, 2011). The combination of knowledge and value clarification is also the source of empowerment towards preferable futures; it opens doors to alternative, sometimes counter-intuitive views on global issues. This deep learning process, focused on the self and the future, strengthens students, and creates commitment and hope, which is needed for informed choice and action (Morgan, 2006; Rogers & Tough, 1996) towards a preferred future.

2.3. A Future-Oriented Geography Curriculum in the Netherlands?

Geography is an optional subject in upper secondary education, and is chosen by one-third of all students (Béneker, 2013b). In 2007 a new geography curriculum in upper secondary schools was implemented, based on a Vision Document, entitled *Regions in Perspective*, written by a commission of the Royal Dutch Geographical Association (KNAG) (Commissie Aardrijkskunde Tweede Fase, 2003). The vision and the curriculum stemming from it contain a better balance – compared with the curriculum that was in place at that time – between global perspectives and local/regional studies, and between the social world (human geography) and the natural world (physical geography). It creates bridges between the global and the local (such as effects of globalization in specific places) and between society and

nature (with regard to climate change issues, for example). This is reflected in the broad outlines of the proposed new curriculum (see Table 2.1). The underlying goal is to create, in a way that is attainable at school level, a 'state of the planet awareness' (Hanvey, 2004, p. 7).

Table 2.1

Vision Document –Broad Outline of Proposed Curriculum

<table>
<tr><td rowspan="2">Domain A Skills

Geographical approach and research: formulating geographical questions; processing geographical information; presenting results</td><td>Domain B World

Human geography: political, cultural and economic patterns and processes at different spatial scales in the context of globalization</td><td>Domain C Earth

Physical geography: patterns and processes for understanding the earth as a system (including 'global climate change' on which we focus later in this study)</td></tr>
<tr><td>Domain D Region in the developing world

Functions as a regional case study</td><td>Domain E Living Environment

Contemporary spatial issues in the Netherlands (including 'water issues in the Netherlands', on which we focus later in this study)</td></tr>
</table>

With regard to pedagogy, there was a strong basis for keeping the former curriculum's focus on traditional skills in place (such as analytical skills, information skills, learning skills). However, the Vision Document also pledges for skills needed in more open, explorative and collaborative learning. In general, geography classes in the Netherlands strongly rely on studying texts and sources (like maps, photos and graphs), and then processing this information through a large number of assignments. Textbook series are designed to be the number-one, and often only, source during a geography class (Béneker & Van der Vaart, 2010). The innovative approach advocated by the Vision Document would counteract and supplement the current mainstream practice.

For a number of reasons, the Vision Document and its intended new curriculum may be seen as a futures-oriented innovation. First of all, the report states the importance and urgency of futures education (Commissie Aardrijkskunde Tweede Fase, 2003, p. 16). Secondly, the chosen content fits into the framework of issues as recommended by Hicks (2001, 2012) for futures education. Controversial global issues are included (climate change; the global food issue) as entry points for enquiry and debate. The inclusion of the Dutch spatial policy agenda invites teachers and students to become engaged in future-oriented classroom activities about topics such as flooding risks and urban issues. Thirdly, the report advocates a pedagogy for open, critical and creative thinking beyond stereotype probable futures.

The Vision Document seems a good starting point for the design and implementation of futures-oriented geography education. Educational research has shown, however, that the road from a curricular vision to an actual curriculum in school practice is long and bumpy (Bednarz, 2003; Goodlad, Klein, & Tye, 1979; Nieveen & Kuiper, 2012). Using Goodlad et al.'s approach (see Table 2.2), we can position the KNAG report and its vision as the 'ideal

intended curriculum'. In line with Dutch national regulations, the ideas of the KNAG report were 'translated' into a rather detailed and formal syllabus: the 'formal intended curriculum' (reference: syllabus (College voor Examens, 2010) and handreiking (Stichting Leerplan Ontwikkeling, 2007)). This syllabus in its turn became an essential source and guideline for textbook authors. The resulting textbooks are an important part of the 'perceived implemented curriculum', particularly because in the Netherlands textbooks largely define what is happening in the classroom (Van den Berg et al., 2009). The syllabus is also used by the teams who construct the national centralized examinations for geography at the end of upper secondary education. These national exams can be seen as part of the 'curriculum in action' (operational implemented curriculum), and are very influential in teaching practice because 50 per cent of a student's final grade depends on them.

Our research focuses on how the innovative intentions of the Vision Document were 'translated' (here meaning: diluted), stepwise, into 'practice'. Sections 4 and 5 respectively present the methodology and the results. It should be stressed however, that the 'attained curriculum' (see Table 2.2), which is the highly diverse actual daily practice in schools, was excluded from our analysis.

Table 2.2

Goodlad et al.'s Curriculum Model (1979)

Intended	Ideal Formal	Vision, philosophy Intentions specified
Implemented	Perceived Operational	Interpretation user Curriculum in action
Attained	Experiential Learned	Perceived by learners Outcomes of learners

2.4. Methodology

The occurrence and nature of futures perspectives in the syllabus, textbook series, and national examinations were explored on the basis of a content analysis (Dogra, 2012; for a practical application, see Krippendorff, 1989). We combined a quantitative approach in order to identify the importance of a futures perspective and a qualitative approach in order to get a more holistic view on the nature of a futures perspective.

2.4.1. Defining units of analysis

In terms of content, we selected two themes from the Vision Document with the most pertinent references to a futures orientation, i.e. '(global) climate change' (part of domain C, Table 2.1), and 'water issues in the Netherlands' (part of domain E). Climate change is part of the school exam, whereas 'water issues in the Netherlands' is part of the national examinations.

As unit of analysis the following sources were selected:

- from the syllabus: the formulated goals and objectives derived from those goals;
- from the textbooks of two market leading textbook series; a) text units of minimally two continuous lines up to a paragraph and b) assignments.
- from the national examinations: questions on 'water issues in the Netherlands' between 2010 and 2013.

The units were identified by close reading, looking for direct and indirect references to the future: *direct*, in the sense of indications of a future time: 'in 2030' or 'the climate in the future' (Van den Berg et al., 2011a); and *indirect,* where, for example, developments and trends were described with probable continuation or consequences in the future, e.g., "the Netherlands can't escape entirely from the combined effects of climate change, subsidence and sea level rise…" (Bulthuis, Gerits & Van den Bunder, 2012, p. 27). To increase reliability, the identification and analysis of the units was done by both authors independently and all interpretations were discussed and cross-checked together. Table 2.3 shows to what extent the future was present in the selected documents.

Table 2.3

Presence of 'the Future' in the Analyzed Documents

Document →	Intended Formal curriculum = Syllabus	Intended Written curriculum = Text in textbook series	Intended Written curriculum = Assignments in textbook series	Implemented Operational curriculum = Questions in National Examinations
Occurrence of future(s) ?	2 of 6 goals 2 of 22 objectives	25 text units in 166 textbook pages	92 of 433 assignments	4 of 33 questions

2.4.2. Coding the units of analysis

For the coding of these selected units the following questions were used:

1. **Are multiple futures explored**? Is the future presented as open rather than fixed? For every unit of analysis this question can be answered with yes or no;

2. **Is a preferable future referred to?** Do texts or assignments refer to a desirable future? For every unit of analysis this question can be answered with yes or no;

3. **What future scenarios are presented**? The scenarios or images of the future were labeled by using Hicks' four most common scenarios of the future mentioned in section 2 (Hicks, 2001). As an indicator for the scenario *Business as Usual*, we looked for key words expressing confidence in human capability to solve future issues ('nothing that can't eventually be effectively dealt with' (Hicks, 2001, p. 232). For the scenario *Technological Fix*, we looked for references to (solutions in) technology and science. For *Edge of Disaster*, we sought (ecological, economic, political or cultural) fundamental disruption. And for *Sustainable Society*, key words were sustainability itself and other terms indicating a major shift away from materialism.

For the analysis of the selected assignments in the textbook series and the selected questions from the national examinations, we added one extra question:

4. **To what extent can a futures pedagogy be seen in the assignments and is this pedagogy tested in the national examination questions?** A futures pedagogy is operationalized through the following questions:

    a) Do the assignments contain steps beyond the first rational stage of learning for the future (Rogers & Tough, 1996) (e.g., formulating grounded opinions and value clarification)?;

    b) Do the assignments invite to creative exploration of futures, as advocated by Hicks (2001)?

For every assignment (textbooks) and question (national examinations) the answer can be yes or no on these a and b questions.

After the process of coding the units of analysis based on question 1-4, we took a next step with a qualitative interpretation. In order to get a more holistic overview we did a close reading of all the units of analysis together, per source (syllabus, textbooks or exams). This way the results of the counting process are integrated and interpreted in their context (Devereux, 2007).

In section 5, we present the outcomes of the content analysis. On the basis of the results of this analysis, we decided to organize a panel evaluation on these outcomes. Content analysis is best combined with other methodologies that focus on 'producers' and 'consumers or audiences' of the text in order to better understand the meaning of the texts (Devereux, p. 192). Goal of this expert meeting was to explain and discuss our results together. In the interest of a logical, chronological structure in this study, the aim and approach of this panel evaluation are further described in Section 2.6.

2.5. Content Analysis Results

In this section, the results of the content analysis are shown. First, Table 2.4 shows the results of the quantitative part of the content analyses and its headlines (qualitative). The Table is structured according to the four analysis questions in the former paragraph. The results are clarified further with the use of typical examples from the sources: syllabus (College voor Examens (CVE), 2010; Stichting Leerplan Ontwikkeling, 2007), books (Bulthuis et al., 2012;

Van den Berg et al., 2011a, 2011b, 2013a, 2013b; Van den Bunder, Padmos & Van Wanrooij, 2011) and exams (CVE, 2010, 2011, 2012, 2013). Also, a short summary per source is given.

Table 2.4

Summary of Findings: Futures in Syllabus, Textbooks, National Examinations on the Selected Themes 'Climate Change' and 'Water Issues'

Units Of Analysis	**Multiple Futures**	**Preferable Futures**	**Futures Images?** **In row 3 & 4: Futures Pedagogy?**	**Qualitative Summary**
Syllabus: Goals (2) and Objectives (2)	 0 goals 1 objective	 2 goals 1 objective	1 x Sustainable society 1 x Technological fix	A sustainable future is presented as preferable and technology is presented as the means to get there.
Text units in textbook series (25)	17	0	11 x Business as usual 14 x Technological fix 8 x Edge of disaster	Future(s) images are mostly presented as containing future issues mankind can deal with, business as usual, with the help of technology and science, technological fix. A negative undertone expressed the edge of disaster-scenario frequently.
Assignments in textbook series (92)	48	13	1 x Business as usual 11 x Technological fix 7 x Edge of disaster 3 x Sustainable society Futures Pedagogy? 1 assignment on *'forming'* an opinion. No exploration or creativity.	Future(s) images are frequently threatening (edge of disaster) but technology rescues, although threat and rescue are more nuanced than in the texts. Also, sustainability is mentioned. Future pedagogy almost absent.
Questions in National Examinations (4)	2	1	2 x Business as usual 2 x Technological Fix No Futures Pedagogy	The image is of a future in which technology helps us to deal with business as usual issues towards a known, preferable, alternative. A futures pedagogy is not visible.

The table shows a clear general picture. Multiple futures are present but outnumbered by fixed future images. Preferable futures are in an even greater minority. In the futures images a clear dominance of the Technological fix scenario can be seen, often combined with a Business as usual scenario. The assignments and examinations do almost nowhere present steps for students to go beyond a cognitive phase and they do not invite students to think open and creative about futures. Examples per source will clarify this general picture further.

The **syllabus** requires students to take sustainability into account and judge governmental policies, on climate change and spatial planning. One of the two future oriented goals requires the student to include aspects of sustainable development, when forming an substantiated opinion on current issues of flooding in the Netherlands. This goal is further elaborated in a number of objectives, of which one is indirectly futures oriented: "the student can judge the management of the Dutch coastline, seen from the perspective of the natural processes and from the ecological and economic value of the coastline*"* (College voor Examens, 2010, p. 39). This illustrates how the syllabus implies futures and expresses, very indirectly, a preferred sustainable future. The syllabus emphasizes smart management and technology as key factors for attaining sustainability. The goal statements give no clues for an open and imaginative exploration of future water and climate issues. There are also no suggestions for classroom pedagogies like there were in the Vision Document, since the syllabus is a document on content.

In the futures-oriented **texts** (of the textbooks**)** the multiple-future scenarios are mentioned now and then. Awareness of the fact that we do not know what will happen is also expressed in words like 'possibly*'* or 'possible consequences*',* and is explicit in statements such as *"*If one thing became clear, it is that, within climate studies, a lot is still unclear…*"* (Van den Bunder et al., 2011, p. 110). The acknowledgement of the importance of the future can be seen in paragraph titles as "Sustainable energy" (Van den Bunder et al., 2011, p. 128) and "The climate in the future" (Van den Berg et al., 2011b, p. 58) (although one liners are formally not part of the analysis). But, besides these openings towards multiple futures and promising headings, the general tone in future- oriented texts is that of presenting the probable way or ways (a few scenarios) things are going to be. Most references to the future are not formulated in terms of 'what could happen', but in 'what is going to or will happen'. The fixedness is shown in the strong verbs used: 'shall and will' dominate over 'might or could', e.g., "Snow and ice coverage of the earth surface will diminish" (Bulthuis et al., 2012, p. 27). Besides being fixed, the texts are often negative about future possibilities and developments, as seen for example in this line presenting the "effectiveness contrast: what is effective to diminish global warming is not obtainable on an international scale, and what is obtainable is not effective" (Van den Bunder et al., 2011, p. 89). This confirms the idea of little flexibility and opportunity for improvement. One textbook paragraph on 'the climate in the future' begins with relating the debate on climate to the day of judgment in the Bible and Koran and ends with: 'Ouch, that was a lot of trouble!'. A clear reference to the edge of disaster scenario. The authors seem to be aware of this negative tone and continue in the same paragraph: "Just like geography, sometimes it is complicated and seems like a problem, but actually it is a tremendous fascinating challenge" (Van den Berg et al., 2011b, p. 59). The chapters generally show the same structure: first, students are informed about the central facts and processes behind climate change and the Dutch water issue. Then a policy overview is given. This could give the impression of matters 'being (technically) under control' or being nothing new: 'business as usual'. But then, the books pledge for a change in these policies. A chapter on climate policy, for example, ends with a comment on the western oil addiction: "It is time for a good alternative" (Van den Berg et al., 2011b, p. 61). And, when evaluating the

policy on water issues, the conclusion is: “time for a change of approach” (Bulthuis et al., 2012, p. 28). In other words: the textbooks first present the issues as more or less under control, so ‘business as usual’ and ‘technological fix’ and then dismantle this completely. This could open doors to thinking and debate about future developments. Unfortunately, the texts do not give any substance or direction for this next step.

The **assignments** could have continued when the texts end, by making the step towards thinking and talking about futures. But the assignments show the same pattern as the texts: students are not encouraged to think about the future, but mostly need to apply information from the books to a (number of) fixed probable future(s), presenting what should be prevented (edge of disaster) through policy based on technology. Interestingly, the image of both disaster and fix in the assignments are nuanced a little. For example; an assignment on flooding asks: “In what two ways is this solved at short notice?” (Van den Berg et al., 2011a, p. 95) expressing that not all is knowable on the long term. Even where key concepts of futures education are mentioned, students are not stimulated to use them in an effective way. As an example to illustrate this, a textbook says: “Formulating a future expectation (1) is of little use if one is not willing to look at the consequences for the present (2)” Van den Bunder et al., 2011, p. 106). The assignment is: “What concepts are applicable for number 1 and 2?”. Students can copy the concepts, being forecasting and back casting, literally from an identical line in the textbook. So an important notion in futures education is reduced to a matching assignment that can be done without any idea of the content. The majority of the futures-oriented assignments focus on the correct application of information; it is thinking in a future setting, not about futures, e.g., “What are the long-term consequences of volcanism on the earth’s temperature?” (Van den Bunder, 2011, p. 86). Only a few times does an assignment directly confront students with multiple scenarios. Even more scarce are assignments which work with or inform about preferable futures. Sustainability is mentioned three times, but in reproductive assignments, e.g., “What is the essential goal of the Kyoto Treaty?” (Van den Bunder, 2011, p. 139). A small number of assignments personally involve students by asking them about their opinion or expectation, e.g., “Name five consequences of global warming that can affect you in the Netherlands personally” (Van den Berg et al., 2011a, p. 45). The assignments which come most close to a future pedagogy are four case studies, at the end of chapters. For example, in one case study, students need to find the best energy mix for the Netherlands in 2030. These case studies are labeled as ‘extra’ and with the enormous number of assignments in Dutch geography books, it is doubtful whether they will be looked at. Unfortunately, even these best examples hardly move beyond the cognitive stage. Students reason and at best include a personal preference, but little debate, value clarification, or back casting is done. In general, the more open or personal assignments tend to be too broad and challenging, e.g., “What is your opinion on climate change as outlined for the Netherlands?” (Van den Bunder, 2011, p. 50), or “Think of a possible solution for the problems presented” (Van den Bunder, 2011, p. 112) – the problems being 18 global consequences of climate change, of which 17 are negative (e.g., geopolitical disputes, climate refugees). Futures pedagogy, as an effective way to work more exploratory and imaginatively is not found in the assignments.

National Examination questions could only be studied for the subject of Water Issues in the Netherlands, as Climate Change is part of the curriculum that is only tested in school exams, which vary per school. As Table 2.4 shows, the future is present in the exams, used as a setting for applying the knowledge described in the syllabus and books (CVE, 2011, 2012). In the two futures oriented questions referred to, a student needs to make a choice between (spatial) alternatives, e.g., “which letter on the map, A, B, C or D, shows the location most fit

for the next realization of this innovative coastal protection project?" (CVE, 2012, p8). This means more than one scenario is possible. But it also illustrates the habit of thinking in knowable, technical alternatives for future development. The candidates are not expected to explore alternatives, but choose the correct answer based on the application of geography knowledge.

In conclusion, the Vision Document's ambition for more futures-oriented learning can only been seen to a limited extent and in an indirect way in the materials studied. This becomes more problematic as we see futures images with a negative connotation for which technology is the solution, and a lack of futures pedagogy.

2.6. Panel Evaluation

After the content analysis we wanted to clarify the results found, and explored a second research question: *What explains the limited success, so far, of implementing futures education in Dutch school geography?* This was done by organizing a focus group meeting in which we presented the results of our analyses, and discussed what the experts saw as causes for the lack of a futures education. We spoke with 12 stakeholders within the community of Dutch school geography: five geography teachers, two textbook authors, a publisher, three geography teacher educators, an exam setter, an educational policy advisor and a professor in geography and education (with some members having plural roles). The panel consisted of three woman and nine men. Four members have a background in physical geography and eight members in human geography. The panel evaluation started with an open reaction of the panel members on the presented results. This was followed by a discussion in which key issues where identified. On two of the emerging key issues the discussion was deepened, being 1) the (national) educational context and 2) the characteristics of the geography teaching community. The meeting was recorded, transcribed and analyzed. The analysis was done by both authors independently and all interpretations were discussed and cross-checked together.

For the analysis we used the work of Bednarz (2003) on the implementation of the Geography Standards in the US. Bednarz distinguishes between the 'form' and the 'function' of an innovation in education. Of these two, the form, the educational technique, is most easily adopted by teachers, especially when the new ideas are familiar and congruent with existing understanding and beliefs. But the function of reforms, being the intention of an innovation, more easily gets lost. This function is often not clear or well institutionalized. And even when it is, it requires deep understanding of the content and often also the unlearning of old techniques and adaptation of new concepts and related practices by teachers. Whether this succeeds depends, according to Bednarz, on four factors: authority, power, prescriptiveness, and consistency. Is an innovation embedded in a law or proclaimed by a charismatic leader? Then the *authority* is stronger. *Power*, strongly related to authority, comes with clear-cut moments when the innovation is set against a norm or a sanction, as with high-stake tests or a national exam. *Prescriptive* innovations are explicit, clear, specific and manageable, and are therefore more often included when teachers decide what and how to teach. When innovations are complex and related to multiple aspects of the teaching and learning system, they are less likely to be implemented. Finally, the degree to which an innovation suits the existing educational system, its *consistency*, is defining. When, for example it is the easily fitting in, long-awaited answer to a current problem, its adoption is assured. An equally necessary but inconsistent change, is more easily ignored or postponed. In addition to the above mentioned four external factors, Bednarz names internal issues, like teachers' misconceptions, perceptions, prior knowledge and experiences. They play a role in

the interpretation and understanding of the form and function of an innovation. It is important to study these internal factors, since Bednarz, as well as Hicks (2012), see the teacher as an agent of change and reform. The outcomes of the focus group meeting were categorized with Bednarz's theory as a framework of analysis. We used the four external factors (authority, power, prescriptiveness, and consistency) and clarified our analyses with quotes from panel members.

The call for futures education in formal geography documents is not strong or authoritative enough, according to the unanimous opinion of the panel members.

- *It would be of great help if this* (the future dimension) *would be in the syllabus, because it would legitimize my attention for it* (teacher).

- *It (*the future dimension*) is seen as something 'extra', not a goal, not a requirement* (teacher, teacher educator and textbook author).

The vision does not explicitly use the language of futurists. Also, the vision contains a great number of ambitions, and futures education is not mentioned in the paragraph on 'fundamental choices'. The vision does speak of a clear societal urgency for futures education in the paragraph on *'the changing context of school geography'* (Commissie Aardrijkskunde Tweede Fase, 2003, p. 16). In a broader, national policy framework, however, futures education is not explicitly on the agenda. As the geography educators do not recognize it in the curriculum, what Bednarz refers to as 'authority' is lacking.

As the number-one structural, institutional cause for limited innovation, all group members see the importance given to test results by the government, school managers, teachers, and parents.

- *Teachers are fearful because the exam results are highly important to the management of the school* (teacher).

- *In practice? Teaching to testing* (teacher educator).

The common way of testing focuses on knowledge reproduction and application and leaves little room for individual interpretation. One panel member, a publisher, pledges for testing through essay assignments, to stimulate teachers to train students on this. Two members, a teacher and the educational policy advisor nuance the image by pointing at the indirect possibilities for futures exploration in the more flexible not centrally organized school exams, for which the individual school holds responsibility (and therefore has more autonomy in the way that formal goals are met). Still, they both also agree on the general tendency of teaching to the test. One of them points at the fact that in the local school exams teachers mostly choose to test in a manner similar to the national examination. When setting exams, the syllabus is used for guidance. But this influence is reciprocal; while forming the syllabus for geography, one criterion is: can the content be tested in clear-cut, fair assignments in the central exam? What Bednarz calls 'Power', the high stake central exam, is not working *for* but *against* this innovation.

While the aforementioned two outcomes of the focus group are related to the context of geography education, the following two factors characterize the geography community itself. First, the way of working on futures education, the pedagogy, turned out to be unclear to panel members.

- *Teachers are unfamiliar with techniques to do this, to train and evaluate this. It is very complicated* (publisher).

- *We have difficulties testing on the future of issues, because: What is this?* (exam setter).

So, not being clear-cut and easily manageable, futures education misses out on Bednarz's required factor of prescriptiveness. Even more so, futures education pedagogy seems to conflict with the geography teachers' tradition of explaining geographical content, instead of putting forward open questions for students to explore and research.

- *Geographers are explainers. People who think clearly. It should not become too vague* (textbook author).

- *As educators, we like to frame answers in clear schemes, and that is impossible when dealing with the future* (teacher educator).

When the position of futures education became subject of debate, seven members express concern on the likelihood of geography teachers automatically going the extra mile to integrate a futures dimension in their education.

- *The future is an issue for society. It is too big to be tackled by geography alone. We find this important, but what is the opinion of a 15/16 years old?* (teacher and also teacher educator and textbook author).

This relates to the consistency with other influences within the educational system; instead of being the 'answer to all educational problems', futures education challenges educators extra. They need to think through their approach and might have to change it fundamentally. With teaching already being a crowded profession, there is insufficient time for this deep evaluation and renewal (Crump, 2005).

Throughout the discussion, internal factors influencing innovation were clearly present, in the form of the experience and prior knowledge of teachers in the panel.

- *As I was originally a spatial planner, I explicitly talk about the future in class* (teacher).

- *We do a lot of debating in class. They get to see different points of view. It forces them to have a clear view on matters* (teacher).

This illustrates that, although activities which explore the future are scarce in the *written* materials studied, *in classrooms* these activities do actually take place, depending on the initiative and capabilities of the teacher.

When studying the factors named by Bednarz that influence implementation, the perspective for futures education is problematic. According to the results of the panel evaluation, resistance against the innovation of futures education is there at the same time as support for and positive experiences with it. Having a consistent opinion on futures education requires a more explicit idea of what it means in terms of both function and form. Also, it requires teachers to engage in deep learning concerning formally unknown aspects of geography and

new, challenging concepts of teaching and learning geography (Bednarz, 2003), and their translation to a futures pedagogy (Bateman, 2012; Hicks, 2012a).

2.7. Conclusion and Discussion

As shown in this study, the intention of working future-oriented that is present in the founding Vision Document for school geography, does not follow through to textbooks and the examinations. The intended, ideal curriculum differs fundamentally from the implemented curriculum; the futures perspective is diluted. As determining explanatory factors, we discovered the institutional constraints (lack of authority and power), missing clarity on the form (lack of prescriptiveness and consistency) and ambivalence (support and, at the same time, hesitation) among members of the community of geography educators.

These realities that hamper the futures education innovation must be seen in the context of mainstream thinking about societal change and the role of education, with a focus on preparing students for a competitive and uncertain labor market. And although the Netherlands is known for its constitutional freedom of education, with the current strict output testing, it is not easy to use this curricular autonomy. The national examinations should work as a means, but function as a goal. At the national political level visionary clarity is missing as scoring in international educational rankings like TIMMS, PIRLS and PISA seems to be the leading ambition (Helmers, 2011; Nieveen & Kuiper, 2012). Dutch national educational documents mention the future in a rhetorical way: e.g., "Our future is in the hands of our education" (KNAW, 2003, p. 13). A lobby advocating a more supportive national policy could be a task for the formal representative of the Dutch geographers, the earlier-mentioned Royal Dutch Geographical Society (KNAG). An initiative worth mentioning is the recently started 'Geo Future School'. Together with selected schools, relevant industries and institutions, KNAG started a breeding ground for futures-oriented learning. This initiative, subsidized by the EU since 2014, can work as an attractive example of what explicitly visionary based education looks like.

Luckily, futures education in geography does not depend on changes in national policy alone. Our study postulates that there is a strong relation between geography and futures education, which brings possibilities for the professional community itself to implement futures education in school geography. Since geography educators have an influence on the whole chain from vision, syllabus and textbook to the examinations, it is important to look at the conditions under which progress can be made.

More clarity should be given to Dutch geography educators about the function of this innovation. International literature on futures education offers a variety of answers to the importance of futures education. These should be studies and promoted among geographers.

Also, the form of this innovation should become clear. Does futures education require a new paradigm, or could it flourish if geographers would (be able to) practice what hitherto has mainly been paid lip service; making a shift from maintenance to innovative, enquiry driven learning (Roberts, 2003)?

Already there are good materials available within the geography community. For example, Roberts's 'Geography through enquiry' approach (Roberts, 2013) stimulates personal involvement, research, and discussion in the learning process. This kind of pedagogy is not exclusive but essential to futures education. Based on our observations, these kinds of

activities are already being practiced in classrooms of progressive teachers. Their efforts should get more exposure.

Teachers might also have to unlearn conventional, teacher centered techniques and become more responsive with their high quality (geography) input, guidance and support. This allows students to learn through a more enquiry- driven approach, including knowledge, personal reflection, and dialogue or debate, towards meaningful outcomes, in terms of both content and personal purpose. As Bateman (2012) describes, active group learning and teaching on futures education have brought positive outcomes. Knowledge, personal reflection, and dialogue turned out to be essential. Given the complexity of the task, teacher education through scaffolding, building expertise and practicing skills under guidance and support of an expert, might offer possibilities (Van Velzen, 2013). Through such a 'guided learning' process, teachers can develop a (renewed) personal understanding of how geography knowledge and pedagogy can be enacted in futures oriented geography education.

Chapter 3. Educating for the Future; the Position of School Geography

This chapter is based on the following publication:

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Abstract

Documents about 'skills for the 21st century' envisage an increasingly competitive, globalised and technologically advanced world that schools should prepare for by focusing on a range of 'skills'. Policy documents and position papers about geographical education mainly assume that the world of the near future will be highly problematic, with many pressing issues, which is presented as legitimation for the importance of geographical knowledge and skills. Both types of future images are taken for fact and lack reflection in the documents. Futures education takes a very different approach to the future. Futures – plural since many different futures are imaginable – should be the object of teaching and learning, using powerful knowledge as well as envisioning and reflective practice. It will be argued in this study that geographical education would be enriched – and could move beyond unreflective rhetoric about 'the future' – by taking the suggestions from futures education seriously. Futures-oriented school geography requires the use of powerful knowledge and an awareness of the situatedness of all knowledge. It is also a natural setting for pedagogical innovation. And finally, future orientation in geography will help in taking a critical position with regard to sense and nonsense of the '21st century skills' movement.

Key words: *twenty-first century skills, futures studies, futures education, geography education, geographical imagination*

3.1. Introduction

In essence, all education is for the future. Its core business is preparing learners for an inherently unknown future: for further study and career, for participation in society, and for a meaningful personal life. Contributing to a better future is one of the key motives for teachers to start an educational career (Jungert, Alm & Thornberg, 2014). Besides being important, the future is also seen by many as urgent and likely to be very different from the world we grew up in. More than fifty years ago, Drucker published *The Age of Discontinuity* (Drucker, 1968) and Polak (1973), one of the founding fathers of Dutch futures studies, wrote that "In the Middle ages, man had time. Now, time has man. Every man stands at every moment before the Kairos" (Polak, 1973, p. 227). More recently, Gore (2013) distinguished a number of drivers of change that make the world fundamentally different from the way it was even a few decades ago: economic globalization and global shift; revolutionary developments in communication technology and robotics; unsustainable (population) growth and resource depletion; fast development in life sciences and material science, enabling the reshaping of life.

Many of these issues and challenges are the object of geographical study and one could expect to find them in geography school curricula. Students in secondary schools indeed recognize concepts such as globalization and global warming as important in their geography classes (Béneker, Tani, Uphues & Van der Vaart, 2013). Geography educators also stress the importance of futures, as illustrated by Taylor's conceptual framework, that explicitly mentions the future in one of four key concepts, that of 'Change' (Taylor, 2008). But recent research for the case of the Netherlands showed that 'the future' is mainly addressed in geography curricula and lessons – if at all – in a fixed, negative way: the future as a continuation of the present, mostly even deteriorating in terms of issues and problems (Pauw & Béneker, 2015). Research indicates that the Netherlands is not an exception in this matter (Roberts, 2011; Hicks, 2012a; Morgan 2013). A growing group of geography educators and researchers pledges for a less limited, more imaginative approach of the future time perspective in geographical educational materials and practice (Hicks, 2007; Lambert & Balderstone, 2010; Roberts, 2013).

How to educate young people for the future is a debate that transcends school subjects. Currently the dominant discourse is about 'twenty-first century skills'. An entirely different discourse is found in the academic field of Futures Education, which is a sub domain of the wider discipline of Futures Studies. What is the stance of geography education with regard to educating for the future? And how does it relate to the discourses in the twenty-first century skills movement and in Futures Education? Can we raise the quality of school geography by incorporating ideas from these discourses? These are the key questions in this study.

This study is not based on empirical data about what happens in geography classrooms with regard to orienting learners to the future. The study shall focus on discourses about 'the future': first on the ideas about the future found in a selection of 21st century skills documents (section 2), then on future images that inspire a selected set of policy documents / position papers about geography as a school subject (section 3), and finally on the discourse about futures in the academic field known as futures education (section 4). Section 5 brings it all together and discusses what could be gained by geography educators from incorporating some key ideas from futures education in curricular and classroom practices.

3.2. Educating for the Future: The Twenty-First Century Skills Debate

3.2.1. Introduction

The idea that our world is being reshaped by technology and globalization is widely accepted. "There is a feeling of distinct disjuncture between centuries past and the one into which we are now emerging" (Kereluik, Mishra, Fahnoe & Terry, 2013, p. 127). Politicians, employers and educators see these developments as a reason to directly address 21st century needs with a set of skills (Wagner, 2012; Jerald, 2009). The term '21st century skills' is common in educational texts, although there is no clear definition on what is precisely meant by this concept (Kereluik et al., 2013). This section will look at four documents about 21st century skills: two with international scope (OECD, EU) and two referring to a specific national context (USA, Singapore) (see Table 3.1). These documents were chosen because they are often cited in educational publications and media (Jerald, 2009; Mishra & Kereluik, 2011; Voogt & Pareja Roblin, 2010). The analysis of the documents centres on images of the future expressed in the text and on the assumed implications of such futures for education.

Table 3.1

Selected Documents on 21st Century Skills

Organization and year of issue	Title of document
Organization for Economic Co-operation and Development (OECD), 2009	*21st Century Skills and competences for new millennium learners in OECD countries*
European Union (EU), 2006	*Key competences for lifelong learning*
Partnership for 21st century skills (P21), 2007	*The intellectual and policy foundations of the 21st century Skills Framework*
Ministry of Education Singapore (MOE), 2014	*21st century competencies*

3.2.2. Analysis of documents

The **OECD document** is a working paper based on a questionnaire study among seventeen OECD countries and study of background materials such as white papers and curriculum reports. The report does not state an explicit image of the future, but implicitly the assumption is that the future will be a world of global competition, in which OECD countries must compete as technologically advanced, knowledge-intensive economies. Hence the document stresses the importance of knowledge (OECD, 2009, p. 5), the need for schools and companies to work together (p. 5) and skills for coping with the information explosion triggered by ICT (p. 9). "Developments in society and economy require that educational systems equip young people with new skills and competences, which allow them to benefit from emerging new forms of socialization and to contribute actively to economic development under a system where the main asset is knowledge*"* (OECD, 2009, p. 5). To prepare students for this future, the OECD working paper proposes three 'dimensions' in 21st century skills and competences: 1) information, 2) communication, 3) ethics and social

impact (p. 8). All three dimensions encompass a number of skills. In total, the research described in the OECD paper explicitly names the following fifteen 21st century skills and competences: "creativity/innovation, critical thinking, problem solving, decision making, communication, collaboration, information literacy, research and inquiry, media literacy, digital citizenship, ICT operations and concepts, flexibility and adaptability, initiative and self-direction, productivity, leadership and responsibility*"* (p. 21).

The selected **EU document** formulated a framework for "Lifelong Learning as a key measure in Europe's response to globalization and the shift to knowledge-based economies" *(*EU, 2006, p. 10). As in the OECD document, the assumed future is a rapidly changing world of fierce global competition, in which the European Union must focus on knowledge-intensive sectors. "Each citizen will need a wide range of key competences to adapt flexibly to a rapidly changing and highly interconnected world" (p. 13). The EU framework suggests eight competences: communication in mother tongue (1) and foreign languages (2), math and basic competence in science and technology (3), digital competence (4), learning to learn (5), social and civic competences (6), sense of initiative and entrepreneurship (7) and cultural awareness and expression (8). The report names a number of skills (although they are called 'themes'): "critical thinking, creativity, initiative, problem solving, risk assessment, decision taking and constructive management of feelings play a role in all eight competences" (p. 14). Both the future image and the set of skills show a substantial overlap with the ones mentioned by the OECD, although the latter working paper does not stress the importance of languages and cultural sensitivity.

The authors of the **American P21 document** believe that we shall see a "more competitive, yet more interdependent world*"* (Partnership for 21st century skills, 2007, p. 23) in the near future. New information technologies enable us to collaborate, even with people far away in "global work teams" (p. 17). But this connectivity also threatens US jobs. Therefore, in the US context, "the most desirable jobs" are "the ones least likely to be automated or outsourced" (p. 12). Distinguishing oneself is seen as essential in the competitive global economy. In good American tradition, the report stresses the importance of "what until now has been the secret of the US economic advantage: the risk-taking, creative and can-do spirit of its people" (p. 16). Other features of the future, according to the P21 document, are the powerful modern media, the expanding service economy, and high information density (pp. 16-18). This overall image of the future in the report is mainly economically and technologically oriented. According to the P21 document, we now need 21st century education to meet future needs. The authors believe that a true 'shift' is needed in education policy: "we must restore to our schools the skills citizens will need to succeed in the worlds of work, higher education and personal life" (p. 23). The paper mentions new opportunities for current and future learning environments, such as 'instant access to facts', 'abilities to connect and create with peers and the wider world' and 'software that adapts to the need of the individual learner' and links these opportunities to insights about depth of learning (e.g., Bloom) as well as breadth of learning (e.g., Gardner). The report mentions four categories of desired outcomes of 21st century learning:

- *'core subjects and 21st century themes'.* As core subjects the report mentions: English, reading or language arts, foreign languages, arts, mathematics, economics, science, geography, history, government and civics. The '21st century themes' are: global awareness; financial, economic, business and entrepreneurial literacy; civic, health and environmental literacy;

- *'learning and innovation skills'*: creativity and innovation, critical thinking and problem solving, communication and collaboration;

- *'information, media and technology skills'*: information literacy, media literacy, ICT literacy;

- *'life and career skills'*: flexibility and adaptability, initiative and self-direction, social and cross cultural skills, productivity and accountability, leadership and responsibility.

The **Singaporean document** about 21st century competencies opens with the following lines: *"*Globalisation, changing demographics and technological advancements are some of the key driving forces of the future. Our students will have to be prepared to face these challenges and seize the opportunities brought about by these forces" (Ministry of Education Singapore, 2014, p. 1). The 'globalized world' is seen as a local reality, a fact of everyday life. Education should help students to adapt to the future of a highly connected and technologically driven local-global world. The tone of the report is not negative; the dynamic future is also seen as offering many opportunities for Singaporean youth. The Singaporean set of competences includes three sets of 21st century skills: 1) civic literacy, global awareness and cross-cultural skills; 2) critical and inventive thinking, and 3) communication, collaboration and information skills. These 21st skills are part of a broader framework that also includes 'social and emotional competences' and 'values'. These values are of central importance in the report, as exemplified by one of the suggested learning outcomes of Singaporean education: the student is a "concerned citizen who is rooted to Singapore, has a strong sense of civic responsibility, is informed about Singapore and the world, and takes an active part in bettering the lives of others around him" (p. 3). The short and clear framework breathes an instrumental, practical approach.

3.2.3. Comparison and discussion

The documents present a highly similar image of the future: a rapidly changing, highly interconnected, competitive, interdependent yet individualized, knowledge-intensive society. Most of the reports use urgent language with regard to future challenges: plain survival seems at stake in a highly competitive global market and an increasingly complex and unsafe world. The documents do not underpin the presented future with evidence (such as extrapolation of trends) nor speak of underlying assumptions or of alternative futures. The consensus suggests that this future image is not just a scenario, but simply 'the future': a matter of fact that we have to face, adapt to, and anticipate.

All four frameworks refer to the changing character of the economy, from an industrial to a knowledge economy. Preparation of young people for the knowledge economy is key in all four documents. According to the sociologist Susan Robertson, this reflects a trend that has been on-going for decades already: "Education systems were mandated to develop efficient, creative and problem-solving learners and workers for a globally-competitive economy, while teachers were to demonstrate that they had taught their young charges through national and global (e.g., PISA, TIMMS) systems which demonstrated 'added value'" (Robertson, 2007, p. 11). The economic priority is most clear in the American public-private partnership P21 (e.g., "financial, economic business and entrepreneurial literacy", P21, 2007, p. 9) which seems to focus on what could be referred to as "skills for the global market" (Standish, 2013, p. 244). The inclusion of 'critical thinking' in all four frameworks may seem to be at odds with skills for the market, but there is little evidence in the documents that critical thinking is

seen as a fundamentally questioning attitude. Critical thinking, as in the four reports, feels closer to 'sharp' or 'analytical' thinking. The four frameworks are unanimous in their listings of 21st century skills (Table 3.2). Even where a specific skill is not explicitly pronounced in a report, it is often referred to in the elaborating texts on other skills.

Table 3.2

Explicitly and Repeatedly Named Skills in the Four Selected Documents

In (all) four frameworks	Critical thinking, creativity/inventive thinking, communication
In three Frameworks	Initiative, problem solving, collaboration/cooperation, self-management, productivity and/ or entrepreneurship, cross cultural awareness or skills, information literacy, civic literacy, media literacy digital or ICT skills
In two Frameworks	Flexibility and adaptability, decision making/taking, innovation, learning (to learn), leadership and responsibility

The 'newness' of the skills is not uncontested. That these skills represent a new way of learning is evident to some (Jerald, 2009) and disputed by others (Rotherham & Willingham, 2009). It is obvious that many of the stated 21st century skills have been on the agenda of educational discourse for decades already. Advocates of the 21st century skills tend to see the comprehensiveness of the set of skills as 'new'. An often heard criticism is the separation between skills and content. Two of the studied frameworks do explicitly name content knowledge in their framework: the EU report and the P21 framework. Although presented as "the solid ground of 21st century education" (P21, 2007, p. 7), the paragraphs on content are limited to listing school subjects and do not specify content. It might give the impression that skills and content are two separate things and that any content can be used for practicing skills. But skills become meaningful through relevant, carefully selected content (Rotherham &Willingham, 2009). In short, the 21st century skill documents aim to prepare students for a 'given' and undisputed future: that of a global knowledge market, through skills that foster a smooth fit in. Education is seen as a driver for economic competitiveness towards a '*successful life*' (EU, 2006; P21, 2007).

3.3. The Future Dimension in Policy Documents About Geographical Education

3.3.1 Introduction

With the changing earth and human society as the object of geography, one might expect that position papers and policy documents about geographical education would pay attention to the future. We shall again have a look at four such documents (see Table 3.3). All four are internationally respected, authoritative documents, quoted in geography networks (e.g., *Eurogeo, Seaga*) and journals (e.g., *IRGEE, Teaching Geography*). Two documents represent the supranational, global scope (IGU and IB) and two documents relate to geographical education in a national context (United States and Germany). The author is aware of current debates about the IGU Charter in the international community of educational geographers. But nevertheless the Charter is included here as a document of truly international scope.

The central questions for the analysis are: 1) what is the image of the future in these policy papers?; and 2) how should geography teachers prepare students for this future?

Table 3.3

Selected Policy / Position Papers About Geographical Education

Organization(s) and year of publication	Title of document
International Geographical Union Commission on Geographical Education, 1992	*The international Charter on geographical Education*
International Baccalaureate Organization, 2009	*Diploma Programme Geography Guide*
National Geographic Society (NGS), Association of American Geographers (AAG), National Council for Geography Education (NCGE), American Geographical Society (AGS), 2013	*A Roadmap for 21st century geography education, Executive Summary*
Deutsche Gesellschaft für Geographie, 2012	*Educational Standards in Geography for the Intermediate school certificate*

3.3.2. Analysis of documents

The **IGU Charter** presents a gloomy image of the world: *"*Population dynamics, food and hunger, urbanization, socio-economic disparities, illiteracy, poverty, unemployment, refugees and stateless persons, violation of human rights, disease, crime, gender inequalities, migration, extinction of plants and animals, deforestation, soil erosion, desertification, natural disasters, toxic and nuclear waste, climatic change, atmospheric pollution, water pollution, ozone holes, limits of resources, limits to growth, land use, ethnic conflict, war, regionalism, nationalism and globalization on 'Spaceship Earth'" (International Geographical Union, 1992, section 'Challenges and Responses').

This image of almost insurmountable issues for the near future is then used as a legitimation for school geography: "in the context of problems facing humanity, the right to education includes the right to high quality geographical education" (section 'Challenges and Responses'). This message resonates throughout the document. In broad terms, the Charter outlines knowledge, attitudes and values that are supposed to help students prepare for living in a troubled world: geographical knowledge so that "…trends can be identified which indicate possible future developments" (section 'Questions and concepts in geography'); knowledge and attitudes that help "avoiding a separation of knowledge and behaviour and encouraging environmental competence, regional and national commitment and multicultural and international perspectives" (section 'Principles and strategies for implementation'); and values such as "concern for the quality and planning of the environment and human habitat for future generations" (section 'The contribution of Geography to education').

The ambitions summed up in the Charter include skills that now might be called 21st century skills. Critical thinking, communication skills, information skills, cooperation, initiative,

problem solving, self-management, decision making skills, cross cultural awareness, civic literacy, learning to learn and responsibility', all listed in section 2, are explicitly mentioned in the Charter or phrased in other words. The key message of the Charter is that our troubled world, with its grave challenges for the future, is in need of geography education, including skills nowadays known as 21st century skills. The document presents a highly problematic future as a certainty, that we should prepare for through geography.

The **IB Geography Guide** for the diploma programme is an influential document: each year, thousands of students in 147 countries around the world write a series of final geography examinations to obtain their IB diploma (Semple & Dawson, 2008; International Baccalaureate Organization, 2014). The Guide's overall ambition is "to create a better and more peaceful world" (IB, 2009, first page, no page number), which implicitly suggests a problematic present. The Guide lists "key global issues of our times*"* (p. 19) and their geographical foundation. The program works with core themes, for all students, and optional themes. We shall here focus on the core themes since all students take at least a standard level of these. The core themes are: population in transition, disparities in wealth and development, patterns in environmental quality and sustainability, patterns in resource consumption. The program requires critical engagement with the topics studied, as can be seen in objectives such as "Examine progress made in meeting the millennium development goals" (IB, 2009, p. 21) or "Evaluate examples of a pro-natalist policy and an anti-natalist policy" (p. 20). While critically engaging with issues and development, the students are expected to take a balanced approach with an eye for positive as well as problematic aspects of change:

> "Attention should be given to the positive aspects of change (not only the negative ones), to the need to accept responsibility for seeking solutions to demographic, economic and environmental issues covered, and, where appropriate, to the management strategies adopted to successfully meet the challenges posed" (p. 19)

The Geography Guide does not refer explicitly to the future. Even where the central issue is sustainability, the guide focuses on descriptive and explanatory study of the past and present causes and processes of environmental deterioration and the importance of biodiversity. Imagining alternatives and pathways towards more sustainable futures is not among the suggested learning activities. It is not surprising in the IB context that much attention is paid to intercultural awareness and tolerance: "There is a strong emphasis on encouraging students to develop intercultural understanding, open-mindedness and the attitudes necessary for them to respect and evaluate a range of points of view" (p. 2). Many 21st century skills are named: decision-making, critical thinking and analysis, reflection, appreciation of and respect for alternative approaches, viewpoints and ideas (p. 4). These skills are part of the general IB program and also prominent in the Geography Guide. Although future images are not clearly defined, the IB geography guide assumes that the future may be better when people take well-informed and responsible action. Students are prepared for this challenge through a programme that focuses on current global issues in which many of the 21st century skills are used.

An important goal of the **American Roadmap** was to counteract the ongoing deterioration of the position of school geography in the US, as a consequence of the political focus on reading, writing and history. The Roadmap Summary does not directly describe an image of the future but presents some perceived features of the future between the lines. With regard to the future, the document uses urgent language about a world at stake: "Never before in human history has it been more important for a person to be geographically literate. Our world is astoundingly complex and increasingly interdependent - economically,

environmentally, politically, socially and culturally' (…) 'Simply put, if our children are not taught to think geographically, their success and the success of our nation and the world in the 21st century are in jeopardy" (Edelson & Pitts, 2013, p. 6). In the face of "Critical societal issues in the areas of social welfare, economic stability, environmental health and international relations" (p. 1), geography should prepare young Americans to make reasoned collective and individual decisions "in the workplace and participating in the democratic process" (p. 1).

The Roadmap stresses that clarity about the big ideas of the subject is essential, to prevent geographical knowledge to be superficial. The document also refers to many of the 21st century skills: digital literacy (including GIS literacy), decision-making, thinking and inquiry skills, information literacy, self-management, cross-cultural awareness and civic literacy. In short, the Roadmap expects a challenging, even problematic future we should urgently get ready for. The Roadmap is clear on the indispensable need for geography, in order to successfully meet future challenges.

The **German Geography Standards** do not present an explicit vision of the future that school geography should prepare for, but between the lines the text tells us something about the way the future is seen.

> "Geographically and geoscientifically relevant phenomena and processes such as globalisation, climate change, earthquakes, flooding and storms, as well as population change, migration, disparities and conflicts over resources, shape many aspects of our lives and our societies on planet Earth. Dealing with these complex developments calls for adaptation of previous behaviour and strategies on the basis of sound knowledge, judgment and problem solving competence" (Deutsche Gesellschaft für Geographie, 2012, p. 5)

We may assume that according to the authors a liveable future would require a change in our collective behaviour. The German Geography Standards combine knowledge and skills in six competences: 1) Subject specific knowledge, 2) Spatial orientation, 3) Gathering information/methods, 4) Communication, 5) Evaluation, and 6) Action. Many of the 21st century skills are included in the competences: critical thinking, information literacy, digital skills, communication, decision-making, problem solving, and self-management.

The stated ambition is to help students achieve higher order thinking processes, such as weighing geographical statements, evaluation, developing a well-founded opinion in a discussion, develop an appropriate compromise, productive role playing and designing scenario's. The fifth competence (Evaluation) aims at the "ability to evaluate humankind's interventions in nature and the environment according to their ecological, social/political and economic acceptability" (p. 23). The future is explicitly mentioned in this context: "name general and subject-specific criteria for evaluation (e.g., ecological/economic suitability, significance now and in the future, perspectivity)" (p. 23). The last competence, Action, stimulates thinking of alternative actions, in which a belief in steering capacity can be seen: "students can assess the natural and social spatial consequences of selected individual actions and think of alternatives". The document is rather directive about desirable behaviour for a better future: "students are willing to work on an everyday basis for better environmental quality, sustainable development, intercultural understanding and peaceful co-existence in One world, e.g., purchase of fair trade and/or organic products, sponsorship, choice of means of transport, avoiding creating rubbish" (p. 26).

In summary, the German Standards aim – among other goals - at behavioural change, towards a more just and sustainable future. Also, it aspires to prepare students for a critical and communicative approach to global geographical issues.

3.3.3. Comparison and discussion

The four documents all assume that the world of the near future will be diverse, connected, full of complex issues, and challenging. This is very similar to the future image we saw in section 2, but here the issues are explicitly named. On how to prepare students for such a future, the documents see geography education as an essential means. The focus should be on global issues paired with (geo) information skills, inquiry and critical thinking skills. There is clear overlap with the 21st century skills. In terms of tone, the geography documents are alarming about the future. Geography seems to be about immense global problems that threaten mankind, especially in the IGU charter and the American Roadmap. The IB programme and the German Standard also focus on problematic global issues, but they pay more attention to positive and constructive thinking. The German Standard contains the Action competence working on empowerment.

Besides the content and skills pledged for, the geography documents also express ideas on values relevant for the future. The IGU and IB documents include generally accepted value sets (the Human Rights Declaration in the IGU Charter and the Millennium Development Goals in the IB Guide). The German Standards suggest certain values of 'good' citizenship. This focus on equity, justice and sustainability moves beyond the neoliberal values echoed in most 21st century skills documents discussed in section 2.

To sum up, the studied geography documents express a global, challenging world full of urgent geographical issues. Instead of debating these issues, we should get ready for them, through subject study and the development of 21st century skills and given values. The state of the world is clearly used as legitimation for school geography. All reports and documents discussed in sections 2 and 3 lack a reflective approach to the future; the future is depicted as a matter of fact. Hicks (2007) has criticized such unreflective notions of the future in many of his writings. He stated: "So what expertise can educators draw on if they wish to be more critically reflective in their approach to the future? It lies in the academic field of futures studies" (Hicks, 2007, p. 181).

3.4. Futures Studies and Futures Education

3.4.1 Some background

In its early years, Futures Studies was closely linked to international political and economic developments and therefore disputed by academia. In the military industry around 1930 in the US, strategically weighing scenarios in 'think tanks' became very important (Van Steenbergen, 2005). It first concerned planning a way out of the Great Depression, which gave way to planning for World War II. Also in Europe, governments started to combine massive planned change with future-oriented research on what specific policy would lead in the desired direction and how this could be monitored. After 1945, Futures Studies organized itself further, in and outside the US, as an academic network, serving industries and government.

In the 1970s, as a reaction to the empirical approach dominating Futures Studies in the USA, a critical Futures Studies school developed, originating in Europe. The spirit was more that of

an international social movement than of a strictly professional, academic organization (Van Steenbergen, 2005). This engagement strongly related to the publication of '*The Limits to Growth*' in 1972, along with other ground-breaking books, like Carson's '*Silent Spring*' (1962) and Toffler's '*Future Shock*' (1970). It was no longer possible to neglect the big spatial and temporal impact of modern life. As a specific form of the critical approach, also seen as a third tradition (Gidley & Hampson, 2005), a non-western cultural oriented tradition developed, in reaction to the mainly western originating initiatives. This tradition calls for a more fundamental consideration of civilizations (Bussey & Inayattullah, 2008; Inayatullah, 2008; Milojevic, 2002; Sardar, 1993).

Also in Futures *education*, the US led the way, with first courses in 1960s. In the 1980s, it expanded to Europe and Australia (Gidley & Hampson, 2005). Futures Education translates futures concepts into learning experiences appropriate for primary and secondary education. It encourages students to think more critically and creatively about the future, especially in relation to imagining and creating the future they prefer. The futures field claims that if futures are not the explicit focus of study, the images of the future in educational materials will often be those of a tacit inference, a token, rhetorical, invocation or taken for granted assumption (Gough, 1990). This could indeed be seen in sections 2 and 3, for example in the statement "the 21st century skills framework provides schools with a pathway to ensure the promise of tomorrow" (P21, 2007, p. 6). To avoid such superficial and unrealistic approaches, futures education translates the principles of Futures Studies into education.

3.4.2. Central concepts of futures studies and futures education

Futures studies and futures education distinguish themselves from common planning, by thoroughly and systematically studying futures. This means: studying *ideas* about futures or images of futures, as the future itself does not exist (Dator, 2002). Futures studies is based on a number of core assumptions and principles (Bell, 2009; Slaughter, 1996). These guiding principles are also the backbone of futures education. This section will highlight three of the most central Futures Studies principles that are mentioned in numerous, authoritative publications on futures in education (Gidley, Bateman & Smith, 2004; Bussey & Inayatullah, 2008; Hicks, 2012a; Slaughter & Bussey, 2012; Dator, 2002).

Principle 1: Multiple futures

While futures study is often associated with prediction, it is crucially different from it, as it concerns scholarship of the future. Studying ideas about the future enables us to discover or generate a number of alternative scenarios, as a context for thought and choice. The importance of this plurality is expressed in the use of the word 'futures' (Van Steenbergen, 2005). Among the options are *possible* scenarios, *probable* scenarios and *preferable* scenarios (Galtung, 1982; Bell, 2009). According to futurist Toffler, futures study is about "visionary exploration of the possible, systematic investigation of the probable and moral evaluation of the preferable" (cited in Bell, 2009, p. 73). Awareness of different scenarios is important, because it enables one to see what the real possibilities for the future are (Bell, 2009). Studying futures also includes clarification of the different motives behind different future perspectives, expressed by influential actors, such as governments, companies, or media. Students should not take any solitary future image as 'the way things really are going to be' without being informed on the motives and data of the author of a specific future image. Morgan (2013) gives a telling example of future work where this went wrong: students were 'informed' about the future and afterwards they reproduced exactly the narrow-minded image presented in the information. Here it concerned the way in which public

health care and pension retirement would develop in the future in New Zealand. Student's felt '*woken up'* to '*the reality*' of the disappearing free health care and pensions (Morgan, 2013; p. 27). It was not possible for them to see through the assumptions and political choices behind the presented future. Morgan concludes: "these young people have accepted the repeated narrative that they will have to be independent, self-actualizing individuals who take responsibility for financing their own old age and health care" (p. 27). Alternatives always exist, but as illustrated here, people are not always able to see or imagine them.

Principle 2: Imagining

The future is not knowable with any degree of certainty. Of course many long-term patterns and trends can be relied on, but according to futurists focusing on what is open instead of on what is fixed, can make an essential difference. The use of knowledge is essential, but futures education aims at taking the thinking process a fundamental step further, into imagination and envisioning. By thinking the 'unthought-of', students create perspectives that might open doors to new approaches and new knowledge about issues we have not yet solved. "Much that will be characteristic of the futures is initially novel and challenging. It typically seems at first obscene, impossible, stupid, 'science fiction', ridiculous. And then it becomes familiar and eventually normal" (Dator, n.d.). The notion here is that moving towards a future one prefers, is highly stimulated by the ability to imagine futures (Hicks, 2012b; Dator, 2011).

Principle 3: Anticipation over apathy

Futurists strongly believe that individual and collective action in the present influences the course of developments, possibly towards a more preferred future. So, opposite to fatalism, futures educators help students to translate their preferable future into current coherent thought and action. On the basis of knowledge and values, students form a personal idea about 'how the world works' and are encouraged to engage in moral evaluation, personal anticipation and action. Simplicity should be avoided: anticipation does not mean that a student can save the world. But neither are students helpless and powerless victims of a dangerous future. Gough points at an analogy with the concept of interpretation in history; it implies searching for meaning and purpose, through interpretation and anticipation (Gough, 1990). This is no simple task. "It is likely that resistance to futures thinking will be a natural reaction for many people" (Rogers & Tough, 1996, p. 492). Being cognitively overwhelmed, people often retreat and disconnect. Thinking of futures requires the acceptation of 'not knowing', to get to a consideration of possibilities, towards anticipation on preferred futures. "The intensity of emotions varies from person to person, of course, but it would be safe to say this involves the heart as well as the mind" (p. 493). To overcome apathy and engage in anticipation, one needs to be aware of personal opinions, feelings, beliefs, and values.

The principles of Futures Studies and Futures Education outline useful concepts for the study of the future in education. The aim is to broaden the perspective by creating awareness of more scenarios, to stimulate envisioning and to think about what this all means for personal ideas and actions. Such an approach – making futures object of study and imagination – would greatly enrich the instrumental and unreflective stance on the future that we saw in sections 2 and 3. In futures education, the work of Hicks and Slaughter has been prolific (Gidley & Hampson, 2005). They translated the principles into concepts, teaching guidelines and pedagogy. Characteristic for these materials is the use of different scenarios: the materials organize and train the students' ability to think in scenarios and their creative skills in envisioning. At the same time, their engagement with futures, mostly sustainable futures, is stimulated.

It should be noted, however, that futures education frameworks often turn out not to be as open as the basic principles pledge for. In many projects, central values are prescribed, instead of discovered or defined by students themselves. Broadly spoken, four values are often seen in futures material: ecological sustainability, economic stability, technological progress and spiritual development. From either a pessimistic fear or an optimistic hope, futurists fill in the actions required for the future (Lombardo, 2007). This engaged determination within both futures studies and futures education narrows the space for debate, envisioning and choice of a preferred future (Marien, 2002). It should be noted however, that a broad spectrum of values is represented. Also, futurists often combine values in their approach, for example by suggesting technological means to prevent further ecological or economic deprivation. And as Hicks rightfully points at, supporting values such as sustainability, responsibility and connectedness in futures education, can be seen as an attempt to counterbalance the consumerism, narcissism, individualism and free market economics so constantly expressed to students through all sorts of media (Hicks, 2012a). Still, predetermining central values while at the same time pledging for openness and personal moral evaluation can be considered contradictory.

3.5. Conclusions and Discussion

3.5.1. The discourses summarized

The papers on twenty-first century skills, all situated in the context of economically developed regions, depict the world of the future as complex uncertain and globalized, a world of fierce competition and rapid technological change. The key argument is that preparing young people for such a world requires a focus on the stated twenty-first century skills. This skills-driven approach includes no novel ideas or concepts, but is without further argumentation labelled as the best answer to current and future issues.

The four selected policy papers about geography education share a dominant image of the future as full of pressing global problems and challenges: issues that already exist in our contemporary world. The image of the future as problematic and urgently in need of solutions seems to legitimize the inclusion of geography in the school curriculum. In terms of skills, the focus is on inquiry skills and – in the IB document particularly – on critical engagement with complex issues. There is a substantial overlap with the twenty-first century skills, mostly for classical cognitive skills and intercultural awareness. Compared to the twenty-first century skills reports, the geography documents place much more emphasis on values such as equity, tolerance, or respect for nature.

From the perspective of futures education, two immediate observations can be made about both the twenty-first skills frameworks and the geography policy documents. Firstly, both sets of documents employ a fixed, specific, un-discussed image of the future. Secondly, none of the documents include a plea for engagement *with* the future in education. Studying futures is not on the agenda. The author believes that geographical education would benefit greatly from incorporating approaches and ideas developed in the field of futures education. Teaching and learning about geographical issues, global and local, should include the study of ideas on their future developments. This requires the correct use of specific geographical knowledge. Concepts and tools from futures education can be of great help in designing an appropriate geography curriculum for the complex task of thinking geographically about futures.

3.5.2. On ‘powerful’ geographical knowledge

When studying future scenarios, students need conceptual frameworks to get to an understanding of how the world works. Young (Young & Lambert, 2014) speaks of ‘powerful knowledge’: conceptual knowledge, grounded in a discipline, which is at the same time dynamic and reliable (Young & Lambert, 2014). This type of knowledge provides a new way of looking at the world, a framework that students do not come across in everyday life. This is what they go to school for. Lambert and Morgan (2010) refer to powerful knowledge as the ‘grammar’ through which students use the ‘vocabulary’, the factual knowledge of geography (Lambert & Young, 2010). Futurist Bell points at the relevance of geography for the type of understanding that is needed for scenario thinking: “our knowledge of the physical and the natural worlds, of cause and effect, contributes to our ability to navigate through time. So does our knowledge of the social world” (Bell, 2009, p. 145). A sound relation between school geography and academic geography is therefore important.

‘Future 3’

Recognizing the importance of knowledge should, however, not lead to the development of a static world image or a fixed future scenario. Young refers to a scenario in which a conservative, undisputed perspective on knowledge is central as the undesirable ‘future 1’ scenario (Young & Lambert, 2014). The ‘future 2’ scenario, in which knowledge is seen as available everywhere through modern technologies, so students just need ‘learning–to–learn’ skills, is also insufficient. Only through relevant content, critical thinking becomes valuable and contributes to the intellectual development of students (Martin, 2011). Young proposes a ‘future 3’ scenario, in which curriculum making, based on powerful knowledge, is an ongoing process. Knowledge is neither given (as in future 1) nor arbitrary (as in future 2 (Lambert & Hopkin, 2014), but consists of the best available insights in a discipline, or in other words: the nearest to truth we can get (Young & Lambert, 2014). This way, students develop a ‘state of the planet awareness’ (Hanvey, 2004) that is challenged and re-arranged, preferably lifelong (Gerber, 2006). Geography offers a rich conceptual toolbox for developing sight on the ‘bigger picture’ including notions such as people-place, society-space, local-global, man-environment and nature-culture. With future issues being highly complex, dynamic, appearing on different scales and often involving both human and natural aspects, geography offers a highly appropriate fundamental conceptual framework for an understanding of these issues. This does not mean that students should be kept away from useful cooperation with other school subjects. Given the multidisciplinary nature of contemporary issues such as climate change and mass migration, working together with other disciplines is crucial to develop a realistic bigger picture, ask the truly relevant questions and develop new solutions for urgent issues.

Geographical imagination

According to Harvey, “there can be no geographic understanding without geographic concepts and there can be no concepts without images” (Harvey, cited in Norton, 1989, p. 189). Images form a fundamental part of geographical thinking and in studying futures, with facts lacking, they are particularly powerful. Massey (2006) wrote about how mental images influence the way we conceive geographical space and about the possibility of “… lots of histories going on at the same time” (Massey, 2006, p. 49). Where facts and patterns can be discovered intellectually, images and imaginations give meaning and purpose to data and lead to insights and judgments (Prince, 1961, cited in Norton, 1989, p. 189). Harvey describes ‘geographical imagination’ or ‘spatial consciousness’ as a concept that “enables the

individual to understand the role of space and place in his own biography, to relate to the spaces he sees around him, and to recognize how transactions between individuals and between organisations are affected by space that separates them" (Harvey, 2005, p. 212). Lambert and Morgan (2010) also pledge for a more imaginative education, given the urgency of our times and the need for more effective teaching practices to meet pressing issues such as poverty and ecological damage. Lambert refers to the words of sociologist Bernstein when formulating the aim of powerful knowledge as: "to think the unthinkable and the yet-to-be-thought" (Bernstein, quoted by Lambert in Stoltman, Lidstone & Kidman, 2015, p. 3). Global education expert Andreotti (2006) formulated the importance of a more imaginative approach as follows: "Rather than individuals becoming active citizens according to what has been defined for them as an ideal world, they should be empowered to reflect critically on the legacies and processes of their cultures, to imagine different futures and to take responsibility for decisions and action" (Andreotti, 2006, p. 48).

Studying different scenarios will open up a student's perspective fundamentally and allow for "visionary exploration of the possible, systematic investigation of the probable and moral evaluation of the preferable" (Toffler, quoted in Bell, 2009, p. 73). As this quote illustrates, moral evaluation is the complex, essential final phase of scholarship of futures. As a discussion about possible, probable and preferable futures is inevitably linked to ethics and criteria on which weighing and choosing is based (Rawnsley, 2000), it requires self-knowledge and clarification with regard to opinions, beliefs and values of the learner. Since futures learning involves the heart as well as the mind (Rogers & Tough, 1996), the intuitive position of a student should be made explicit. If not, it might blind the learner: information that does not suit the 'intuitive identity' gets lost (Haidt, 2012). Not blindly following but *understanding* a personal perspective can enlarge the learners' flexibility. Knowledge functions as an anchor in this context (Jolles, 2010). It lessens the intuitive need to defend a gut feeling and enables students to see 'the bigger picture' and open up to new insights or unlearn outdated opinions (Andreotti, 2006).

Studying futures requires finding a balance: on the one hand, scenario development needs knowledge to develop a "propensity and disposition to think about alternative social, economic and environmental futures" (Lambert & Morgan, 2010, p. 65). On the other hand it is essential to make students aware of the nature of this knowledge: which is not absolute, but fallible and conditional. But being extensively tested and with its assumptions grounded, the use of this situational knowledge is very reasonable and important, to get from hindsight to foresight (Bell, 2001).

3.5.3. On innovation in pedagogy

To learn and teach about futures requires an appropriate pedagogy, high levels of geographical knowledge and, as Lambert and Hopkin rightfully emphasise "not a small amount of confidence and support" (Lambert & Hopkin, 2014, p. 75). Futurists' and geographers' ideas on this pedagogy are highly similar. First, an enquiry driven approach is needed (Roberts, 2013; Hicks, 2012b; Martin, 2011). Additionally, futures orientation needs a 'pedagogy of dissensus' instead of consensus (Martin, 2011) to stir up matters and create insight in images, underlying messages and hidden driving stakes and forces. The result of such pedagogy is "knowledges" instead of knowledge, and geographies, histories and futures (Martin, 2011, p. 220). This allows learners "to make meanings through the contexts of their lives" (Den Heyer, 2009, p. 27). Giving students more ownership of their learning process and results requires a more "writerly" approach, compared to the current "readerly" approach

(ibid, p. 27). Aim is to engage students in a conversation about complex global issues and challenge them to think about how the world could be different (Standish, 2013).

More context aware and open learning also requires self-knowledge. The teaching of values is widely seen in both geography and future education (e.g., diversity, equity, sustainability). An open study of the future, however, implies that values are studied and developed, instead of being given and transferred. In the values education approach of Fien and Slater (1985), controversial issues are handled by giving insight in the influence of attitudes (relatively easy to see), relating to beliefs (often hidden) relating to values (fewer in number and hidden). Uncovering and expressing positions and viewpoints in dialogue and debate is essential in learning about futures. With the current strong pressure and high expectations in the educational sector, curricula have increasingly lost the vital porosity that is needed for this "meeting of minds" that is essential for "the making of meaning*"* (Roberts, 2013, p. 251).

These directions on pedagogy are not exclusive for futures education, but they are essential in it. This is illustrated in the materials made for teaching, for example by Hicks and Slaughter. Classroom activities such as using extended timelines, consequence wheels and annotated sketches of futures scenarios illustrate features of active construction of personal visions and powerful knowledge on futures (Hicks, 2012b; Slaughter & Beare, 2011).

21st century skills?

Many of these pedagogical suggestions imply the use of the skills mentioned in section 2 as 21st century skills: critical thinking, creativity or communication. It is important to stay away from the narrow, instrumental interpretation of these skills being skills for survival (Hicks, 2001) or skills for the market. Futurists point at a feature of 21st century living: "the feeling that the immensely powerful forces which are shaping the social and natural environments of the globe are now out of control of any governing entity" (Edwards, 2005, cited in Slaughter, 2008b, p. 123). The message cannot be: the problems are immense and these skills are our answer. Skills are part of scholarship and as such an important ingredient of intellectual and personal growth that creates empowerment.

It seems fair to conclude that geography can offer the substantive connection between the instrumental approach to the future in the 21st century skill frameworks on the one hand and the deeper messages of futures education on the other hand. "At its best, school geography can be dynamic, innovative and deeply relevant subject for pupils to study" (Rawding, 2013, p. 288). Why settle for less?

Chapter 4. Designing Lessons for Futures Education in Geography

4.1. Introduction and Research Question

Research shows that secondary geography education pays insufficient attention to the future time perspective (Slaughter & Beare, 2011; Hicks, 2012a; Roberts, 2011; Pauw & Béneker, 2015; Pauw, 2015). And, in the limited cases where the future is on the agenda in the classroom, two pitfalls often arise. Firstly, teachers and schoolbooks often present a fixed future, instead of a range of possible futures. Secondly, students are not challenged to actively think critically and creatively about futures. Because teachers have insufficient knowledge and experience concerning futures education, they fall back on 'explaining' a future, instead of putting forward open questions to explore futures (Pauw & Béneker, 2015). The lack of exploratory attention for futures perspectives in secondary geography education was the main topic of chapter 2.

In chapter 3, the academic field of futures studies was introduced, as the discipline that systematically studies futures in order to develop a profound understanding of futures (Bell, 2009; Slaughter, 1996). The subfield of futures education translates principles and approaches from futures studies to education. Futures education encourages students to think critically and creatively about futures, beyond the familiar (Gidley, 2016; Hicks, 2007). School geography is one of the subjects that may foster such a thinking process about plural futures, as it encompasses both the content and the approach to think through global issues and their uncertain courses in futures (Martin, 2011; Roberts, 2013). Thinking merely geographically (Brooks, Butt & Fargher, 2017; Jackson, 2006) does not provide a blueprint for understanding the world or its future, but geographical key concepts, such as diversity, interaction, perception and change (Taylor, 2008), can structure one's perspective on a diverse, dynamic world.

To actually make futures education happen in classrooms is no simple task, even when the pitfalls are recognized and the fruitful possibilities to combine school geography and futures education are acknowledged. According to Hicks (2012a): "Teachers, teacher educators and educational publishers still find it difficult to grasp the nature of futures and futures thinking because they take it to be too abstract for the classroom*"* (p. 12). Making futures education work seems to involve a twofold balancing act. First, it requires the use of both knowledge and imagination, in just the right amount of each so as not to frustrate the other. Second, it requires both student autonomy and teacher guidance and support, but the latter should be timed and dosed in such a way that it does not disturb students' own efforts. In essence, knowledge and imagination can reinforce one another, and so can students' autonomy and teachers' guidance. In practice however, they easily get in each other's way. School geography teachers express uncertainty and unfamiliarity concerning these balancing acts, and they lack good examples (Pauw & Béneker, 2015).

In this chapter, an approach for the kind of critical and creative futures-oriented school geography advocated in chapter 3 is developed and tested, while taking into account the pitfalls discussed in chapter 2. The approach consists of design principles and an exemplary intervention, consisting of learning and teaching activities. The principles and intervention will be developed throughout this chapter. The teaching and learning activities will also be used in the next chapter for analysing students' ability to envision futures.

4.1.1. Research question

This study aims to answer the following research question:

How can feasible futures education lessons for school geography be developed that can achieve a balance between the use of knowledge and of imagination, as well as a balance between students' self-guidance and teachers' guidance?

The chosen method is Educational Design Research, explained further in the next section. The study consists of two design and test cycles, concerning two prototypes, each with their own focus. The second prototype allowed for adjustments based on the lessons learned with the first prototype.

The first design cycle aimed to clarify to what extent students could rely on their prior knowledge and self-guidance for thinking about futures. Therefore, the basic assumption was that students could use sufficient prior knowledge and mostly direct themselves during futures thinking. In this way, students' minds would not be clogged by teacher's delivery of knowledge about futures during the lessons. This meant that extensive scope was provided for two specific ends of the two key balances that are mentioned in the research question, viz. for imagination and for self-guidance. Our first prototype consisted of creative, open learning tasks in which students could make choices and use their prior knowledge and their skills to look up additional knowledge themselves.

In the second design cycle, the lessons were adjusted, based on the experience with the first design. As will be described later in this chapter, the focus on imagination and self-guidance did not prove fully effective as students underused their knowledge. Therefore, the second design focused on ways for teachers to give guidance and information without inhibiting imagination and self-guidance unnecessarily.

4.1.2. Structure of the chapter

Section 4.2 explains the method of Educational Design Research (EDR). In line with the requirements of EDR, section 4.3 introduces the design principles that are used in the design process. Section 4.4 describes the design, try-out and evaluation of a first prototype. Section 4.5 describes the results of a focus group discussion that reflected on a concept version of the second prototype. Section 4.6 describes the design, try-out, and evaluation of the second prototype. Section 4.7 contains the conclusions and discussion.

4.2. Educational Design Research

Introducing futures education in geography is a complex innovation. Clear examples of how to do it are lacking and many disciplines are involved. Requirements from the field of geography, pedagogy, and psychology have to be taken into account to make futures education work in educational settings. Educational Design Research (EDR) is a research method that is suited to handle a multi-perspective view of innovation and implementation processes in education, which is the first reason for choosing EDR in this study. Kelly (2013) states that EDR is time-consuming, which makes it inappropriate for fairly simple or already addressed matters. However, for substantial, open or even 'wicked' problems without satisfactory how-to-do-guidelines, EDR can be recommended. This is a second reason for choosing EDR.

The distinct emergence of EDR can be traced back to the early 1990s, with the work of Brown (1992) and Collins (1992). The most compelling argument for Brown's and Collin's landmark papers was the desire to increase the relevance of educational research. For most of its history, research in education has influenced practice only loosely and indirectly (Burkhardt & Schoenfeld, 2003; Walker, 2006; McKenney & Reeves, 2012a). The emergence of new theories of learning that stress context and the complexities of practice was a second reason for the rise of EDR (Walker, 2006). Critics of the limited impact of conventional approaches to research in education in school practice share: " a fundamental assumption […] that cognition is not a thing located within the individual thinker but is a process that is distributed across the knower, the environment in which knowing occurs and the activity in which the learner participates" (Barab & Squire, 2004, p. 1). If one believes context matters, isolating learning processes within laboratory settings will necessarily lead to an incomplete understanding (Brown, 1992). The desire to acknowledge the messiness of real-world practice led to the rise of EDR as a complementary, socially responsible, supportive research method that is rooted in, and not cleansed of, the complex variation of the real world (McKenney & Reeves, 2012b).

EDR is the systematic, cyclic process of designing, developing, and evaluating educational programs, processes and products (Van den Akker, Gravemeijer, McKenney & Nieveen, 2006). Plomp (2013) lists the following characteristics of EDR, following Van den Akker et al. (2006), A. Kelly (2006), and Nieveen (1999):

> - Interventionist: the research aims at designing an intervention in a real world setting;
> - Iterative: the research incorporates cycles of analysis, design and development, evaluation and revision;
> - Process-oriented: the focus is on understanding and improving interventions (a black box model of input-output measurement is avoided);
> - Utility-oriented: the merit of a design is measured, in part by its practicality for users in real contexts;
> - Theory-oriented: the design is (at least partly) based on a conceptual framework and theoretical propositions, whilst the systematic evaluation of consecutive prototypes of the intervention contributes to theory building;
> - Involving practitioners: the research involves active participation or collaboration with practitioners in the various stages and activities of the research – this will increase the chance that the intervention will indeed become relevant, practical for the educational context which increases the probability for a successful implementation. (p. 20)

EDR results in a twofold outcome, as shown in Figure 4.1, of a maturing intervention and a theoretical understanding. It is through this double outcome that EDR distinguishes itself from action research (Plomp, 2013). The theoretical contribution of EDR concerns re-usable design principles, which are experience-based suggestions articulated as heuristic guidelines (Design-Based Research Collective, 2003; McKenney, Nieveen & Van den Akker, 2006; Plomp, 2013). Throughout the EDR process the design principles may be adapted or modified, based on the experience gained from in the design research. "Design principles are not intended as recipes for success but to help others select and apply the most appropriate substantive and procedural knowledge for specific design and development tasks in their own settings*"* (McKenney, Nieveen & Van den Akker, 2006, p. 73). Comprehensive design principles serve not only other designers who want to address similar issues in comparable settings, but also researchers and educational policy makers (Nieveen & Folmer, 2013).

Although EDR has a nonlinear character, many EDR papers present the same main phases, shown in Figure 4.1. McKenney & Reeves' model (2012a) attempts to adequately represent the dynamic nature of design research, while allowing for a large degree of methodological freedom (McKenney, Pieters & Raval, 2012).

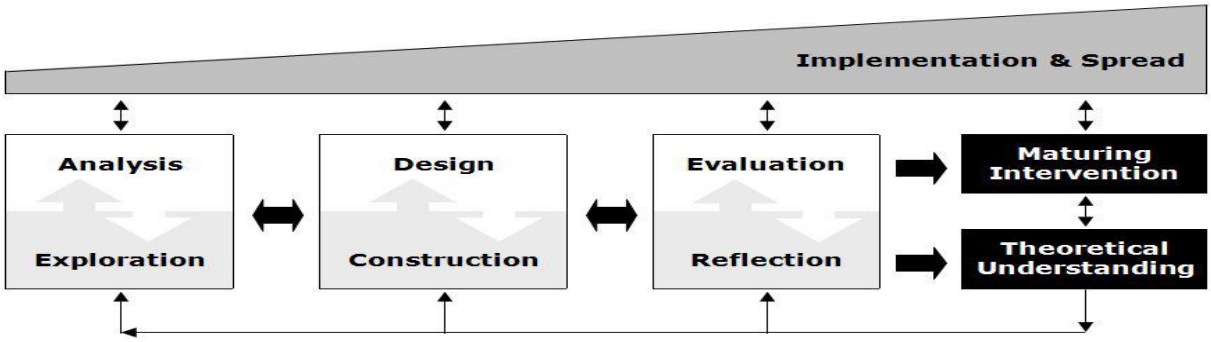

Figure 4.1. Generic model for design research in education (McKenney & Reeves, 2012a, p.77)

In the first phase, called 'Analysis' and 'Exploration' in Figure 4.1, EDR researchers analyse students' learning needs for the issue at hand and explore available knowledge. This leads to a suggested approach, formulated as tentative design principles. In the second phase – 'Design' and 'Construction' in Figure 4.1 – an intervention (for example, educational materials and/or learning activities) is designed, constructed and tested, through research activities such as document review, observation, feedback of teachers and pupil assessments. A subsequent third phase of systematic 'Evaluation' and 'Reflection' leads to the twin outcome of a maturing intervention, which in our case consists of futures-oriented geography lessons, and a theoretical understanding, which in in our case consists of three tested and refined design principles.

In line with the model in Figure 4.1, our EDR for futures education in school geography is nonlinear and at the same time well-structured. The next sections report on different EDR phases. Section 4.3 deals with the analysis and exploration phase of the process and postulates design principles that will be used and possibly adjusted throughout the process. Section 4.4 is about the design and test of a first prototype of the intervention (lesson series), followed by the description of a subsequent evaluation phase with a focus group of experts in section 4.5. Section 4.6 describes the design and testing of a second prototype of the intervention – a second cycle of design and construction. The chapter ends with a conclusion section 4.7 which summarizes and discusses our results.

4.3. Design Principles

4.3.1 Formulating three tentative design principles

In chapter 3, the discipline of futures studies and of futures education was explored with a focus on the core ideas of futures education (Bell, 2009; Slaughter, 1996). One core notion is thinking in terms of multiple futures, thereby acknowledging the importance of plurality (Van Steenbergen, 2005). Another is the use of imagination as an indispensable partner of knowledge during the analysis and design of multiple futures (Dator, 2011; Hicks, 2012a). We also introduced the key notion of anticipation. Anticipatory thought can assist students in

developing their *"*capacity to face new, possibly unprecedented situations*"* (Botkin, Elmadjra & Malitza, 1979, p. 25).

These foundational notions are the first starting point for the formulation of three tentative *design principles* for futures education in school geography. Another important starting point is the literature on innovative geography education. It offers concepts and approaches for critical and creative geographical learning, that focus on enquiry (Roberts, 2013), stimulate debate (Lambert, 1999), and result in the development of a diversity of "knowledges", "geographies" and "futures" (Martin, 2011, p. 220). More diversity in the outcomes of education allows students to make personal meanings through the contexts of their own lives (Den Heyer, 2009). Additionally, insights from educational sciences are used, since the roles of students and teachers in this kind of more open futures education is still largely unexplored (Bateman, 2012; Gidley & Hampson, 2005; Hicks, 2012a).

On the basis of all this, we identify three tentative design principles. The literature that underpins these three principles was discussed in the previous chapters. In this chapter, some key references will be repeated and characteristics of the design principles will be elaborated. The first tentative design principle is 'scenario thinking', a way of thinking that combines critical, imaginative, and evaluative thinking about different options in futures. The second tentative principle is 'student voice', referring to the explicit involvement of students' personal understandings of futures in the learning process and outcomes. The third tentative design principle is 'scaffolding', referring to a complex set of collaborative interactions through which teachers guide and foster students' thinking (Roberts, 2013; Webster, Beveridge and Reed, 1996). It is important to note that the three tentative design principles are related: the presumption is that scenario thinking can prosper with student voice and scaffolding. The three tentative design principles and their practical implications will now be explained.

4.3.2. Scenario thinking

In this section scenario thinking is explored, by defining the term 'scenario', explaining why scenario thinking is a suitable technique for futures-oriented school geography, and clarifying what it takes to think about multiple scenarios with geography students.

The term 'scenario' was coined by Kahn (Kahn, 1962; Kahn & Wiener, 1967) and became popular in the 1970s in commercial organizations and the military to identify possible hazards and choices (Hicks, 2007; DeLeon, 1973; Slaughter, 2002). Scenarios enable strategic thinking about uncertain times. A scenario is "Not a future reality but a means to represent it with the aim of clarifying present action in light of possible and desirable futures" (Durance & Godet, 2010, p. 1488) or "A description of a future situation and the course of events which allows one to move forward from the original situation to the future situation*"* (Godet & Roubelat, 1996, p. 166). Two major categories of scenarios are: "exploratory, reasoning from past and present into likely future; [and] anticipatory or normative, built on the basis of different visions of the future; they may be either desired or, on the contrary, feared" (Godet & Roubelat, 1996, p. 166). These categories clarify that many scenarios are *possible*, some are *probable* (e.g.,because they are firmly based on knowledge and current trends), and that for different persons – depending on individual preferences – different scenarios may be *preferable.* The language of probable, possible, and preferable futures or scenarios has become common among futurists and in futures education (Bell, 2009; Hicks, 2007).

Thinking about multiple scenarios is popular among futurists, because scenarios confirm that futures are open but at the same time not completely unpredictable (Bell, 2001; Dator, 2002; Veenman & Leroy, 2016). Moreover, scenario thinking is a relatively practicable futures-thinking technique (Slaughter, 2002) when compared with, for example, Casual Layered Analysis (Inayatullah, 2004). In education, scenario design is a powerful forward-thinking strategy to activate and acquire knowledge, create new perspectives, and reflect on futures (Snoek, 2003). Students can develop scenarios as "pictures of the future" (Hicks, 2007, p. 187) that can assist in exploring several options for futures. More specifically in geography education, scenario thinking is a means for educators and students to unravel future worlds in an open yet structured way. Geography education focuses on many issues that are likely to be part of futures, such as climate change, migration, and urban growth. Despite the uncertainty of futures, geography education about these issues would not be complete without looking at futures, and scenario thinking is seen as a suitable technique (Hicks, 2007). To clarify what thinking about multiple scenarios involves in geography lessons in secondary schools, three vital elements are elaborated on: 1) disciplinary knowledge and skills, including knowledge about societal developments and trends; 2) imagination; and 3) moral-ethical reasoning. On the basis of these three elements, students can design scenarios about how futures of geographical issues could unfold.

Geography, as a school subject, aspires to educate students for functioning in a complex world, from local to global (Commissie Aardrijkskunde Tweede Fase, 2003). Therefore, it makes sense to study current significant issues that are likely to be part of futures, such as climate change. When designing scenarios about, for example, climate change, students need knowledge about how climate change is defined, what its causes and effects are, at different places, and in what ways different stakeholders react to climate change. Knowledge that defines and explains the current state of climate change can foster scenario thinking about this multifaceted issue. Students have prior geographical knowledge and skills − such as map skills and critical thinking skills − from earlier education, that needs to be activated and enriched. Geographical knowledge and skills assist students in developing vague images of uncertain futures into scenarios that can be interpreted as 'educated guesses'.

As illustrated by the example of climate change, the core of school geography is the human-nature relationship in which environments are shaped (Geographical Association, 2012; IGU-CGE, 2019). Students can think through future environments by looking at how natural/ecological, economic, socio-cultural, and political processes interplay and in what future environments this interplay may result, from the local to the global (IGU-CGE, 2019; Koninklijk Nederlands Aardrijkskundig Genootschap, 2017). By looking at extended timelines (Hicks, 2007) into the recent past and future worlds, the geographical key concept of 'change' (Taylor, 2008) is thought through. Questions to address are, for example: What if climate change accelerates? What if climate change becomes the leading issue on political agendas? What activities and actors can be part of such changes, where, and why there?

A practical means for taking current, major societal developments into account is the study of trends, a common technique for exploring futures (Hicks, 2007). In futures education, the term 'trend' refers to a significant, currently discernable, societal development, heading in a certain direction. Trends bring students a certain level of clarity, as they demarcate developments. Moreover, students already carry around ideas about trends (Benammar et al., 2006), as it is a familiar term. But although a trend is distinctive, it is important to stress that it is also provisional: "a trend is not a destiny" (Slaughter & Beare, 2011, p. 118). Students cannot be allowed to take trends as future truths. Instead, trends should be used as guidelines,

and their legitimacy can be discussed. Moreover, different directions of societal developments and distinguishable trends need to be considered. Imagination can be helpful here, as will be described in the next paragraph about this second element of scenario thinking.

With imagination, creative responses to future challenges can be explored during scenario thinking. "Geography and creativity are fundamentally aligned. Trying to make sense of the world and understanding the forces that act upon it – key geographical endeavors − require us to think creatively" (Scoffham, 2013, p. 372). But, however clear on a visionary level, the explicit use of imagination is not so common in geography classrooms, "Creativity, though it may be seen by teachers as a 'good thing', raises problems at a classroom level" (Scoffham, 2013, p. 371). Creativity is a fluid and ill-defined concept, fitting uneasily into the current educational system, as it takes time and is hard to assess (Scoffham, 2013).

In this study, the starting point of exploring creative, possible scenarios is students' divergent thinking (Guilford, 1950). Divergent thinking generates variability: "doing things differently from the usual, regardless of accuracy, meaning, sense, significance or interestingness*"* (Cropley, 2001, p. 14). To trigger divergent thinking, teachers can make use of students' personal ideas that are, whether or not consciously, part of students' understandings of how the world works (Egan, 2001; Hopwood, 2011; Massey, 2006). Since these personal ideas can encompass a not well-defined network of memories and associations, they are specifically useful for divergent thinking. Divergent ideas can appear as separate thoughts, but they are often part of a narrative (Bruner, 2004; McPartland, 1998; Scoffham, 2013). The function of narrative in geography education is "to stimulate the geographical imagination, to act as a vehicle for the transmission of geographical values and to promote the acquisition of geographical knowledge and understanding" (McPartland, 1998, p. 342). Our geographical understanding of the world, relies partly on our experiences (Bennetts, 2005), and the memories of these experiences can be fruitful for composing futures thinking. Although the future does not exist, with our memories we can create 'fictive experiences' through imagination and narratives. "The notion here is that we cannot move towards a future we prefer, unless we are able to imagine it" (Hicks, 2012b, p. 55).

Moral ethical reasoning is the third key element of scenario thinking, which is necessary to explore what students prefer and why, by reflecting on their motives and values. Perspectives of others – for example, coming from peers, parents, or media – can be used to put personal ideas into perspective. However, geographical knowledge is also an essential benchmark for preferable scenarios. Students critically think through their preferred future scenarios, addressing analytical and moral-ethical aspects and values.

Scenario thinking − based on geographical knowledge and skills, imagination, and moral-ethical reasoning − puts demands on learning environments. In concrete terms, this tentative design principle implies that the teaching and learning activities and materials of our intervention are designed in such a way that:

1. Students design multiple scenarios for futures about a key geographical issue or theme;

2. When designing scenarios, students use (prior and new) geography knowledge about human nature relationships, about place and space from local to global and about (societal) developments and trends;

3. Students use imagination when designing scenarios;

4. Students use moral ethical reasoning when evaluating scenarios.

4.3.3. Student voice

The previous paragraph explained that students' personal ideas of the world and its futures can play a fruitful role during scenario thinking. Moreover, students' personal understandings of the world are always present and influential. "The point is that the world 'out there' is framed, understood and conditioned through the world 'in here'" (Slaughter, 2002, p. 29). This second design principle concerns the recognition, expression and acknowledgment of what students think and feel about futures. The influence of a personal frame of reference (Mezirow, 1997) on futures thinking may seem self-evident at first glance, but scenario thinking can be performed without students comprehending that futures education is about *them* and concerns *their* futures. Futures education literature acknowledges that students can disconnect from futures, cognitively and emotionally (Rogers & Tough, 1996). Actively using students' voices can make students aware of what their mental frames are, and what influences these have on their futures thinking. Students' personal development and understanding can benefit from such perspective awareness, just as their ability to develop future scenarios can.

A wide range of terms is used in the educational literature to refer to relevant aspects of students' frames of reference. Mezirow (1997) distinguishes "associations, concepts, values, feelings and conditioned responses" (p. 5) that define a life world. Geography education literature also advocates for the use of student frames of reference (Biddulph, 2011; Hopwood, 2011; M. Robertson, 2007). Bennetts (2005) explains how our understanding is a complex cooperation of:

> **Experiences***:* potentially rich and complex, direct and indirect, structured to a greater or lesser degree; **Ideas**: mental constructs, e.g., concepts, generalizations, models, theories, personal and public meanings; Linked by **mental processes**, involving language, recall, cognitive activities, reflective thinking and imagination. (p. 114)

Futurists also emphasize the importance of paying attention to students' voices as these echo students' mental constructs, experiences, and meanings that influence their futures thinking (Eckersley, 1997; Hicks & Holden, 1995; Hicks, 2012a).

Scenario thinking offers opportunities to increase students' awareness of personal frames of reference. Once this awareness is there, intuitive beliefs can be scrutinized and narrow perspectives widened. Especially when matters get complex – for example concerning futures of climate change – narrow perspectives and simplifications can be attractive. Media headlines express simple one-liners on these matters, which can turn into influential frames in people's minds (Haidt, 2012; Hulme, 2009; Veenman & Leroy, 2016). These frames are by no means purely intellectual constructions, as thinking is influenced by affective states (Slovic, Finucane, Peters & MacGregor, 2004; Picard et al., 2004). Especially hopes and fears are often referred to in futures education literature (Hicks 2012a; Kelly, 2008; Lombardo, 2007; Rogers & Tough, 1996; Saunders & Jenkins, 2012). Three other insights from literature about affective states involved in futures thinking are:

- Students in general tend to be more hopeful about their *personal* futures and more fearful about *global* futures (Béneker, 2013a; Hicks, 2012a).

- Feelings can both stimulate and discourage scenario thinking (Rogers & Tough, 1996; Saunders & Jenkins, 2012);

- Students often experience it as unsettling to express their personal ideas and feelings about futures (Saunders & Jenkins, 2012). This might be even more so for adolescents for whom long-term thinking is more difficult, and who are sensitive to peer approval (Jolles, 2016).

Although addressing affective states in futures education appears to be important, no clear guidelines for how to accomplish this were found. A good starting point in the present study seems: making affective elements explicit and addressing these during reflection, feedback, study, and conversation. Assistance can come from peers, the teacher and disciplinary knowledge. The role of geography classes for students is to "ensure that their personal meanings are put against what is known*"* (Lambert, 2014, p. 179). Taking students voices seriously requires respectful attention, which includes openness, as well as a critical check. The geography class might be the only place where students encounter notions such as spatial and temporal interdependence. This can help them to see how, also in their own lives, 'the global is in the local' and 'the future is in the present'. Students' attendance at school is, for example, futures-oriented.

In concrete terms, our design principle of 'student voice' implies that the teaching and learning activities and materials of the intervention are designed in such a way that:

1. Students explain their personal (affective and cognitive) perspectives about futures;

2. Students discuss and evaluate their personal perspectives on futures, using peer perspectives and geographical knowledge as frames of reference, to broaden their minds and alter their misconceptions.

The ambition of working with students' voices during scenario thinking puts the teacher in the challenging position to organize "thinking-with-feeling in the classroom" (Newton, 2014, p. 5). The next section elaborates on this teacher role.

4.3.4. Scaffolding

The teacher approach that is considered suitable for organizing scenario thinking is called "scaffolding" (Wood, Bruner & Ross, 1976). The metaphor of the scaffold refers to the need to provide support, as well as scope, for students' own thoughts. Scaffolding is strongly related to Vygotsky's concept 'zone of proximal development' (1978), in which "the child never succeeds too easily nor fails too often*"* (Wood, Wood & Middleton, 1978, p. 144). *"*Scaffolding refers to support that is contingent, temporary, and aimed at the transfer of responsibility for a task of learning" (Van de Pol, 2012, p. 199).

To scaffold scenario thinking requires the design of appropriate student tasks and a specific management style of the learning process during classes. Both this design and management are briefly explained here.

The core of the designed task, which structures both content and process, is a significant geographical issue or theme, related to a specific location or scale, around which students can design scenarios. Subsequently, the teacher selects significant societal developments and

trends that are expected to influence the issue or theme. In terms of process, the design should offer organizational clarity, provoke critical thinking, allow for peer communication, and organize reflection. All these demands should, however, not result in a scaffold that is, in fact, a cage. This would conflict with the ambition of 'autonomy supportive teaching' (Ryan & Deci, 2000; Belland, Kim & Hannafin, 2013), in which the responsibility for the (highly organized) learning process is initially given to students themselves. To preserve autonomy and, at the same time, provide clarity, the design consists of bigger tasks that from the beginning clarify the ultimate aim**:** scenarios for futures**.** Designing bigger tasks is based on what is called the **'**whole task approach' (Van Merriënboer & Kester, 2008; Janssen, Hulshof & Van Veen, 2016), which enables students to work for themselves and teachers to differentiate by offering 'contingent support', which is "tailored, adjusted, differentiated, titrated, or calibrated support*"* (Van de Pol, Volman & Beishuizen, 2010, p. 274).

In terms of management of learning, a scaffolding approach should stimulate students to work autonomously, while providing guidance when needed (Hmelo-Silver, Duncan & Chinn, 2007). Teachers' geographical expert guidance can consist of the following instruments: ascertaining students understanding for differentiation (Van de Pol, 2012); giving clear, explanatory, timely feedback (Belland, et al., 2013); and modelling, in the sense of demonstrating behavior that students can imitate (Van de Pol, 2012; Wood, Bruner & Ross, 1976). In terms of group dynamics, scaffolding scenario-thinking requires confident leadership (Van de Pol, 2012) "to negotiate the flow of affective experience" (Newton, 2013, p. 41) that is often evoked by creative thinking. The tendency to misjudge creative and enthusiastic students as disruptive should be avoided (American Psychological Association, 2015). Student-teacher interaction can better be characterized as dialogic rather than authoritative (Scott, Mortimer & Aguiar, 2006). However, students' ideas should also be scrutinized, in order to avoid an ineffective "anything goes approach to geographical learning" (Biddulph, 2011. p. 53) or "a flabby relativism where each and every geographical imagination has equal validity" (Castree, 2004, p. 139). The tone and targeting of feedback matter and allow for critical yet constructive classroom management (Newton, 2013; Scoffham, 2013).

In concrete terms, the third design principle of scaffolding implies that:

1. Teachers design big, open tasks, as frameworks for content and instruction;

2. Teachers explain the tasks to students and subsequently teach in a way that supports students' autonomy, i.e. they leave the responsibility for learning to the students themselves for as long as it is fruitful;

3. Teachers repetitively ascertain students' understanding, differentiate by providing timely feedback, and model intellectual and creative reasoning about futures;

4. Teachers acknowledge, use, and manage student's affective reactions.

Based on the three design principles and their implications, a first prototype was developed. Section 4.4 describes the design, try-out, and evaluation of this first prototype.

4.4. Design and Test of the First Prototype

4.4.1. Focus of first prototype

The aim of the first test and design cycle was to find out to what extent students in upper secondary school could rely on their self-guidance for scenario thinking. In terms of the research question, the first prototype provided scope for students' self-guidance by limiting teachers' guidance, to see what effects this would have on scenario thinking with knowledge and imagination. The first prototype, therefore, consisted of creative, open learning tasks. The assumption that students can be self-supportive is legitimized by the fact that the participating students have already had five years of secondary school geography.

The geographical theme that on which the lessons focused, was 'urban futures'. Cities are ambiguous, dynamic, related, complex and uncertain (Sennett, 2018), just as futures are. Furthermore, urban environments are familiar to most students, as many of them are growing up in such environments (Béneker, Sanders, Tani & Taylor, 2010). The global relevance of urban futures is illustrated by the fact that 'Sustainable Cities and Communities' is one of the 17 sustainable development goals on the agenda of the United Nations (United Nations Development Programme, 2015). Moreover, urban environments are studied throughout secondary school, and urban *futures* are a theme in the Dutch school geography curriculum (College voor Toetsing en Examens, 2015). For example, in lower secondary school, students study different types of urban neighborhoods or look at economic, socio-cultural and political activities in cities. Also, map skills such as map reading, map analysis, and map interpretation have been practiced. Therefore, it appeared reasonable to expect students to be able to use to a certain extent their prior knowledge and skills for futures thinking about tomorrow's cities, even though attention for futures had been underemphasized in their education so far (Pauw & Béneker, 2015).

Given the depth and width of urban futures as a theme, it could be considered likely that students would be in need of information additional to their prior knowledge. The test with the first prototype intended to find out whether students would seek and find this information themselves: for example, in their provided school books and atlases, or on the internet. New information and knowledge is currently often considered available for anybody with computer access (Veen & Vrakking, 2006; Partnership for 21st century skills, 2007; Organization for Economic Co-operation and Development (OECD), 2009). The first test could clarify whether this availability had actually led to the disclosure and use of new information.

To assist students in focusing their search for additional information and − more generally − their thinking about urban futures, four societal developments were used in the lessons: *sustainable development; economic development; individualization;* and *deregulation,* Preselecting these developments that are likely to occur in urban futures, can assist students to a certain degree, while still leaving open options for scenario thinking. The selection is based on numerous reports about urban futures published by scientific, governmental and commercial institutions (e.g., Deloitte, 2015; Harvard Business School, 2011; Raad voor de leefomgeving en infrastructuur, 2014; Technische Universität Dortmund, 2013). The four societal developments were considered important for urban futures in the reports. Moreover, the developments are related to four dimensions, 'nature, economy, culture and politics', which are part of the way of thinking propagated in the Dutch geography curriculum for upper secondary schools (College voor Toetsing en Examens, 2015). The chosen terms are briefly explained here. 'Sustainable development' refers to the process in which current needs

are met, without compromising the ability of future generations to meet their own needs. 'Economic development' refers to the gross domestic product, which can develop in multiple directions: economic growth, decline, and everything in-between. In the term 'Individualization' a trend is defined, referring to a process in which citizens function in society increasingly as individuals and less as a members of a group. In the term 'Deregulation' again a trend is defined, referring to the process of decreasing government control, in the Netherlands mainly visible on the level of national government. The four terms, although somewhat different in nature, aim to summarize major developments in societies, in order to assist students in finding a worthwhile and comprehendible direction for starting their futures thinking about tomorrow's cities.

Features of the first prototype

The first prototype consisted of three lessons, as listed in Table 4.1. All lessons were structured as follows: the teacher activated prior knowledge; then students worked on a task; and finally the teacher and students interpreted and discussed the students' results.

Table 4.1
The first prototype summarized

Aim: students design and evaluate scenarios of urban futures, using their prior geographical knowledge and skills, knowledge of societal developments/trends, and imagination

	Content per lesson	*Main student activities*
1	Creative outlines of urban futures	Design, present, and evaluate outlines of future cities, including actors, activities and artefacts.
2	Scenarios of Amsterdam in 2050, based on two developments: 'sustainable development' and 'economic development'	Design, present, and evaluate scenarios based on: a) prior geographical knowledge and skills about: - actors, activities, artefacts, dimensions, spatial scales, time periods and maps; - sustainable development and economic development; b) imagination, based, for example, on memories or associations.
3	Preferable scenarios of Amsterdam in 2050, based on two out of four developments and trends: 'sustainable development', 'economic development', 'individualization', and 'deregulation'	Design, present and evaluate scenarios based on: a) prior geographical knowledge and skills about - actors, activities, artefacts, dimensions, spatial scales, time periods and maps; - two chosen developments out of four suggested: sustainable development, economic development, individualization, and deregulation; b) imagination, based, for example, on memories or associations.

More information on the individual lessons can be found in the following description of the test and in the lesson plans in Appendix 1.

4.4.2. Test of first prototype

First, the context and the method of the test of the first prototype are described. After that, the three lessons are described.

Context and method of the test

The first prototype was tested in a small private secondary school in Amsterdam during three lessons, each of one hour. The small upper secondary class consisted of seven students, aged 16, 17 and 18, at pre-university level. When positioned in Nieveen & Folmer's (2013) classification of evaluation methods common in EDR, this test might be best characterized as "a micro try out": a small-scale test of three designed lessons, which were rapidly prototyped to efficiently gain first insights. The researcher also participated as the teacher. This role mingling should be approached critically, given the risk of losing objectivity once the researcher is subjectively involved. It can, however, also be treated as a productive force contributing to balanced solutions (Van der Jagt, 2016; Van den Akker, Branch, Gustafson, Nieveen & Plomp, 1999). As a rule of thumb, these authors suggest the constructive allowance of double roles in the earlier stages of the research such as this first test, while in later stages, the researcher should shift to a stronger role as critical researcher (Van den Akker et al., 1999, p. 11). Data on the test were collected through classroom observations, field notes, student products, and a final written survey for students.

Lesson 1

During the opening of Lesson 1, students individually answered questions on their hopes and fears about futures, derived from a publication about scenario thinking in higher education (Benammar et al., 2006). The questions concerned students' questions about futures and their hopes and fears for Amsterdam in 2025. Futurists emphasize the influence of hopes and fears on futures thinking (Bell, 2009; Lombardo, 2010; Hicks, 2012a). Students did not seem immediately ready for exploring futures, as indicated by first reactions such as "How should I know?". Nevertheless, after initial hesitations, students wrote down their answers that were subsequently discussed briefly. They did seem to take futures as a topic that concerned themselves, since they formulated questions such as: "Where will I be in 20 years?" and remarked "I would only want to know my future, if I can still influence it*"*. For Amsterdam, they hoped for more entertainment options, more green areas, more space and tolerance among its inhabitants, and the conservation of its beauty. Students' fears for Amsterdam's futures were overpopulation, disagreements and the extension of unattractive business parks and housing at the expense of green areas and historical heritage.

Students' answers in the orientation phase provided leads for the teacher to present the aim of the series: the design of multiple scenarios of urban futures. So as not to complicate this innovative aim unnecessarily at this stage, the terms 'possible', 'preferable' and 'probable' were not used explicitly. The teacher asked students what importance futures thinking about tomorrow's cities could have for them. In this conversation, the teacher clarified the relevance of the series within the geography curriculum. Subsequently, students were stimulated to activate their images and knowledge about urban environments, with the help of Power Point slides with questions about urban artifacts, actors, and activities (e.g., 'who makes the city? Write down actors'). Students were also stimulated to think about

tomorrow's cities in new ways, with the help of two short videos that introduced the concepts of the 'smart city' and the 'creative city'. The smart city was illustrated by a short video of Masdar City in the United Arab Emirates. The creative city was illustrated by a short video of the Dutch city of Almere which enables citizens to construct their own house and neighborhood with minimal government interference. After this, students started working on the main task of the first lesson: building an outline of a future city, with several sorts of candy for use as building material. This task, named 'the Sweet City' was developed by a secondary school teacher who was aiming to stimulate more creativity in her classroom. The peculiar material of candy was chosen to trigger playful thought on a complex matter. Students were instructed to base their city outline on: 1) prior knowledge about actors, activities and artefacts involved in current and future cities; and 2) personal ideas and preferences for future cities. No spatial scale or time period was given to see what students would come up with. The task was performed in two duos and one trio.

Classroom observations reported lively speculations on choices and possible outcomes while the students built outlines, as illustrated by the two examples in Figure 4.2. The outlines included activities such as working, living (dwelling), recreating, and transporting. Different activities were represented by different types of candy.

During the presentation of the outlines, similarities and differences between the outlines and underlying motives were explained and discussed. For example, in one of the outlined future cities different age groups were mingled to profit from potential complementarity, such as with the elderly looking after children during parents' working hours, while, in another outlined future city, age groups were strictly separated to prevent nuisance as a consequence of differences in preferred living conditions, such as youngsters liking a lively night life, while older people preferred quiet surroundings. In summary, it resulted in diverse but also simple scenarios, free from dilemmas. The different artifacts, actors and activities did not seem to cause friction in the outlines of these future cities. The teacher asked questions about the outlines, to check whether students saw frictions implicit in their urban futures, and if so, to get these thoughts out into the open. One group, for example, suggested separating different income groups to "prevent problems". When the teacher tried to reason about the practical implications, advantages, disadvantages, and moral-ethical aspects, the students seemed reluctant to analyze their scenarios. A student cut the conversation short by concluding that their outline was "not perfect but as good as it gets". Students seemed satisfied and possibly even relieved, with having created a scenario with at least some consistency. In the final reflection phase of the lesson, students wrote down their learning

outcomes, such as: “I now know how to focus on the future and its issues and solutions”, and “I wonder how the diversity of ideas about futures can be combined in a plan that leaves no one dissatisfied”.

Lesson 2

In the opening of Lesson 2, it took some effort for the teacher to get the students back into an atmosphere of active, open thinking. The teacher asked questions to recall students’ experience and lessons learned during the first lesson. When a student mentioned the smart city, the teacher used this lead to recall the concepts of the smart and the creative city and brought up some critical opinions published by geographers (Cugurullo, 2013; Engelen, 2012) to the students’ attention. The aim was to stress that the concepts are both popular and criticized. Moreover, the teacher invited the students to also think critically themselves.

The students were subsequently given information about two developments and their influence on Amsterdam’s future: ‘sustainable development’ and ‘economic development’. The teacher and students discussed the two kinds of development and thought about different scenarios that could arise when the developments happened in futures, in varying combinations: economic development could show growth or decline, in a society that could become more or less sustainable, and could be threatened by more or less climate change.

Students then took up a scenario development task in two small groups. They discussed the impact of economic development and sustainable development on the city of Amsterdam in 2050, and in what four scenarios this impact could result. The aim was that each small group would present two scenarios. The teacher had suggested presentation options such as a sketch map of a city outline, a mind map of key concepts, or a short video clip. As an example, the teacher showed an illustrative sketch map by Hicks (2012b) concerning a preferred sustainable future.

Compared with the Sweet City task of Lesson 1, this second task was more demanding: it contained two developments that required reasoning about different geographical dimensions and a specific spatial scale and time. After brainstorming about all sorts of possible scenarios, the students had to design and underpin two scenarios: one scenario about what they *thought* futures would be like − a probable scenario; and one scenario about what they *hoped* futures would be like – a preferable scenario. The task required a lot of cause and effect reasoning by students. This brought up many personal perspectives, assumptions, and narratives, but also many substantive questions. It was difficult for students to reason logically about sustainable development and economic development and imagine futures actors, activities, and artefacts that could occur in a certain combination of developments. Students did not use atlases, even though their use is common in Dutch classes and they provide relevant maps of Amsterdam. Hence, the teacher was constantly assisting students, and the task took more time than planned. Field notes describe the atmosphere in the classroom as ‘rushed’.

The debriefing looked at the consistency and the underpinnings of the scenarios. Each group managed to develop one scenario which contained probable and preferable elements. One scenario was presented as a sketch map and the other as a written text. The sketched scenario focused on Amsterdam’s residential function and stayed close to the current situation of Amsterdam to which high-rise buildings were added. Although the scenario seemed to express economic development, this was not explicitly mentioned. The other, written, scenario foresaw a prosperous and green Amsterdam, based on highly active participating inhabitants and government, without explaining further what specific activities or actors this

concerned. In summary, the task of the second lesson, which gave more directions than the task in the first lesson, resulted in very open, unfinished scenarios. These scenarios showed that students had many ideas about futures but these remain unfocused. The newly introduced developments, the open task and the limited time available for it, made too high demands for them to develop the range of scenarios aimed at. In the final reflection phase of the lesson, students wrote down their learning outcomes, such as: "trends influence a city and how Amsterdam will be in the future" and "different futures in terms of climate for optimists and pessimists". As a homework assignment, students were asked to write a short story (100-200 words) about their personal life in a preferred future in 2025.

Lesson 3

In the opening phase of Lesson 3, two students read out stories about their personal lives in 2025. The teacher highlighted elements in these stories that could refer to trends. One student for example saw her future-self going around London by bike, and the teacher asked whether this biking was related to sustainable development, which was the case. One student's preferred future showed the disappearance of smart phones, "back to Nokia", and an "equal budget for defense and art". The teacher used these preferred changes as a lead to two new trends that were introduced: 'individualization' and 'governmental deregulation'. Together with the students, the teacher reasoned about causes of individualization and governmental deregulation and their probable and possible consequences in futures. The teacher also explained how these trends can be related to the dimensions 'culture' and 'politics' that students are familiar with as part of a geographical approach.

In the central task of this lesson, students developed preferred scenarios based on a framework of two trends, just as they did in Lesson 2. However, this time students had to choose two out of the four developments and trends discussed: 'sustainable development'; 'economic development'; 'individualization'; and 'governmental deregulation'. The assignment challenged the students to reason about actors, activities, and artefacts that could occur in their chosen combination of trends. Students could also use ideas from their personal futures stories prepared as homework. Students had to present the scenarios in the form of a short, self-made animated film. The teacher modelled the form of this film in a simple way, by presenting a line-up of five drawn scenes and a voice over, about a fictive adolescent 'Sam in Amsterdam' in 2050. In accordance with the focus on students' prior knowledge and self-direction, the teacher emphasized that the example illustrated the form of presenting and not so much the content of the futures. After the students saw this example they made their own version of scenarios in the form of animations, in two groups. First, they made drawings of urban futures scenes in which the trends had to be visualized. Then, they lined up the scenes as a story, filmed it and added a voice over.

There was an energetic atmosphere among students while designing the scenarios. Students had many ideas and narratives. However, to embed them in coherent, underpinned scenarios turned out to be complex. Although urban actors, activities, and artefacts were heard and seen in the scenarios, conversations rapidly shifted from one idea to another. The teacher assisted students towards more systematic reasoning, which put pressure on the intention of autonomy-supportive teaching, just as in Lesson 2. For example, one group imagined a new university in a poorer neighborhood of Amsterdam, in order to lift the neighbourhood out of poverty. The students were satisfied with their plan but did not critically evaluate it. Only after feedback from the teacher, did they wonder where the nearest already existing university was, and where potential students for the university could come from. The students

themselves had not considered a larger spatial context or asked themselves critical questions about their scenario to strengthen its content or underpinning.

In the next phase of Lesson 3, the two short animated films that had been made by the students, were watched together. The animations showed, in total, three scenarios: one animation presented two opposite scenarios and one animation presented one scenario. The animation that presented two opposite scenarios showed two narratives based on 'economic development' and 'individualization'. Both scenarios showed far-fetched individualization. The first scenario showed no governmental control, which led to conflicts between individuals with different viewpoints. This scenario could be characterized as an 'edge of disaster' scenario, an often-heard narrative in futures education (Roberts, 2003; Hicks, 2007). The second scenario showed separate territories for groups or individuals with different viewpoints. Economic development was not worked out well by the students. The other animated film presented one single scenario, based on the trends 'sustainable development' and 'individualization'. It declared how urban futures would be more sustainable and healthy, characterized by strong social cohesion and be part of an economically more equal world. This scenario resembled another often-heard future narrative, referred to as a 'sustainable society' scenario (Roberts, 2003; Hicks, 2007). The animation mentioned cooperation between organized citizens and a strong government, which was financed by economic revenues earned with successful, sustainable innovations. Underpinnings, similarities, and differences were discussed in the teacher-led debriefing. A conversation about the consequences of the scenarios for the inhabitants of Amsterdam in 2050 was started, but could not develop due to the limited time.

In conclusion, the students managed to present ideas about developments and trends in futures which included actors (e.g., citizens, government) and activities (cooperation, innovation). The students did not mention functions, although the scenarios referred to 'urban people' which probably implied their residence. The narratives were general and included no artefacts or other references to concrete urban scenes. One reference was made to a larger spatial scale, since more economic equality was said to be expected globally. The scenarios seemed to stand apart from the specific time scale of 2050 and the specific spatial scale of the city of Amsterdam. The scenarios seemed to express values such as peace, sustainable development, health, and justice. However, these moral-ethical aspects remained general and free of obligations.

The lesson ended with two final activities: a written evaluation survey of the three lessons and a short, concluding conversation to summarize the aims and results of the series together.

4.4.3. Evaluation of the first prototype

In the first design cycle, the question was whether students could use sufficient prior knowledge and direct their learning process themselves. The intention was to prevent students' minds from being clogged by the teacher's delivery of knowledge about futures and teachers' instructions. In terms of our research question, this meant that extensive scope was provided for the specific ends of the two key balances: for imagination and for self-guidance. The first prototype consisted of creative, open learning tasks in which students could make choices within tasks and use their prior knowledge, skills, and imagination.

It turned out to be practically feasible to organize fairly autonomous thinking about futures by students. In the three lessons, each student worked on three or four different scenarios, and, in total, eight scenarios were developed throughout these three lessons. This indicates that two

common pitfalls in futures education (as referred to in the introduction of this chapter) were avoided: the pitfall of presenting the future as one fixed, knowable 'script', and the pitfall of (accepting) a passive audience of students to which this fixed future is presented. Therefore, the fact that students actively developed a range of different futures can be considered an important result.

However, when evaluated beyond feasibility of organisation, the test showed simplistic scenarios that required further development. Students' prior knowledge of urban areas was only seen to a limited extent in the scenarios. Students brought up actors, activities, artefacts, and dimensions, but these appeared rather isolated. Where friction appeared between different functions or dimensions, students seemed to accept imperfect scenarios rather than to take the analysis further. Relations with other spatial scales were mentioned once, and mapping skills were also used once. During the debriefing of scenarios, students appeared reluctant to approach their first drafts of scenarios critically. Just as their designs appeared unsophisticated and orderly, their reasoning was also straightforward, staying away from the reality of messy urban areas. They seemed to 'defend' their scenario against feedback, instead of using feedback as a starting point for joint substantial reasoning and the improvement of their scenarios. Possibly, the debriefing sessions could have achieved this with more time. In this test, however, students considered their scenarios finished and seemed relieved to have designed at least fairly consistent scenarios.

In terms of the design principles, the test with the first prototype showed students' scenario thinking, in which divergent thinking and student voices were seen. However prior and new knowledges were underused. Scaffolding provided scope for active participation, but came under pressure as students needed a lot of help. Moreover, it remained doubtful whether reflection based on geographical knowledge took place, and whether misconceptions about futures were altered.

In conclusion, in this test with this first prototype, scenario thinking appeared too complex for students to fulfill as an autonomous task. Although the scenarios that were made can be interpreted as starting points, the emphasis put on students' prior knowledge turned out to be not effective. The reasons behind students' neglect of prior knowledge in the scenarios are not so clear. Possibly, the limited time is a factor, as well as the newness of scenario thinking. Moreover, students are conditioned to work on clearly demarcated tasks and to call upon their teacher as a disciplinary expert when knowledge is needed. Clarity in tasks and assistance may have been all the more needed by students during creative futures thinking that is "quite alien" to students (Saunders & Jenkins, 2012, p. 499).

Written evaluation

The written evaluation at the end of the lessons concerned the students' reflection on their experiences and shows the following results:

- The students were confident about their ability to name developments and trends after the lessons: on a 3-point rating scale ('yes' - 'a little' - 'no'), six out of seven students considered themselves able to mention developments and trends relevant for future times after these three lessons, while one student chooses 'a little'.

- The students saw the relevance of thinking about the city of the future: 'yes' was chosen five times and 'a little' two times.

An open question asked what should be maintained in the lessons. Students answered: “the creative group tasks” (four times), “the Power Points“ (twice), “the atmosphere”, “the enthusiasm of the teacher”, “the great number of examples and visual materials”, “the structure of explanation and application”, “students who are not so outgoing are being involved, which I consider a plus”. A second open question asked what the students thought should be improved. Students answered: “nothing” (twice), “more interaction with students during explanation”, “more specific explanation of key terms” and “more attention paid to how realistic our ideas are, and how we can pursue them”. Although the last answer indicates that this student wanted to develop scenario thinking further, none of the students asked for more knowledge about urban futures.

Consequences of the evaluation

Based on the lessons learned from the evaluation, three alterations were made:

- A set of resources about the four trends was added to the lesson series. The resources, for use to students during scenario design, contained maps, graphs, pictures, and texts about the trends. The resources defined the trends, put these into a time perspective of the past and into a future urban context. The aim was to assist students in their thinking about functions and dimensions (represented by artifacts, actors and activities) in urban futures that could be related to other spatial scales and time periods. In this way, information was provided without directly threatening students’ autonomous thinking. A fragment of the set of resources can be found in Figure 4.6. The complete set of resources is available on the website (see: http://irispauw.nl).

- To stimulate relational geographical reasoning, ‘food supply in urban futures’ was chosen as a focus point for questioning the students, in case they designed unsophisticated, stereotypical scenarios. Food supply is a concrete, and at the same time, complex sub-theme. It can easily bring up vivid questions about how different urban functions and dimensions match or mismatch (represented by matching or mismatching artifacts, actors and activities). Food supply relates the urban territory to other spatial scales and time periods. By modelling and stimulating futures-thinking about food supply in tomorrow’s cities, scenarios can become more profound.

- The lesson series was extended from three to five lessons. Giving the students more time enabled them to activate their prior knowledge, study the provided resources, and develop relational geographical reasoning, under increased guidance and stimulation from a geography teacher.

4.5. Reflection in a Focus Group Meeting

Context and method

To get feedback on the concept version of the second prototype, a formative evaluation was organized by a focus group, as recommended in EDR literature (Nieveen & Folmer, 2013). The focus group meeting was part of the third phase of McKenney & Reeves’ EDR model, presented in Figure 4.1 and was intended to improve the second prototype, which was part of the second phase. This shifting between phases confirmed the dynamic nature of Educational Design Research as emphasized in McKenney & Reeves’ model (2012a).

The focus group consisted of seven experts from both within and outside the educational field: two geography teachers, two geography teacher educators, a graphic designer, an urban developer with experience as a geography teacher, and a journalist with expertise in the field of food in the city. The relevance of the geographers' input is evident. The involvement of the other three participants with a diverse, relevant background was aimed at introducing innovative, creative thinking about the design, as advocated in futures education literature (Inayatullah, 2008; Slaughter, 2012).

In advance of the focus group meeting, the members had been given the concept version of the second prototype and questions guiding the analysis. The focus group members were asked to evaluate the design concerning its relevance, consistency, expected practicability, and expected effectiveness. The meeting took two hours and was chaired by a senior geography education specialist, so not by the researcher herself. Feedback from the focus group members was gathered by written group feedback and individual feedback and by group discussions, of which recordings and minutes were made by a geography professor and the chair.

Results

The formative evaluation led to the following conclusions:

- The design was unanimously considered to be relevant. As one of the teachers said: "essential design";

- The design was considered consistent. As one of the teachers said: "the series offers a good, consistent structure with a variability in learning activities";

- The design was seen as challenging for both teachers and students, which might have consequences for its practicability. As the urban developer said: "the design is demanding for students (nice!) but do they have the right tools at their disposal?";

- Several suggestions were made to improve the effectiveness of the design. First, the geographers in the group advocated a stronger geographical emphasis in the scenario-designing tasks, a focus on relations between the dimensions *in* the city and *of* the city, and with other places in the world. Second, members recommended stimulating more creativity more explicitly. The third recommendation concerned having a stronger emphasis on how students' personal lives are connected to urban futures.

The feedback of the focus group confirmed the idea to add substantial resources to the design of the second prototype, as concluded in the evaluation of first prototype. The focus group acknowledged and stressed the importance of paying attention to the functions, dimensions, scales, and maps of future urban places. The feedback was also an alert to avoid the problem that having more content can threaten the imagination task in scenario thinking. Based on the focus group feedback, the concept version of the second prototype was changed:

- More emphasis was put on maps and outlines of urban futures by including a major task in which students had to draw urban scenarios;

- Creative thinking was stimulated more explicitly by using the work of socially-engaged designers;

- The connection between futures and students' lives was emphasized further by a reflection task;

- More time for design and a critical study of the scenarios was provided by extending the series from five to six lessons.

4.6. Design and Test of the Second Prototype

4.6.1. Focus of second prototype

The second prototype aimed at a more extensive use of geographical knowledge. More geography teacher involvement was integrated in the design to support this aim. In terms of the research question, both balances − between the use of knowledge and of imagination, and between students' self-guidance and teacher's guidance − were adjusted. The ambition was, however, to enlarge the role of knowledge and teacher assistance in such a way that it hindered students as little as possible in their imagination and autonomous learning. For example, to avoid the pitfall of passive students, the first three lessons focused on students' prior knowledge and existing personal mental frames about futures. Once these were activated and expressed, the teacher provided resources, mainly concerning societal trends in futures, in the second half of the series. In this way, stimulating intellectual growth could be pursued without by-passing students own ideas and creativity. A fragment of the resources concerning societal trends can be found in figure 4.6 in Section 4.6.2. The complete set of resources is available on the website (see: http://irispauw.nl).

Table 4.2 shows the addition of 'preparation' of scenarios to the central aim of the series, before design and evaluation. Since the test with the first prototype indicated that students did not use prior knowledge automatically, activating prior knowledge and becoming engaged in futures thinking appeared an explicit step in the first test. The second prototype initially consisted of six lessons to which a seventh assessment lesson was added during the test of the prototype. Table 4.2 presents the content and main student tasks of the second prototype.

The key theme continued to be urban futures and, although the same developments and trends were used, a number of alterations was made in their definition and communication. The rather broad term 'economic development' was replaced by the more specific trend of 'technology development', referring to the process of the increasing influence of technology on people and society. Sustainable development was referred to by the trend of an ever stronger focus on 'sustainability'. The other trends remained the same: individualization (the process in which citizens function in society increasingly as individuals and less as members of a group); and deregulation (the process of a changing role of the government, including processes such as privatization and deregulation). When exploring urban futures and trends, two choices were made, in terms of conceptual language:

- The lessons again focused on students' thinking in terms of urban landscape elements: artifacts, actors, and activities. The artifacts, actors, and activities express functions and dimensions;

- The second prototype explicitly used the distinction between probable, possible, and preferable urban futures to stimulate students' familiarity with futures education vocabulary.

Table 4.2

The second Prototype Summarized

Aim: students prepare, design and evaluate scenarios of urban futures, using their prior geographical knowledge and skills, knowledge of trends and imagination

	Content per lesson	*Main student activities*
1	Introducing futures thinking and becoming engaged	Fill out a questionnaire about scenario thinking; Activate prior knowledge and ideas about urban futures in a chosen introductory assignment.
2	Different perspectives on futures	Analyze scenarios published by a scientific, a commercial, and a governmental institution; Detect and analyze 'optimism' and 'pessimism' in scenarios.
3	Multiperspectivism and context awareness in futures thinking	Analyze and discuss personal and other peoples' perspectives on futures; Analyze food supply in urban futures; Sketch urban futures.
4	Trends in urban futures: sustainability, individualization, deregulation and technology development	Study resources about trends; Develop a poster presentation about a trend.
5	Analyzing first drafts of scenarios of urban futures with peers	Design, analyze, and evaluate first drafts of scenarios, based on: - prior geographical knowledge and skills about artifacts, actors and activities, with awareness of different spatial scales; - imagination; Give and receive peer feedback; Advise a fictive mayor of a future city concerning preferable urban futures.
6	Designing scenarios for urban futures	Make a sketch of an urban future scenario, consisting of artifacts, actors, and artefacts; Evaluate the lesson series in a reflective videotape.
7	*Assessment*	*Answer assessment questions;* *Fill out a questionnaire about scenario thinking*

More information on the individual lessons can be found in the following description of the test and in the lesson plans in Appendix 2.

4.6.2. Test of second prototype

First, the context and the method of the test of the second prototype is described. After that a description of the lessons is given.

Context and method

The second prototype was tested in a Waldorf school, grounded in the educational philosophy

of Rudolf Steiner, in Amsterdam. The participation of the school was based on the willingness and ability of the teachers to participate and not on its anthroposophical character. However, this special character may have influenced the results since in Waldorf schools artistic, social, and emotional development generally receive more attention than in regular schools (Barnes, 1991; Steenbergen, 2009).

The test took place in an upper secondary class of 23 students (11 boys, 12 girls) at pre-university level, aged 16, 17 and 18. Each lesson had a duration of 75 minutes. Due to class schedule conditions, two teachers carried out the lessons: a 36-year-old, male teacher of social sciences carried out the first three lessons and a 32-year-old female geography teacher carried out the last three lessons. The students were new to the first teacher, but the second teacher had taught 17 of the 23 students at least once before.

The researcher instructed the teachers about the aims and the planning of the lessons in a joint two-hour meeting prior to the start of the lessons. All lesson materials − such as Power Points, tasks and resources about trends − were supplied by the researcher. All materials are available on the website (see: http://irispauw.nl). The researcher observed all lessons and evaluated them with the teacher directly after the lesson, in semi-structured interviews. Besides the observations and the recorded and transcribed evaluations, data were gathered through audio material and video material recorded during the lessons, products made by students during the lessons (posters, sketches, videotapes, assessment), and student questionnaires on expectations (before the series) and experience (after the series).

Lesson 1

First, students filled out a questionnaire which will be discussed separately at the end of this section and is available on the website (see: http://irispauw.nl). Subsequently, the teacher started an introductory conversation about whether the students perceived thinking in scenarios was useful. Students actively participated and openly expressed opinions, such as "Google Glass scares me" and "We are all afraid of change". The teacher related students' thoughts about futures to the aim and the approach of the lessons ahead: thinking in multiple futures, with knowledge, imagination, and values. Key concepts such as perspectives, scenarios, spatial scales and urban futures were briefly introduced in the conversation.

After the introduction, students were instructed to choose one out of three tasks:

- to interview each other concerning their personal expectations of urban futures. This assignment was chosen by 15 students, working in trios;

- to study three resources: two articles and one mind-map that presented visions about futures of scientific, business or governmental institutions. This assignment was not chosen. Since the resources play a role in the second lesson and their study was also a homework assignment, more about the resources will be explained at the end of the description of the first lesson;

- to design a response to a creative project called "the incredible shrinking man", by Dutch designer Arne Hendriks. Hendriks's project was subsidized by The Royal Netherlands Academy of Arts and Sciences (KNAW). Hendriks proposes a peculiar plan for better futures: to shrink mankind, for the sake of a smaller ecological footprint. Students were challenged to oppose to this creative plan in a creative way. This assignment was chosen by 7 students, working in two duos and one trio.

While one-third of the class started enthusiastically, most students needed some teacher encouragement to get going. Once activated, they openly discussed futures. The interview made students compare current urban facilities, features and places with what they expected and wanted in future cities. In general, students wanted more sustainability – e.g., less polluting cars − and expected more technology − e.g., robots – in tomorrow's cities. The analysis and response to the creative project triggered out-of-the-box-suggestions, such as a soyabean plantation on the moon and large-scale, underground city life. As homework, students were asked to study resources about future scenarios and narratives for the Netherlands.

The first lesson confirmed the students' ability to actively express their own ideas in divergent thinking about futures, and also in more demarcated tasks and with more guidance than during the test with the first prototype. However, the teacher doubted whether all students grasped the bigger picture of what scenario thinking is and why it is done. Moreover, transfer of information appeared to be difficult in the lively lesson. As a response to this teacher evaluation and in consultation with the teacher, the researcher wrote three reading texts in which key concepts of scenario thinking on urban futures were elaborated. Given the absence of a study book, it seemed fruitful to provide texts that briefly explained key concepts used during the lessons such as 'multi-perspectivism', 'trends', 'scenarios' and 'urban spatial developments'. The texts enabled students to study the background to the lessons in more quiet moments than during the dynamic lessons. In total, three reading texts were handed out during the series, in Lesson 2, 4 and 5. The reading texts are available on the website (see: http://irispauw.nl).

Lesson 2

The second lesson focused on the recognition of different perspectives on futures and used the binary structure of optimism and pessimism for this. As homework, students had been asked to study three resources that contained eight future scenarios and narratives for the Netherlands in 2030 or 2050. The scenarios and narratives were published by governmental, scientific and commercial organizations, i.e., the PBL Netherlands Environmental Assessment Agency (2013) in cooperation with the CPB Netherlands Bureau for Economic Policy Analysis, the VU University Amsterdam (VU Connected, 2012), and Siemens Business Development (Remerie, 2014). Although the resources differed, they generally depicted an urbanized, high-tech future, e.g., 'in 2030 a symbiosis has taken place of man and technology' (VU Connected, 2012, p. 2). The resources worked out a variety of scenarios that responded to a high-tech future, e.g., an international cyber tribunal in the city state RotterHague in 2050 (Remerie, 2014). The scenarios in the resources paid attention to the international and global scale (e.g., a possible world population of 11 billion in 2050), and to different time periods (e.g., in 1970 the life expectancy for men was 71 years) which intended to trigger reasoning and imagining beyond the familiar.

In a group task, the students analyzed the scenarios in the resources. As homework, they had studied the resources and had selected elements from them that they personally considered optimistic and pessimistic. Students wrote these optimistic and pessimistic future scenario elements on a joint worksheet. Subsequently, they read and explored each other's texts and worked – in dialogue and discussion – towards shared statements about futures in the Netherlands. The task was intended to illustrate how different perspectives can be legitimate (seen in the resources and in the different perspectives of peers) and that common ground can often be found in different perspectives.

Students reasoned about the possible consequences of the selected scenario elements. They mentioned developments that could influence futures of certain basic urban functions such as working, housing and recreation. For example, a student wrote: “A 24 hour working week is positive, because people will have more time for hobbies and voluntary work”. One student imagined moon tourism which provoked irritated comments from peers (“bullshit!”). The teacher evaluated such comments as “a lack of self-control” and “an inability to reflect on your thoughts and behavior”. After analyzing the variety of perspectives on futures, students worked towards common viewpoints. In these shared viewpoints, different dimensions can be seen, as illustrated by the shared statement of one group: “If we run out of non-renewable resources, mankind will more effectively search for alternative resources, such as energy generated by households. Political conflicts related to resources will fade away”.

Lesson 3

The third lesson opened with a task that was not performed behind classroom desks but involved physical movement and positioning, as shown in the photo in Figure 4.4. First, students in small groups shared slogans about futures. The slogans had been formulated as homework. To model this, an art project by the Canadian artist Douglas Coupland called “Slogans for the 21st Century” had been described in the first reading text, which students had been given after Lesson 2. In his exposition, exhibited in museums around the world, Coupland reflected on modern times in slogans such as: “the future is homework” and “I miss my pre internet brain” (Coupland, 2016). After having seen Douglas’ examples, students formulated their own slogans. Students came up with slogans such as “my robot prints my cookies” and “the future is a more beautiful past”.

Secondly, students positioned their slogans in a set of axes that was constructed on the classroom floor with tape: the vertical axis went from ‘optimism’ to ‘pessimism’ and the horizontal axis from ‘innovative’ to ‘conservative’. The two ends of the vertical axis, optimism versus pessimism, are referred to by futurist Lombardo (2007) as a fundamental dimension of ‘future consciousness’, which is defined as “ the total set of psychological abilities, concepts and experiences humans use in understanding and dealing with the future” (p. 1). The distinction between innovative and conservative was also referred to by Lombardo (2007) when he wrote “One fundamental clash of perspectives revolves around change and transformation versus either stability or a return to some envisioned ideal past” (p. 13). By positioning their slogans in the framework, students were challenged to explore if optimism, pessimism, innovation, and conservatism could be seen in their slogans about futures. Thirdly, students were asked to consider individually to what extent the position of their slogan in the framework more generally represented their way of approaching

Figure 4.4. Teacher and students in Lesson 3

futures. After consideration, the students themselves took a position in the set of axes. Remarkably, all the students stood in the quadrant that combined optimism and innovation, which provoked reactions. For example one student wondered: “Would this also be the result in a house for the elderly?” and continued: “I am going to sort that out!”. Another student nuanced the univocal result by saying: “I do not have the same position all the time, I want to be able to shift.”

During the debriefing, the teacher related the students’ positions and remarks to similarities and differences in their contexts (of time, place and person) and explained how different perspectives on futures can be the result of different contexts. He illustrated his point by sharing a personal memory of how his perspective on futures changed when he was their age. He told the students how reflection gradually made him see futures - and his role in it - differently. The students appreciated both the task and the debriefing as interesting, cool, and eye-opening.

In the second half of the lesson, in a reorganized classroom, the teacher recalled the central aim of the lesson series: thinking in multiple futures, with knowledge, imagination, and values. He summarized how the emphasis had so far been placed on futures *images* and their relatedness to person, time, and context. He told students that, in the next few lessons the emphasis would be on *knowledge* about futures and, more specifically, about urban futures. The teacher led a classroom conversation about ‘food supply in urban futures’, a sub-theme that almost automatically brings up geographical questions about different actors, activities, dimensions (economy, politics, nature, culture) and scales (from local to global).

Students subsequently took up an individual study task about food in urban futures. Students chose one (out of five) research questions about food supply, such as: “How sustainable is our food supply?, or “What are the consequences of globalization on food supply?”. These questions were explored with the help of infographics about food supply in urban futures. The set of infographics was developed specifically for this purpose, by Master’s students of the Geo-communication Department of Utrecht University. The geographical materials included the different perspectives of stakeholders (such as local government, industries and inhabitants) on different spatial scales (local, regional, and global) that influence food chains in urban futures. Cause and effect relations were explained and dilemmas introduced in the infographics, as illustrated in the fragment in Figure 4.5. The infographics are available on the website (see: http://irispauw.nl). The students were focused and engaged while working with the infographics.

Figure 4.5. Fragment of the infographics, used in Lessons 3 and 5

Just before the enquiry tasks started, the teacher recruited four students who volunteered to do a different, creative task. These four students went outside the school, chose a specific place and sketched a drawing to answer the question: What do you expect this place to look like in 2030? The alternative creative assignment was called 'mindscaping', a term referring to the influence that personal experience and imagination have on how we see the landscape around us (Jacobs, 2006). The aim of the assignment was to create examples of sketched futures images for use as examples in the next lesson. Also, it enabled differentiation through the provision of different tasks that would be suitable in a scaffolding strategy (Van de Pol, 2012).

The closure of the lesson consisted of students handing in their results of the enquiry task or sketch. After the lesson, the teacher evaluated the exercise with the axes as "rewarding", and considered "the immediate visibility of the results on the floor" to be a factor in this success. "They [the students] seem to develop an understanding that the future depends on them, that they are behind the steering wheel." About the role of the teacher in this strongly interactive and dynamic part of the lesson he said: "The teacher needs to be one step ahead of the mood in class (….) to be able to steer it."

Lesson 4

The four students who had sketched futures in the third lesson, presented their drawings in the introduction phase of the fourth lesson. The two trends, sustainability and technology development, dominated in the sketches. In all four sketches, students drew futures with increased technology and sustainability, visible, for example, in electric bicycles and floating houses. The other two trends, deregulation and individualization, were less visible in the students' sketches, so the teacher introduced them in a conversation, with the help of elements in the students' sketches. For example, she started a conversation about individualization by focusing on the smart phones that some students had sketched in their scenarios. She asked students what they thought the influence of smart phones could be on individualization. Some students thought smart phones increased individualization, while others thought the opposite. At the end of the conversation, all four trends – technology development, sustainability, individualization, deregulation − were discussed and listed on the whiteboard. The teacher told the students that these trends would be the focus of the subsequent assignment.

The teacher gave instructions for the main task of the lesson: the study of trends which would result in poster presentations. More information on the task can be found in Appendix 2. Four expert groups each focused on one trend. The assignment was to study and present the trend in such a way that each student would be educated about all four trends, after the development and presentation of the four posters. Students received a resource set of information about the four trends. The resources consisted of maps, graphs, images, and texts that defined the trends, presented their features, their recent history and their visibility in changing urban areas. Figure 4.6 shows an illustrative fragment of the resources concerning the trend individualization. The complete set of resources is available on the website (see: http://irispauw.nl). The task explicitly required students to use the information from the resource set in their presentation.

Students needed a lot of support and expert talk from the teacher in understanding and processing the information about the trends. For example, the trend deregulation turned out to be new and abstract to students. But, after working with the resources, the students were able to reason about the consequences of deregulation. The teacher assisted them by taking education as an example of a sector in tomorrows' cities that might undergo changes if the government deregulated. One student concluded that increased deregulation might mean that in future times, Dutch education would "be more like in the United States", referring to private schools. The lesson resulted in four posters, of which Figure 4.7 shows an example concerning the trend technology development.

The teacher reflected on her active role of structuring students' reasoning and modelling relational thinking with the remark: "I was constantly giving mini lectures". Also, she noted large differences among different students in their ability to reason about trends. The lesson ended with the handing out of the second reading text, about trends and scenarios, as homework.

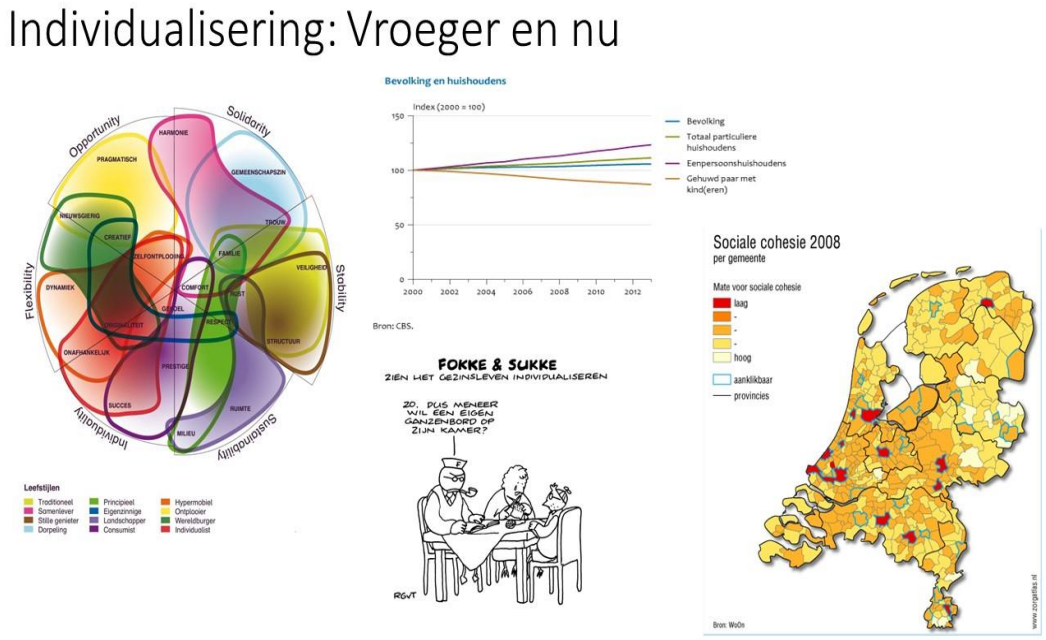

Figure 4.6. Fragment from the set of resource about trends

Figure 4.7. Example of students' poster presentations

Lesson 5

The four groups of students presented the four trends to an audience of their peers who took notes and asked questions. The aim of the presentations was to develop enough understanding of all four trends in order to develop scenarios for urban futures. The following observations were distinctive during the presentations:

- The poster showed a mixture of information coming from the set of resources and students' associations. Each poster contained the definition of the trend, its features, its recent history, its visibility in changing urban areas, and the relation of the trend to other spatial scales. To this information from the resources, students had added drawings (e.g., drones on the poster concerning technology) and associated key words (e.g., "selfish stick", referring to a selfie stick on the poster concerning individualization).

- Presenters and reacting peers tended to reason in black-and-white logic: "There are no rules after deregulation", or "The Chinese will take over" and "Older people will not be able to keep up, I see that happening already now". Students who attempted to reason in a more nuanced way, often expressed only slivers of their logic, quickly accompanied by disclaimers such as "never mind". Both the complexity of reasoning about trends and the setting of presenting and discussing with the whole class seemed to inhibit them from persisting and seeing whether their reasoning made sense.

- Students did not explicitly mention the relation of trends to their own life. When concrete suggestions for futures were mentioned, such as "separating waste" or "less travel by scooter", abstract performers were named, such as "the people" or "mankind", and it remained unclear whether these groups included the students themselves.

After the trends were presented the teacher showed an educational clip about Masdar City in the United Arab Emirates, as an example of a highly technologized urban project that can be interpreted as a 'sustainable' project but also as a 'commercial' project. The teacher emphasized that Masdar is not 'the' future and challenged students to think for themselves.

Subsequently, the students formed couples and chose a trend that they applied to the theme of 'food in the city of the future'. Students were supported in this task by a worksheet that stimulated them to consider different phases of food supply, consumption and waste disposal, different actors, and different spatial scales. Subsequently, they thought about two different scenarios for how the trend could develop further: towards a preferable and a not preferable future. For example, a couple who chose the trend 'sustainability' saw a probable future with locally produced food for the city grown on roof gardens fertilized by green waste. The inhabitants would be allowed to eat meat only once a week. The two scenarios that were developed subsequently were titled "cooperation society" versus "a gap between the strong and the weak". In the cooperation society, "all people work together and listen to each other, there is enough food and little transport and waste". In the gap scenario, "people do not succeed in cooperating and they start to claim things, the survival of the fittest plays a major role and a gap arises between the strong and the weak". Moral ethical aspects resounded in these two opposing scenarios. The students worked hard and seemed motivated, although many of them also expressed that they found it difficult to think about trends and scenarios. The teacher explicitly acknowledged the complexity of the task. She emphasized that scenario development requires knowledge, imagination, and the courage to reason beyond what is known.

Reasoning about scenarios was practiced further during a "speed date": a lesson activity in which students provided each other with feedback in quick rounds, in order to strengthen their scenarios. After this, the final exercise of this lesson was to formulate advice to a fictive mayor of a future city. On three flip overs, students wrote their answers to three questions: 1) *Knowledge*: What does a future mayor need to know?; 2) *Imagination*: What creative images does a future mayor need to bear in mind?; and 3) *Values*: What needs to be protected or strengthened by a future mayor? The students wrote insights on all three flip overs. These concerned diverse and general suggestions, such as "let's all travel by tram", "grow food close to or in the city", [build] "cities smaller than 100.000 inhabitants, in order to keep everything manageable" and [construct] "vegetable-flats", the latter referring to the new practice of vertical farming where crops are grown in stacked indoor systems, to maximize the use of scarce land. Other spatial scales were taken into account in advice to import food from poorer regions with more suitable climates. Thinking in extended timelines was illustrated by a student reasoning: "Our parents' chose for us to grow up in an urban environment and as a reaction to this, we may prefer to get away from the crowded urban areas and live with our children in more rural environment in futures." Although the advice contained sensible elements and indicated relational thinking about urban futures, it proved difficult to develop coherent preferable scenarios and advice leading towards these. The lesson ended with handing out the third and last reading text as homework. The text concerned developments in spatial planning, on a local and global scale and with a focus on urban areas. The students were requested to study this reading text, as well as the other resource materials (reading texts, infographic, resources about trends and their personal notes).

In the evaluation afterwards, the teacher reported on both enthusiasm and resistance among students. This did not surprise her, as the students were taken out of their comfort zone by the complex tasks in the limited time. Moreover, she mentioned some tension that arose, more often seen in her own classes, when adolescents in a group are being both serious and personal about their futures. Her concluding remark was: "Thinking in scenarios requires an intellectually challenging impulse and at the same time enough social safety to express your personal ideas".

Lesson 6

In the opening phase, the teacher informed the students about the aim of this lesson: to apply knowledge and imagination. This application was done in two big autonomous tasks: sketching a scenario for urban futures, and recording a reflective videotape about the whole lesson series. Both products needed to be handed in at the end of the lesson.

For the first task, the sketch of an urban future, the students were instructed to base the sketch on 1) their knowledge, about tomorrow's urban actors, artefacts, activities, urban food supply, and the urban place's relatedness to other spatial scales; and 2) their imagination. In the first half hour of the lesson, each student sketched a scenario, individually and in silence.

Students mainly drew annotated sketches: images of a local urban environment, with annotations to underline or explain their message, as illustrated by the example in Figure 4.8. Nineteen sketches were made. Many elements of the trends were visible in the sketches, although this was not explicitly required in the assignment. In one sketch, only one trend was recognizable; twelve sketches showed two trends, and six sketches showed three trends. Technology development was drawn most often (sixteen times), and deregulation least (six times). Elements of the sketches that expressed the trends were for example:

- hover trains (as visible in the example shown in Figure 4.8), drones, powdered foods, and mutated cattle, all visualized ‘technology development’;

- segregated and excluded groups of poor people (as visible in the example shown in Figure 4.8), water wars, and closed down community centers, all probably aimed at expressing increased individualization. Elements that indicated the opposite development of less individualization were also seen in, for example, communal food production, newly built community centers, and communal child care centers;

- ecological urban farming, windmills and green roofs visualized increased sustainability. Elements that indicated the opposite, of less sustainability, were also seen, in, for example, plastic particles in urban water, sea level rise, and a shortage of non-renewable resources;

- run down anarchistic neighborhoods and a cut in the police force seemed to visualize increased ‘deregulation’, while linear gridding and an abundant of police force on the streets seemed to indicate the opposite development of less deregulation and a strong government.

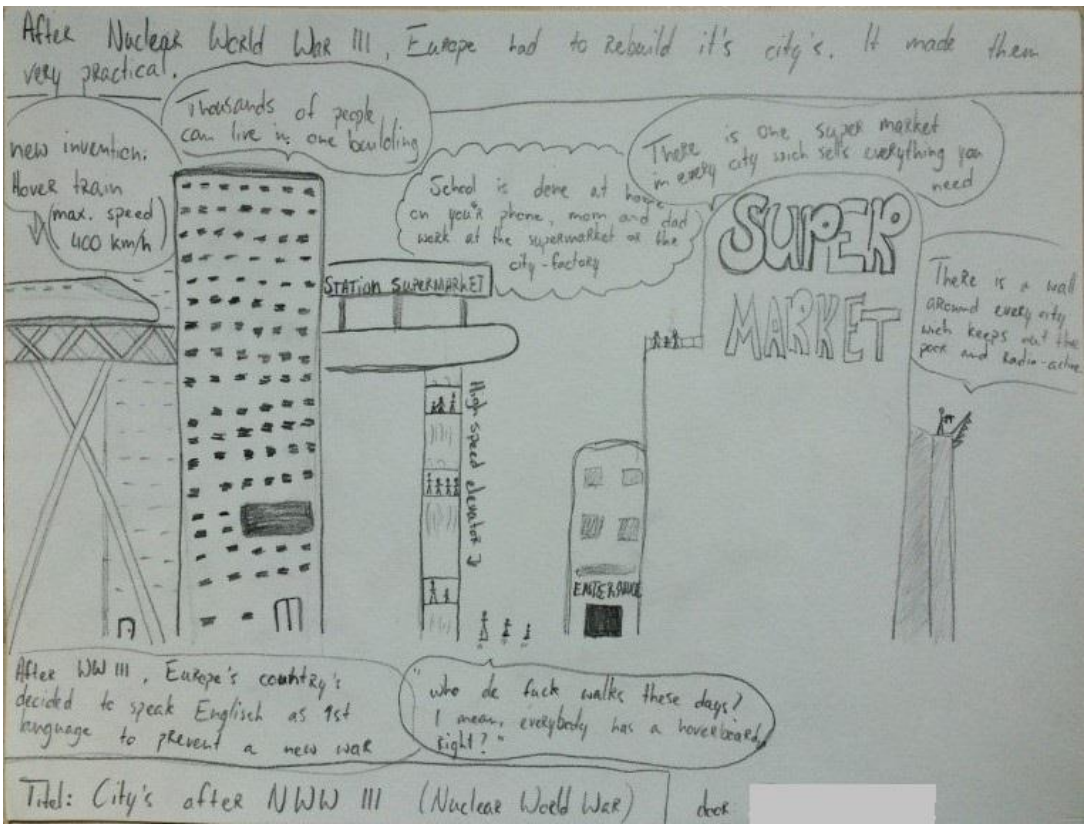

Figure 4.8. Example of a sketched scenario

References to how food is supplied in urban futures are seen in 13 sketches, for example as urban farming or powdered meals. Some students related their urban futures to other spatial scales. Figure 4.8, for example, shows a wall around every city “to keep out the poor”, English as the common first language “to prevent a new war”, and a fast hover train that can go hundreds of kilometers in an hour, indicating that this city has relations with other spatial

scales. Other scenario sketches show tensions between trends. For example, one student sketched a scenario that she titled “Biodiesel = Sustainable ?!”. It shows a strictly organized environment that seems to aim at sustainability. At first sight, this future environment can be interpreted as ‘high tech and wealthy’, with high-rise buildings and many cars. Two sketched individuals in the scenario support the idea of biodiesel being sustainable: one cuts down a forest for biodiesel, saying “I am going to cut down this whole forest for the sake of making even more biodiesel!!”, and a second individual drives a car, saying: “I drive sustainably, my car uses biodiesel”. Two others sketched individuals who seem to protest: one is in the forest that is being cut down, saying: “What are you doing to this beautiful forest?”, and a last, fourth character stands on top of the highest building, saying: “Is this really a solution?”. The tension in this sketched future scenario is caused by different perceptions of what a more sustainable human-nature relationship might look like.

After the sketches were taken in, the students prepared reflective videotapes, in which they summarized their most important insights during the series. Two frames assisted the students in making their videotape: first, an example of a short, informative clip was shown, in which a researcher from the Dutch Wageningen University summarized, in 2 minutes, her main results concerning the logistics of sustainable food. The clip was chosen because it modeled ‘to-the-point reporting’ on complex issues. Also, the research topics in the clip were related to the topics that the students had been working on, sustainability and food. Second, a framework was given, consisting of four sentences that had to be completed in the videoclips by the students: 1) What I found important in this series was (choose one particular insight)…. ; 2) What I learnt concerning this insight is …. ; 3) I hope that the future concerning this insight will be as follows …. ; 4) A first step in the right direction is ….. Figure 4.9 shows examples from answers to the reflection questions expressed in the student’ videotapes.

- “That I have a unique idea about the future”;
- “That I got extensive time to think about my future. In my former school, with regular education, I did not come to think of it. I really appreciate it, so that I have something to work towards”;
- “That there is more than just the direct surroundings”;
- “That, as an individual, you should take the initiative”;
- “That we were working on the future, by combining knowledge and creativity. After all, it is our future.”

Figure 4.9. Examples from answers to the reflection questions for students

Students worked in couples, interviewing and taping each other. This, again, brought them in the position of ‘critical friend’, as they questioned each other’s proposals. One student, for example, was critical of her classmate’s plan to work in future urban farming, that was formulated as a first step towards a more sustainable city. She scrutinized her friend’s plan by asking: “How often do you currently work in the garden? Do you actually see yourself working in the fields a whole day per week? I do not feel that for myself”. The expression of ideas and subsequent dialogue helped students to scrutinize and develop preferable scenarios.

Divergent assessment

A reoccurring area of concern during the evaluations of the lessons with the two teachers was whether students had fully shown their capabilities in scenario thinking. The researcher shared the teachers' concern and, teamwise, the decision was made to add a summative assessment in an extra class hour. To enable students to demonstrate their capabilities, a divergent assessment (Pryor and Crossouard, 2008; Bijsterbosch, 2018) was designed by the researcher and approved by the two teachers. Students were informed a week before the assessment took place. It took 50 minutes and consisted of eight assignments. The summative assessment can be found on the website (see: http://irispauw.nl). Two assignments were obligatory, and students could choose three out of the remaining six. The researcher graded the assessment, based on a rating model defined beforehand. Students scored an average of 6.5 on a 10-point rating scale, with 4 out of 21 participating students scoring insufficiently.

The assessment results offered the following four insights:

- All students applied knowledge about the four trends in their scenario thinking;
    - Students noted explicit, visible changes in urban futures, such as "more single-person housing", "more urban farming", "more solar panels", "security cameras", "very fast, silent traffic". These answers indicated thinking about futures artifacts, actors, and activities representing different functions and dimensions;
    - Students noted many changes in urban futures without explaining their visible, spatial impact. For example, students noted "more indoor living" while "being connected by the internet" or "robots taking over jobs", and "everybody printing their own food". These changes do have physically visible consequences for future urban environments and connected areas, but these are not always described;
- Many students refer to other spatial scales or areas in some ways: for example by writing "don't exploit the Earth", "cooperation between countries" or "outside the city, there is no-man's-land";
- There were some clear patterns in how students valued the trends:
    - Students unanimously prefer an increase of sustainability in urban futures;
    - All but one student prefer an increase of technology development;
    - Considering individualization and deregulation, the students' express more varied preferences: both an increase and decrease are named and underpinned;
    - When writing about their preferred futures, students frequently use abstract actors who need to make these futures happen, such as "mankind" or "the people".
- Some students refer to tension between trends. One student, for example, labeled a combination of strong individualism and a weak government as "feeling free in other people's waste", referring to a mixture of an advantage, i.e. experiencing great freedom, and a disadvantage, i.e. a collective problem of waste – whether literally or figuratively – in the future she described.

In conclusion, the assessment shows that in the assessment most students were able to apply their knowledge, including about the trends, in imaginative futures thinking to a reasonable

level. On the one hand, this was to be expected, after working with trends. On the other hand, since the new information had been processed in an innovative way − not in a classical teaching and learning setting – it was reaffirming to see that the students were able to use their new knowledge of trends.

Students' evaluations

During the extra hour in which the assessment took place, students also filled out the final, written evaluation. An identical questionnaire was filled out before and after the lesson series. The questionnaire and its results can be found on the website (see: http://irispauw.nl). The questionnaire distinguished between: 1) "thinking in scenarios"; 2) "creative imagination"; and 3) "evaluation and choice of a preferable future scenario". Students were asked to what extent they thought these three elements of learning about urban futures were "useful" and "interesting". Beforehand, the answers informed after students' expectations, and afterwards their actual experiences. In the questionnaire after the lessons, students were also asked whether they thought of them as "achievable". The questionnaire was filled out by 22 students beforehand, and by 21 students afterwards (due to the varying number of students being absent at the time of each assessment). Since the research population of students is small, the results of the questionnaire should be interpreted with caution. In general, no major changes in student perception are seen. At both times, these students were not very outspoken in their opinion about the lessons. This can be due to many factors, among which the design of the lessons and/or the questionnaire.

4.6.3. Evaluation of the second prototype

The second design cycle focused on ways in which the teacher could provide more substantial resources and guidance than in the first prototype, without inhibiting imagination and self-guidance. The lessons learned concerning each design principle in the test with the second prototype will be explained here.

Concerning scenario thinking

Just as in the test with the first prototype, scenario thinking in the test of the second prototype avoided the pitfalls of presenting one fixed future to inactive students. In the lessons of the second prototype each student actively worked on at least three different scenarios. Scenarios were designed, as well as evaluated. All students together developed 44 scenarios. It is important to note is that the increased number of lessons, from three to six, was probably the explanation for this enlarged number of scenarios, in comparison to the first prototype.

Concerning the content, the input of resources seemed to have a positive influence on the scenarios. After the students had studied a set of resources about trends and began reading texts with background knowledge from school geography and futures education, more artifacts, actors and activities are visible in the scenarios. The richer scenarios express urban futures' functions (such as housing, working, recreation and transport) and dimensions (economy, politics, culture and nature) indicating the use of prior geographical knowledge. The presence of all four trends in the scenarios was prominent. Technology development was drawn most often, for example, in scenario elements such as drones, robots and hover trains. Half of the students sketched or wrote about other spatial scales in their scenarios, for example, by sketching a world congress in tomorrow's city, mentioning global food supply linkages or expecting disadvantages of urbanism for rural areas. Some students seemed to acknowledge the complexity of multidimensional thinking, by putting forward dilemmas or friction in futures, such as water wars or a technologically advanced, sustainable but dehumanized future.

The students' imagination did not seem to be threatened by the substantial resources about urban futures that were provided in this second prototype, given the broad spectrum of scenarios drawn. Possibly, the examples used of the ideas of socially engaged designers such as Hendriks and Coupland demonstrated "out of the box"-thinking and stimulated imaginative thought. Students' products showed more divergent thinking in the test of the second prototype than in the test with the first prototype, when the scenarios were more stereotypical. The Waldorf character of the school may have had some influence here too.

To discern and evaluate preferable scenarios appeared to be a motivating but complex and layered task. The students were motivated, but it proved ambitious to formulate a coherent agenda for a fictive mayor of tomorrow's city, out of all the diverse ideas for futures. This resulted in wide-ranging advice that were not explained well. Lack of time probably was a factor, as well as the abstract and complex nature of the task. Evaluating scenarios is complex and difficult intellectually, as well as morally. The students did not directly consider the consequences for their personal lives or their own steering capacity, but peer feedback appeared fruitful for grasping the true implications of suggested advice. For example, students' general suggestions to, for example, all travel by tram or work in urban agriculture, were thoroughly scrutinized by their peers, which increased students' willingness to reason. In conclusion, the second prototype appeared more successful in organizing scenario thinking than the first prototype.

Concerning student voice

Once stimulated, most students got engaged and actively expressed their personal perspectives, including rational and affective aspects. Some students were immediately intrinsically motivated to use personal ideas about futures. Most students showed some ambivalence but got engaged with the help of clear, challenging tasks, and resources. Three students seemed to have more difficulties in getting engaged, and they appeared to experience resistance in sharing personal ideas.

Having both enthusiasm and resistance in the classroom during the imagination of possible futures was both relevant and challenging. It was relevant, because it offered students an educational scene in which to express, hear, and sharpen their different views on how the world works, in order to find their mature place in this world (Biesta, 2018; Illeris, 2002, Verhaege, 2017). It was challenging, because a teacher aspires to provide a safe learning environment, but allowing students to fiercely disagree can bring tensions (Newton, 2013). The teachers managed to negotiate the stream of affective reactions in a clear and constructive manner. After initial tumult, critical exploration of student voices was done with the assistance of geographical and futures education resources. Although these students had already been educated about urban areas in earlier years, it turns out not to be automatic that this knowledge will be used to express, explore, and evaluate personal perspectives on futures. Possibly, this was due to the time pressure, since there was a lot to rethink and relate in just a few lessons. Also, the theme, the approach, and one of the teachers were all new. However, the evaluation showed that, after this intervention with more teacher guidance, most students considered scenario thinking (to some extent) achievable. In the reflective videotapes, students seemed to be aware of their roles in futures, as illustrated in Figure 4.9. Working on scenario thinking may have contributed to their enlarged future consciousness (Lombardo, 2007).

Concerning scaffolding

The teacher was more influential in this second prototype than in the first prototype: resources were provided, and the tasks had a more steering character. This appeared effective

and enabled the enlarged autonomy of thinking and learning *within* the tasks. It was, however, a multifaceted role for the teacher. Differentiation concerned content, task, tempo, order, and affective states. The design aimed at provoking internally held ideas and prior knowledge. Subsequently, it was up to the teacher to manage different students into an active and constructive scenario-thinking process, which required an approach tailored to the individual student.

In this complex teacher role, explanatory and timely feedback seemed to open new perspectives for students. An illustrative example of this is the teachers' assistance in Lesson 4, while students were trying to grasp the trend 'deregulation'. The teacher chose to apply the trend to the future of education. She asked students numerous questions about probable, possible, and preferable consequences of deregulation on education. Through this conversation, in which the teacher combined feedback and modelling of intellectual reasoning, students developed an understanding of the trend and were able to explain the trend to their peers on a poster and in a presentation. Another example of the mixed use of feedback and modelling reasoning was the use of the sub-theme of 'food in the city'. Given its familiarity, all students have some prior knowledge about food as a theme. From this starting point, the teacher started conversations about food in tomorrow's cities, to get students' scenarios away from clichés. Eventually, 13 sketches (of 19) in lesson 6 included references to food supply in urban futures, such as by urban farming.

A final remark about the teachers' role concerns the divergent assessment: this evaluation moment marked a clear, familiar opportunity for students to show their abilities concerning scenario thinking. Even the three students who showed resistance throughout the series scored sufficient results on the test. The assessment worked as an impulse to achieve and get rewarded. Given the divergent character of the assessment, which allowed for a certain level of choice by students, it did not conflict with the character of the series and its aims.

Final lesson series

Based on the lessons learned with the second prototype, a final lesson series was designed to enable the gathering of data about this kind of futures-oriented geography teaching and learning in an empirical study. The series of six lessons continued to revolve around probable, possible, and preferable scenarios, as studying, imagining, and evaluating with these types of scenarios appeared fruitful, based on our experience with the two prototypes. Three main adjustments were made:

- to start an earlier interplay of cognition and affect, the study of trends was done earlier, in the second lesson. The information about the trends seemed to support most students during futures thinking. Moreover, an earlier use of information about trends might help students to experience the series as less odd, without diminishing its innovative character. After having studied the trends, students use two of these as a framework for scenario design. While using knowledge about the trends during imagination, students can integrate "thinking with feeling" (Newton, 2014, p. 4) in a more subtle way;

- preferred futures are analyzed and scrutinized in a more personal and stepwise manner − first together in a debate and subsequently individually − in order to make this complex task less abstract and develop more profound futures thinking;

- the final divergent assessment is planned from the beginning. Moreover, to integrate design and reasoning, it focused on a case study. It concerns a spatial problem, a design issue, in an illustrative urban future environment. To provide answers to the problem,

students design, explain and evaluate scenarios in the form of explicit spatial scenarios for the urban environments.

Since the next chapter reports on the students' results that were obtained with the lesson series, a summary of the final lesson series can be found in chapter 5, in Table 5.1.

The complete lesson plans and all lesson materials are available on the website (see: http://irispauw.nl).

4.7. Conclusions

In this study, an approach for critical and creative futures-oriented geography education was developed and tested. The aim was to avoid two pitfalls that are common when the future is addressed in education: the pitfall of presenting the future as a single, fixed, knowable 'script', and the pitfall of teaching such a fixed future to a passive audience of inactive students. This section summarizes the main findings, describes the conclusions, and mentions the limitations of the chapter.

4.7.1. Summary of the main findings

The research question of this chapter was:

How can feasible futures education lessons for school geography be developed that achieve a balance between the use of knowledge and of imagination, as well as a balance between students' self-guidance and teachers' guidance?

The two balancing acts mentioned in the research question were examined by developing and testing two prototypes.

The first design and test cycle intended to show how far students could get with open scenario design tasks, relying on their own prior knowledge and skills. During the test, students actively developed multiple scenarios which illustrated thought beyond a single, fixed future. But the developed scenarios disappointed in terms of sophistication: they were simple and stereotypical. The limited use of prior subject knowledge was the main area of concern. This indicated that futures education lessons can only to a certain extent rely on students' prior knowledge and self-guidance. Although the simple scenarios were disappointing, it remains important to acknowledge that students did show their ability to use imagination in school geography, where its use is uncommon.

In the second design and test cycle, the lesson series was adjusted, based on the experiences with the first design. In terms of the research question, a better result was achieved in the first-mentioned balance – that between knowledge and imagination. Therefore, the second mentioned balance – that between students' self-guidance and teachers' guidance – was adjusted, as the teacher's role was enlarged. A set of resources about trends in urban futures was provided to students. Moreover, the teacher carefully guided scenario thinking more intensively, while minding to not frustrate fruitful autonomous thinking when it occurred.

Both teaching and learning about futures appeared a feasible but complex process, composed of several stages and elements. This research resulted in a number of directions with respect

to these stages and elements can be included in futures-oriented geography education. These directions came in two forms, in accordance with EDR guidelines: as design principles, and a corresponding lesson series. The final lesson series was presented in section 4.6. The final design principles will be presented here.

4.7.2. Final design principles

Three tentative design principles were formulated, prior to designing and testing the lessons. Based on the experience and results of the tests, the conclusion is that all three tentative design principles can be maintained in general, but need refinement concerning specific elements. These refinements often concern additional assistance from teachers to students, because futures thinking appeared to be too complex to fulfil autonomously, especially given its innovative character. The experiences per design principle will be summarized here and the refinements are briefly explained.

The first design principle, scenario thinking, appeared relevant for the development of lessons in which students considered multiple urban futures. However, it remained challenging to combine geographical knowledge and imagination in explorative thinking about complex, uncertain futures. Geography educators should refrain from doing the futures thinking *for* students, but students' futures thought was in need of suitable geographical knowledge and skills. Therefore, resources were provided about urban actors and activities − here and there, in recent history, current times, and in trends – in order to assist students in their thinking about urban futures. Exploring multiple trends and scenarios sheds light on the possibilities that tomorrow's cities can offer. Other school geography issues, such as climate change and migration, could also benefit from more scenario thinking. This could result in an increased understanding of the issues and the possibilities concerning their development in future times. Such higher-order learning offered many possibilities but also made high demands. Therefore, the design principle of scenario thinking in its final version encompassed more teacher support for students, about which more is explained later in this section, in the refinements concerning the third design principle of scaffolding.

The second design principle, student voice, appeared relevant to enlarge the input that students had during learning about futures. However, to express a coherent, personal perspective is a complex task (Eisner, 1982), especially concerning uncertain futures. Students tended to take the easy road by copying stereotypical futures images from the media, schoolbooks, or their peers. Therefore, to elicit more authentic student voices about futures, in its final version, the design principle required more teacher involvement. Incentives needed to be given in such a way that they would stimulate and not overrule students' voices. An example of an incentive is the use of evocative critical art, which seemed to assist students in expressing and structuring their thoughts about futures. Once expressed, student voices needed to be set against other perspectives, especially those of their peers and perspectives derived from school geography knowledge. Reflecting on the ambition to make students think about their position in the world − from the local to the global, and from current times into futures − it appeared essential to explicitly ask students to think about spatial and temporal interdependencies. Adolescents are focused on the immediate time and space (Jolles, 2010) and seemed in need of assistance in developing a wider perspective, including during futures thinking. Geography educators are equipped with both the suitable subject knowledge and the pedagogy to provide such assistance.

The third design principle, scaffolding, appeared to be a relevant teaching strategy for the continuous adjustment of the level of assistance, which depended on the effectiveness of

students' autonomous learning about futures. However, the very open teaching approach of the first prototype made too high demands on students' autonomous learning. Therefore, the role of the teacher was extended in a fine-tuned manner, throughout the study. An important addition was the increased input of geographical information, which helped students to develop, strengthen, and scrutinize scenarios. Moreover, since students did not automatically activate prior knowledge about urban environments, incentives to think geographically about tomorrow's cities were needed. Teachers also stimulated imaginative thinking more intensively and stepwise. However, the best timing for providing resources and incentives was a delicate matter. Although teachers' involvement in most cases did not seem to hinder students' critical and divergent thinking, some students had vivid personal ideas about futures, which needed to be voiced first and checked and developed further with the help of resources. In the same fine-tuned way, teachers stimulated moral ethical reasoning about futures, by giving more stepwise assistance towards more coherent thought. Some students who had difficulties with getting involved, seemed to get motivated by a final assessment that was added to the second prototype, as a familiar, worthwhile 'end goal'. The refinements made in the strategy of scaffolding extended the teacher role but did not change the nature of the approach, as the big tasks remained open for different perspectives on futures. The final divergent assessment also had this open character. In summary, the process of scaffolding, the third design principle, was elaborated, in order to develop scenario-thinking with knowledge and imagination, the first design principle, while taking into account student voices, the second design principle.

Practical implications of the refined design principles

To assist educators in their development and practice of futures-oriented geography education, the practical implications of the three final design principles are summarized in Table 4.3. It concerns hands-on suggestions for envisioning of futures in school geography. For the most part, these implications were also described in Section 4.3, but adjustments were made as a consequence of testing the prototypes. To distinguish the adjustments, these new elements are underlined in Table 4.3.

The design principles and their practical implications do not pretend to be the single or best way to make futures-oriented school geography work, but they do map a route that proved to be feasible in a try-out in a geography class. And even within the tested route that is summarized in Table 4.3, professional choices still need to be made by geography educators, concerning the right timing, intensity and sequence of the incentives, depending on varying contexts. Moreover, the ambition of futures-oriented geography education cannot be simplified to merely following any set of steps. Integrating a futures dimension into school geography is a complex, non-linear innovation, as was illustrated throughout this chapter. As claimed in the futures education literature, a futures orientation is not just an 'add-on' (Slaughter & Beare, 2011) as it intensifies and changes teaching and learning fundamentally.

Table 4.3

Practical implications of three final design principles for futures-oriented school geography

Practical implications of scenario thinking 1. Students design multiple scenarios for futures about a key geographical issue or theme; 2. Students activate and use (prior and new) geography knowledge, about human nature relationships, about place and space, from local to global and about (societal) developments and trends when designing scenarios; 3. Students use imagination − in multiple steps, from divergent thinking to novelty and to creativity − when designing scenarios; 4. Students use moral ethical reasoning – in multiple steps towards more coherence − when evaluating scenarios.
Practical implications of student voice 1. Students' explain their personal (affective and cognitive) perspectives about futures; 2. Students' discuss and evaluate their personal perspectives on futures, using peer perspectives and geography knowledge as frames of references, to broaden their minds − which includes taking spatial and temporal interdependencies into account − and alter their misconceptions.
Practical implications of scaffolding 1. Teachers design big, open tasks, as frameworks for content and instruction, which include: geographical resources that students are unlikely to find themselves; evocative creative elements, i.e. critical art that can stimulate out-of-the-box thinking. 2. Teachers explain the tasks to students and subsequently teach in a way that supports students' autonomy, i.e. they leave the responsibility for learning to students for as long as it is fruitful. Clarity about minimal requirements and steps to be taken is included in the tasks. 3. Teachers repetitively ascertain students' understanding, differentiate by providing timely feedback, scrutinize semi-finished scenarios, model intellectual and creative reasoning about futures and assess results in suitable, divergent forms of assessment; 4. Teachers acknowledge, use, and manage student's affective reactions to both the content – uncertain futures − and the process – open, analytical and imaginative scenario thinking.

4.7.3. Limitations

This study is an attempt to explore futures education in Dutch school geography, by bringing it into practice and studying the teaching and learning process and its results. The exploratory approach consisted of only two prototypes that were tested in two specific schools with, respectively, seven and twenty-three students. The tests of the prototypes were not systematic empirical studies but try-outs in a few upper secondary geography classes in order to explore the feasibility of futures education lessons for school geography.

This limited extent of the study calls for cautious use of its results. Moreover, due to the exploratory nature of the study, it did not result in clarity about the 'best' way for school geography to implement a futures perspective. The suggested, tested, and refined approach in which this study resulted, can be characterized as "not intended as recipes for success but to help others select and apply the most appropriate substantive and procedural knowledge for specific design and development tasks in their own settings" (McKenney, Nieveen & Van den Akker, 2006, p. 73).

The involvement of teachers in this explorative study took place during the focus group, in the preparation of the test with the second prototype, and during the test itself which was performed by two teachers. More feedback from teachers on this kind of futures education for school geography is a vital topic for follow up research. Also, students' feedback on the lessons is important, as well as the study of the results students can actually obtain during the lessons. As this exploratory study focused on the development of the lessons and the design principles, it did not yet make clear exactly what results students can obtain, in terms of scenarios for urban futures. A start with this last research issue is described in the next chapter 5.

Chapter 5. Students' Abilities to Envision Scenarios of Urban Futures

This chapter is based on the following publication:

Pauw, I., Béneker, T., Van der Schee, J. A., & Van der Vaart, R. J. F. M. (2018). Students' abilities to envision scenarios of urban futures. *Journal of Futures Studies, 23*(2), 45-65.

Abstract

In this study, we report on students' abilities to envision scenarios of urban futures after a lesson series based on futures education. The results on the critical and creative scenario thinking of geography students in three upper secondary schools improved significantly between a pretest and posttest. However, embedding newly imagined ideas in the spatial structures of tomorrow's cities turned out to be challenging for students. Although geographical knowledge and skills do seem to support students in scenario thinking, it appears to be a complex task to effectively combine knowledge and imagination in scenarios of urban futures.

Keywords: *futures education, urban futures, scenarios, geographical knowledge, imagination*

5.1. Introduction

It may seem evident that education focuses on the future. Already in 1974, the cover of Toffler's classic '*Learning for Tomorrow, the Role of the Future in Education*' stated: "All education springs from images of the future and all education creates images of the future". However, the future itself is rarely an object of study, as noted by Hicks (2006): "If all education is for the future where is the future explored in education?" (p. 8). Most references to the future in education are tacit, token, or refer to a fixed, taken-for-granted future (Gough, 1990).

In the scientific disciplines of futures studies and futures education, researchers advocate a different, systematic and more open approach to future times (Botkin, Elmandjra & Malitza, 1979; Bell, 2009; Dator, 2009; Hicks, 2012a; Inayatullah, 2008; Slaughter, 1996). Advocates and researchers of futures education seem to agree on three main principles. The first principle is the study of multiple futures, stressing the importance of plurality (Van Steenbergen, 2005; Bell, 2009; Hicks, 2012a). The second principle is the imagination of novelty as an essential complement to knowledge (Dator, 2011; Hicks, 2012a). The third principle is the commitment to work towards preferred futures, seen as a better choice than apathy (Rogers & Tough, 1996; Botkin et al., 1979; Slaughter, 1996).

Potentially, geography education – the four authors' domain of expertise – is an excellent partner for futures education, given geography's focus on a multi-dimensional approach to spatial issues from local to global scales (International Geographical Union, 2016; Hopwood, 2011; Pauw, 2015). Geography educators recognize their responsibility in contributing to the exploration of futures and explicitly acknowledge the importance of creative imagination in geography education (Fairgrieve, 1926; Lambert & Balderstone, 2010; Martin, 2011; Massey, 2006). The open, critical, and creative education that these geography educators envision involves uncertainty, and requires reflective and evaluative skills, or, in other words: it assumes higher-order thinking skills and complex modes of thinking that generate multiple solutions (Resnick, 1987). Anderson & Krathwohl (2001) see the ability to create as the highest level of thinking in their revised taxonomy of Bloom (Bloom, Engelhart, Furst, Hu, & Krathwohl, 1956). Since the core of futures thinking consists of creating multiple ideas, higher order thinking is also indispensable for futures education.

In practice, however, neither futures education nor the innovative ideal-type of geography education outlined above has yet gained momentum in secondary schools (Bateman, 2012; Hicks, 2012a; Lambert & Balderstone, 2010; Roberts, 2013; Scoffham, 2013; Slaughter & Beare, 2011; Standish, 2013). In an earlier study we found that Dutch teachers see critical and creative thinking about futures in school geography as important, but impracticable (Pauw & Béneker, 2015). Other studies confirm that teachers are hesitant towards the use of creativity in other subjects than the classic art subjects such as music and drawing (European Commission, 2010; Newton, 2013; Scoffham, 2013). Teachers are generally risk-averse in their pedagogy, and they believe that there is insufficient clarity about the exact formal requirements, the methods, and the results of open and future-oriented geography education that could build on students' imagination and creativity, as well as on their basic cognitive knowledge and understanding (Pauw & Béneker, 2015). According to Hicks (2012): "Teachers, teacher educators and educational publishers still find it difficult to grasp the nature of futures and futures thinking because they take it to be too abstract for the classroom*"* (p. 12). In practice, teachers focus on lower-order learning in their classes, since this is what is required in mandatory national exams (Bijsterbosch, Van der Schee & Kuiper, 2017; Krause, Béneker, van Tartwijk, Uhlenwinkel & Bolhuis, 2017). Futures education itself faces similar problems, with

a lack of both authority and perceived practicability. Futures education is barely seen in curricula, and even successful projects do not persist but instead "end up in the too-hard basket" (Slaughter, 2007, p. 47). Teachers consider futures relevant, but too complex to grasp in class. A complex innovation such as futures education is less likely to succeed when it is not obligatory and not elaborated in clear, evidence-based examples (Bednarz, 2003; Gidley, Bateman & Smith, 2004).

In our research project, a series of future-oriented lessons for geography in upper secondary schools was developed, with design principles based on futures education and innovative geography pedagogy. We hope that our results will contribute to education research and teaching by providing the examples and empirical evidence that can help teachers to overcome their skepticism.

Our series of lessons focuses on urban futures. The subject of urban areas is part of school geography curricula all over the world, and most students grow up in an urban environment (Béneker, Sanders, Tani & Taylor, 2010), so studying and imagining tomorrow's cities seems plausible. Also, in the field of futures studies, cities are referred to as "agents of global change and key elements of foresight exercise*"* (Vanolo, 2016. p. 26).

The aim is to engage students in the mental and social activities of scenario thinking. The lessons are not about 'learning' the images of future cities as developed by experts, or 'learning' definitions and techniques of scenarios and scenario development. Instead, in the classroom activities, students engage in activities such as:

- Exploring the range of future possibilities by developing multiple scenarios for future cities, thereby using their imagination and creativity, in combination with their knowledge about cities and societal developments;

- Making connections between social trends today and probable urban futures;

- Distinguishing probable, possible, and preferable futures, using analytic, imaginative, as well as moral-ethical reasoning;

- Brainstorming and discussing the value-laden aspects of urban futures.

In this way, students practice what both geography educators and futures education scholars promote as urgent innovations, i.e. breaking away from 'correct answer' reflexes, using imagination as a complement to formal knowledge, engaging with futures, et cetera (Gidley, 2016; Hicks, 2007; Martin, 2011; Roberts, 2013). By using imagination, for example by means of divergent thinking (Guilford, 1950), students can think beyond the fixed and familiar to arrive at novel, possible and preferable futures. Students may then become aware of how every future scenario is influenced by ideas about what is considered preferable: "The point is that the world 'out there' is framed, understood and conditioned through the world 'in here'" (Slaughter, 2002, p. 29).

The aims of our lesson series can only be realized when teachers withhold from 'teaching' about probable futures, but rather invite and encourage students to think for themselves, imagine, reflect, and discuss. In our project, we therefore trained teachers to use the instructional strategy called 'scaffolding' (see Wood, Bruner & Ross 1976). "Scaffolding refers to support that is contingent, temporary and aimed at the transfer of responsibility for a task or for learning*"* (Van de Pol, 2012, p. 199). This means students are supported in their scenario

development for as much and as long as they need to progress towards independent scenario thinking.

5.1.1. Research question

The goals and classroom activities of our lesson series about urban futures are different from mainstream geography classes, and from most secondary school activities. In our research project, we wanted to explore to what extent futures learning is feasible in a formal school context. After all, as explained above, many teachers are skeptical about futures education in their classes. Therefore, our main research question is:

To what extent are upper secondary school students able to think in terms of scenarios for urban futures?

A scenario can be defined as "not a future reality but a means to represent it with the aim of clarifying present action in light of possible and desirable futures*"* (Durance & Godet, 2010, p. 1488). Scenarios are powerful tools for futures thinking because they respect two key characteristics of future times: the future is open, but it is not an empty canvas (Bell, 2001; Dator, 2002; Veenman & Leroy, 2016).

5.1.2. First research sub-question

We have tackled the question by means of an intervention study. The intervention in this case is the controlled experiment of a five-hour series of lessons about urban futures. On the basis of a pretest and a posttest, we were able to answer this first sub-question:

To what extent do students' abilities to think in terms of scenarios for urban futures improve after an intervention based on futures education?

It may appear self-evident that an intervention of instruction and well-chosen learning activities improves the ability of students to think in terms of scenarios. Earlier studies have shown, however, that many teachers are skeptical about futures education as learnable and teachable (Hicks, 2012a; Pauw & Béneker, 2015). During the intervention, three building blocks for scenario thinking are used. These building blocks are the framework for the analysis of the tests in section 3.

1. The first building block is 'knowledge and skill application'. This building block is indispensable to scenario design, as it reactivates and enlarges students' knowledge and skills on urban areas, necessary for scenario design. We distinguish prior and new knowledge and skills:

a. prior geographical knowledge and skills: the students in our experiment already have geographical knowledge and skills from earlier classes, such as knowledge about urban structures and urban functions;

b. new knowledge and skills: knowledge of trends is provided to enlarge students' understanding of processes in urban areas. Four trends are introduced: an ever-stronger focus on sustainability; technology development; individualization; and deregulation (the process of a changing role of the government, including processes such as privatization and deregulation). During the intervention students' skills to use multiple trends are trained.

2. The second building block is ‘creative scenario design’ for urban futures. Students use not only knowledge and skills but also imagination, to creatively think beyond the familiar. With regard to aspects or phases of creative imagination, we only checked the ability of divergent thinking (coming up with alternatives about urban futures) as part of research sub-question 1. A more extended analysis of creative imagination is done later concerning the second research sub-question 2.

3. The third building block is ‘critical scenario evaluation’ in which students use not only knowledge, skills, imagination, but also moral-ethical reasoning to include more than just analytical arguments in their reasoning about what to consider preferable futures.

5.1.3. Second research sub-question

To learn more about how different building blocks are successfully combined in students’ notions of the future, we analyzed sketches made by the students during one of the lessons of the intervention. This analysis focuses on the first two building blocks mentioned above: knowledge and skill application as well as creative scenario design. The second sub-question is:

What combinations of prior geographical knowledge and skills, knowledge of trends, and imagination are visible in students’ scenarios?

The results are discussed in section 4. Envisioning futures with the use of imagination is considered a crucial step in empowering students to create their desired futures (Gidley et al., 2004; Hicks, 2012a). However, not all imagination is equally valuable for scenario thinking. Based on literature about creativity in education (Bruner, 1962; Cropley, 2001; Finke, Ward & Smith, 1992) we distinguish three subsequent phases towards creative imagination: divergent thinking, novelty and creativity. Imagination starts with divergent thinking (Guilford, 1950), which becomes more relevant for scenarios when it is unorthodox and surprising, qualities also referred to as ‘novelty’ (Bruner, 1962). Novelty becomes even more valuable when it is also effective, by serving a purpose. Novel, effective imagination is considered to be ‘creative’ imagination (Cropley, 2001). This implicates that creative imagination involves the use of knowledge. In section 4, therefore, we will analyze students’ sketches through the lenses of different kinds of knowledge (prior geography knowledge and knowledge of trends) and three phases of imagination (divergent thinking, novelty and creative imagination). In this sense, the analysis of creative scenario design is more elaborate here than under sub-question 1, where we will only analyze students’ ability of divergent thinking.

5.2. Method

This method section consists of three subsections. First, we provide general information about the lessons and data collection (2.1). Then, we focus on two methods of data collection to answer the research questions: a pretest and posttest design (2.2) and an analysis of the sketches made by the students during the lessons (2.3).

5.2.1. General Information

Table 5.1 presents a summary of the series of lessons on urban futures for upper secondary geography students. The complete lesson plans and all lesson materials are available on the website (see: http://irispauw.nl).

The aim of the lesson series was to stimulate students' critical and creative thinking about tomorrow's cities. Students had to prepare, design, and evaluate scenarios of urban futures using their geographical prior knowledge, knowledge of trends, and imagination. As shown in Table 5.1, after a general introduction (lesson 1), important learning activities were analyzing trends (lesson 2), designing scenarios (lesson 3), and evaluating probable and possible scenarios (lesson 4) before choosing a preferable urban future (lesson 5). The lesson series consisted of five lessons, preceded by a pretest and finished with a posttest. Earlier, two prototypes of the lesson series were tested with other students in the same age group. The third and final version of the series of five lessons on urban futures took 300 minutes, excluding the pretest and posttest. Three geography teachers with university degrees volunteered to use this lesson series in 2016 in five classes in three secondary schools in the Netherlands. A total of 142 pre-university students aged 16, 17 and 18 participated. The lessons were new to the students. The teachers prepared by attending a 2-hour training session led by a researcher. The teachers kept a logbook to report on the progress of the lessons. A researcher observed two lessons per school class in order to get an impression of how the intervention was working.

Table 5.1.

Summary of the Series of Lessons on Urban Futures

Aim: students prepare, design, and evaluate scenarios of urban futures, using their geographical prior knowledge and skills, knowledge of trends, and imagination.	
Content per lesson	*Main student activities*
Pretest	Students prepare, design and evaluate scenarios for a yet to be developed urban area.
1. Introduction: becoming engaged	For getting into the subject, students choose one out of three introductory assignments about creative perspectives on futures: students explore an idea for a radically different future, developed by a critical designer, *or* they explore personal ideas about urban futures in peer interviews, *or* they imagine radically different urban futures. The assignments require the use of students' ideas about futures and introduce them to more open, creative learning.
2. Knowledge and skill application: the study of probable urban futures	Students study and discuss four trends: *sustainability; technology development; individualization; deregulation.* They analyze the spatial appearance of each trend in changing urban areas (in recent history, at the current time, and in probable future times), thereby including connections to other spatial scales (e.g., regional, national, global). They use prior geography knowledge and skills.
3. Creative scenario design: the exploration of possible urban futures	Students design spatial scenarios for the city of the future, based on: - prior geography knowledge and skills about urban artifacts, actors, activities, and spatial relationships

		both within the city and between the city and other spatial scales; - knowledge about trends: a chosen combination of two trends is the framework for a sketched scenario; - imagination.
4.	Critical scenario evaluation: analyzing preferable urban futures with peers	Students analyze, discuss and evaluate multiple probable and possible scenarios for urban futures. They use prior geography knowledge and skills, knowledge about trends and imagination and moral-ethical reasoning.
5.	Critical scenario evaluation: analyzing and evaluating urban futures individually	Students formulate their own preferred urban future scenario, underpin it with analytic and moral-ethical argumentation, and think of an imaginary opponent and its counterarguments. They use prior geography knowledge and skills, knowledge about trends and imagination and moral-ethical reasoning.
Posttest		Students prepare, design and evaluate scenarios for a yet to be developed urban area.

5.2.2. The pretest and posttest design

To investigate the effect of the lesson series, the four researchers developed a test that was used as both a pretest and a posttest. Table 5.2 gives a summary of the test. The complete test is available on the website (see: http://irispauw.nl). The test focuses on an authentic case study about a spatial design question in the medium-sized and fast growing Dutch city of Almere in 2016. Students were asked to think about the yet to be built center of a residential area that was also still in development. Basic information about the spatial situation of the neighborhood and its center was provided in the test, as well as information in which students could recognize trends affecting the spatial situation.

The test consisted of three assignments concerning the three building blocks for scenario thinking: knowledge and skill application; creative scenario design; and critical scenario evaluation. The first and last assignment were split up into smaller sub assignments. In total, students could score 21 credits for 21 items in the test, as can be seen in Table 5.2. In assignment 1 about knowledge and skill application, students had to recognize and analyze trends and relate developments at different scales. This first assignment was relatively large since this activation of students' knowledge and skill base required several steps. In assignment 2, students designed two possible scenarios for the future neighborhood center and explained their sketches. This second assignment was the most innovative part, since students had to combine knowledge and creativity. Finally, in assignment 3 students selected their most preferred scenario, motivated their choice, and evaluated it from different perspectives. In this last assignment, knowledge and creativity are complemented by students' reflection on values. A tryout with a prototype of this test was done in another secondary school geography class with the same age group.

Table 5.2.

Summary of the Content of Pre- and Posttest

Context: In the case study test, students were asked to design and evaluate two scenarios for the center of a new neighborhood in the medium-sized Dutch city of Almere.
Summary of the test assignments
1. Knowledge and skill application to prepare scenarios in 3 sub-assignments with 10 items
Students had to: *- name two trends that could be recognized in the dataset (2 items).* *- design a street view image of the new neighborhood that contains spatial elements that were not seen in a neighborhood 50 years ago. Add an explanatory statement. Relate the sketch to a trend, and add an explanatory statement about this relationship (4 items).* *- name two expected future changes that are related to urban futures in the Netherlands: on the national scale and on the global scale. Explain how these changes could become visible in the future street view image of Dutch neighborhoods (4 items).*
2. Creative design of scenarios in 1 assignment with 6 items
Students had to*:* *- sketch two scenarios of the future neighborhood center, while using prior geographical knowledge and skills, knowledge of two trends, and their own imagination. Add two short explanatory statements.* *(3 items in two sets of a sketch and explanatory statement: 6 items).*
3. Critical evaluation of scenarios in 2 sub-assignments with 5 items
Students had to: *- make a case for their favorite scenario, while using an argument based on their prior knowledge and an argument based on their personal values (2 items).* *- make a case against their favorite scenario, while using an argument based on their prior knowledge and an argument based on their personal values, and give an example of an opponent (3 items).*

Out of 142 students who took the test, 89 students were present during both tests and all five lessons. Their tests were selected for assessment. The pretest and posttest were assessed by the researcher (the first author of this chapter). For the purpose of inter-rater reliability, a second researcher assessed 10 pretests (11%) and 10 posttests (11%). The assessors independently listed six scores per test: three for each sub assignment of assignment 1, one for assignment 2 and two for each sub assignment of assignment 3. The assessors were aware of whether it concerned pretests or posttests and used a rating model agreed beforehand. The average measure Intraclass Correlation Coefficient (ICC) showed a high degree of reliability:

- The average measure ICC of the pretest ratings was .920 with a 95% confidence interval from .867 to .953 ($F(59,59) = 12.390$, $p < .001$).

- The average measure ICC of the posttest ratings was .889 with a 95% confidence interval from .812 to .935 ($F(59,59) = 9.459$, $p < .001$).

The minor differences in scores were discussed until a consensus was reached, and the rating model was adjusted. The results of the pretest and posttest are presented in section 3.

5.2.3. The analysis of scenario sketches

To answer the second research sub-question we focused on students' sketched scenarios of urban futures that were drawn in the third lesson, as shown in Table 5.1. Our aim was to see what combinations of the two building blocks of knowledge and skill application and creative scenario design were visible in these students' sketches.

The four researchers looked at the difference between sketches in which knowledge and imagination are successfully combined, and sketches that lack a fruitful combination.

We analyzed six sketches, case by case. This concerned three high scoring sketches and three low-scoring sketches, based on a rating process that will be explained later in this paragraph. For each sketch, we first noted where we saw imagined novelty, i.e. surprisingly new ideas. Then we determined whether the combination of novelty with geographical prior knowledge and skills and knowledge of trends was visible, and whether this resulted in an integrated scenario of an urban future.

We selected six sketches out of a total of 55 sketches, drawn by 114 students, working in pairs, during 40 minutes in the third lesson of the series. The student population here was larger than in the pretest and posttest (N=89) because 114 students were present in the five participating school classes when these sketches were made.

We selected the six sketches as follows: first, we discussed three criteria to assess the sketches and practiced the assessment together. The criteria were based on a part of the rating model used for the pretest and posttest, as these tests also included sketches:

1) Are geographical prior knowledge and skills visible, in the form of urban functions, a spatial structure, and/or a focus on the human-nature interface?

2) Are two of the four trends visible, and are they integrated in a spatial context?

3) Is imagination visible, and is it novel and effective? Effectiveness is interpreted here as being embedded logically in the spatial context.

Then, we independently assessed the total of 55 sketches. Per criterion, 0,1 or 2 credits were given. Aim of this approach was not to generate valid scores for the sketches, but to create enough consensus about the visibility of fruitful combinations of knowledge and imagination. So when the scores of the four assessors differed by more than 1 credit regarding a criterion, that sketch was excluded from the analysis. All scores with sufficient agreement were grouped in five categories. Three sketches ended up in the highest category: all four assessors rated them in either category 4 or 5 on all criteria. These three sketches were the subject of further analysis. From the bigger group of 18 low-scoring sketches with all scores in the lowest categories 1, 2 and 3, we selected three representative sketches that included elements of knowledge and imagination: these were also subject of further analysis.

Thirdly, we together analyzed the visibility and fruitfulness of the combination of knowledge and skill application and creative scenario design in these six sketches, by thinking out loud and discussing our observations and interpretations. The results of our analysis are presented in section 4.

5.3. Results of the Pretest and Posttest

In this section we present results that answer the first sub-question: *To what extent do students' abilities to think in terms of scenarios for urban futures improve after an intervention based on futures education?* First, we present the results of the test as a whole. Second, we focus on the results per building block of scenario thinking: knowledge and skill application; creative scenario design; and critical scenario evaluation. After that, we briefly comment on results of relevant subgroups in the data and we close this section with final remarks.

5.3.1. Overall results of the tests

In the pretest the average student scored 35% of the credits and in the posttest 75% of the credits, so there is a clear progression. A paired-samples t-test confirmed that students' posttest mean scores were higher than their pretest mean scores (see Table 5.3).

Table 5.3.

Results of the Pretest and the Posttest as a Whole

Means pretest	SD pretest	Means posttest	SD posttest	Paired T-test score
7.41*	3.53	15.71*	3.06	$t(88)= -18.93$, $p<0.01$
* out of a total of 21 credits				

5.3.2. Test results per building block of scenario thinking

Student mean scores on pretest and posttest also differ significantly per building block, see Table 5.4.

Table 5.4.

Results of Pretest and Posttest per Building Block of Scenario Thinking

Means pretest	**SD pretest**	**Means posttest**	**SD posttest**	**Paired T-test score**	**Students who scored sufficient on pretest**	**Students who scored sufficient on posttest**
Step 1: knowledge and skill application					Sufficient = 6 out of 10	
4.19 (out of 10 credits)	2.51	8.41 (out of 10 credits**)**	1.57	$t(88)= -14.24$, $p<0.01$	25 students: 28%	82 students: 92%
Step 2: creative scenario design					Sufficient = 3.5 out of 6	

1.39 (out of 6 credits)	1.28	3.56 (out of 6 credits)	1.52	$t(88)= -10.87$, $p<0.01$	10 students: 11%	52 students: 58%
Step 3: critical scenario evaluation					Sufficient = 3 out of 5	
1.83 (out of 5 credits)	1.64	3.74 (out of 5 credits)	1.12	$t(88)= -9.34$, $p<0.01$	28 students: 32%	61 students: 69%

5.3.3. Test results concerning knowledge and skill application

The average number of credits on knowledge and skill application doubles, as Table 5.4 shows. These results concern both the use of 'prior geographical knowledge and skills' and 'new knowledge' of trends in assignment one of the test (see Table 5.2). The number of students who score at least 6 out of 10, a score that can be considered "sufficient", increases from 28% to 92% between the pretest and the posttest, as can be seen in Table 5.4. In the posttest, these assignments were too simple for half of the students, as this group scored an average of 9.5: a ceiling effect. This caused the 7 students who scored "insufficient" to be outliers, with one students' score being an extreme. Looking at the frequency with which students mention trends in their answers concerning open knowledge and skill application questions, we see that sustainability is mentioned most often in both pretest and the posttest. Table 5.5 shows that the students' use of all trends increased in the posttest.

Table 5.5.

Frequency of Mentioning Different Trends in Knowledge and Skill Assignment in Pretest and Posttest (N=89)

Trend	Pretest	Posttest
Sustainability	18	76
technology development	5	59
Individualization	5	53
Deregulation	2	65

5.3.4. Test results concerning creative scenario design

As Table 5.4 shows, creative scenario design resulted in the lowest scores on both the pretest and the posttest. Also in the posttest, most scenarios are not yet fully developed. At the same time, students make more progress concerning this building block than concerning the other two, as shown in the increased mean scores in Table 5.4. When we consider this progression in more detail, we first see an increased ability to imagine multiple futures, as in the posttest students design more scenario sketches. The assignment asked students to sketch two scenarios. In the pretest 20 students do not sketch at all, 62 sketch one scenario, and 7 students sketch two scenarios. In the posttest, 13 students sketch one scenario, and 76 students sketch two scenarios. Besides the quantity, also a better quality of the scenario sketches resulted in more credits for the posttest. As Table 5.4 shows, in the pretest 11% of the students scored at least 3.6 out of 6 credits, a score that can be considered "sufficient". In the posttest 58% reached this level. In

the pretest one student obtained 5 credits (out of a maximum of 6) while in the posttest 22 students got this far or further.

For creative scenario design, students need to think divergently, to explore alternatives beyond the familiar. Although divergent thinking differs from the knowledge and skill application looked at in the previous paragraph, students are stimulated to use their knowledge and skills again, as a basis for scenario design. Table 5.4 shows that the mean score for the building block of creative scenario design increased from 1.39 in the pretest to 3.56 in the posttest, out of a total of 6 credits for this building block. This increase is explicated somewhat further in table 5.6, which shows how much of the total credits were obtained by students, per test and for what element of creative scenario design. The results in Table 5.6 suggest that the increase in scores for creative scenario design, might be due to both progress in divergent thinking and in the use of knowledge and skills. Both the number of credits scored for divergent thinking and for the use of knowledge and skills, by all students in the pretest, compared to all students in the posttest, more than double. However, both Table 5.4 and Table 5.6 also shows that there remains room for improvement in students' creative scenario design, since 41% of the credits remains unscored, even in the posttest.

Table 5.6.

Credits Scored in Creative Scenario Design, average percentage scored per component (N=89)

	Credits Pretest	Credits Posttest
Divergent thinking	19%	59%
Knowledge and skills	25%	60%
a. prior geographical knowledge & skills	34%	64%
b. new knowledge of trends	17%	55%
Average of all credits	*23%*	*59%*

Looking at the frequency with which students use trends in their designs, Table 5.7 shows the same pattern as Table 5.5: Students use sustainability most often, and the use of all trends increases.

Table 5.7.

Frequency of Mentioning Different Trends in Scenario Design Assignment in Pretest and Posttest (N=89)

Trend	Pretest	Posttest
sustainability	23	75
technology development	16	64
individualization	6	34
deregulation	5	20

5.3.5. Test results concerning the critical scenario evaluation

Table 5.4 shows that the ability to critically evaluate scenarios improves between pretest and posttest. As Table 5.4 also indicated, 32% of the students obtained 3 credits or more on the pretest, a score that can be considered "sufficient". In the posttest, this was 69% of the students. To obtain a sufficient score, students had to reason beyond their first reaction, by using different types of arguments or by looking at scenarios from different perspectives. For example, students frequently chose a sustainable, technologically advanced urban future as their preferred one and reviewed it as 'ecologically sound' and 'attractive', but in the second instance also as 'expensive'.

Looking at the frequency with which students use trends in their evaluations, we see a remarkable increase of technology development between pretest and posttest, as shown in Table 5.8. However, sustainability dominates in the answers to the questions concerning the evaluation of scenarios in both tests.

Table 5.8.

Frequency of Mentioning Different Trends in the Evaluation of the Scenario in Pretest and Posttest (N = 89)

Trend mentioned	Pretest	Posttest
sustainability	30	30
technology development	0	12
individualization	5	7
deregulation	1	1

5.3.6. Test results of subgroups

Although we treat the data as one group, we here report on evident subgroups within the group as a whole.

5.3.6.1. Concerning different teachers and classes

The data show some differences between the three teachers and their five school classes, as displayed in Figure 5.1.

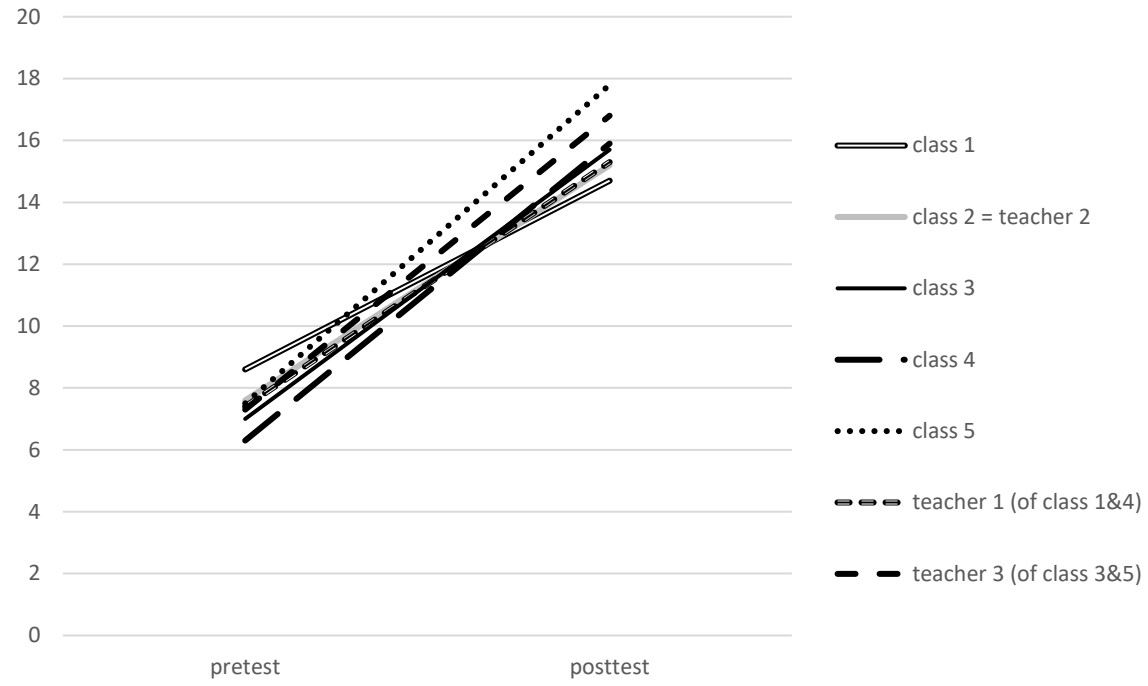

Figure 5.1. Mean results pretest and posttest per class and per teacher

No significant effect of the different teachers on the student's test scores (difference scores) was found: F(2,86) = 1.692, p = 0.017. The dependent variable *difference score* was created by subtracting each student's score after the intervention with their corresponding score before the intervention. This way a one-way ANOVA could be used to test the (possible) differences in the increase of scores among groups.

There was a significant effect of the variable school class on the student's test scores (*difference scores*): F(4,84) = 3.193, p = 0.190. Post hoc comparisons using the Tukey HSD test show that:

- it is the school class with the highest mean difference score (M =10.21, SD=2.96) that differs significantly (p = 0.028) from the class with the lowest mean difference score (M= 6.12, SD=3.49);
- the mean difference scores of the other three classes (M=7.62, SD=4.03; M=8.73, SD= 4.75; M= 9.57, SD=4.34) do not differ significantly from any of the other mean difference scores.

Interpreting these differences any further goes beyond the scope of our study.

5.3.6.2. Concerning low, medium and high scores

When we group students' scores in three categories − low, medium, and high − we see the students' progression in the different categories, as shown in Figure 5.2. The biggest group of 34 students proceeds from a medium pretest score to a high posttest score. A second group of 30 students makes a bigger step: from a low pretest score to a high posttest score. There is also a smaller group of 12 students who show progression from a low pretest score to a medium posttest score. 12 students stay in the same category, one of whom repeats the same score and

11 make progress within their category (once in low, nine times in medium, and once in high). But one student falls back from a high pretest score to a medium posttest score.

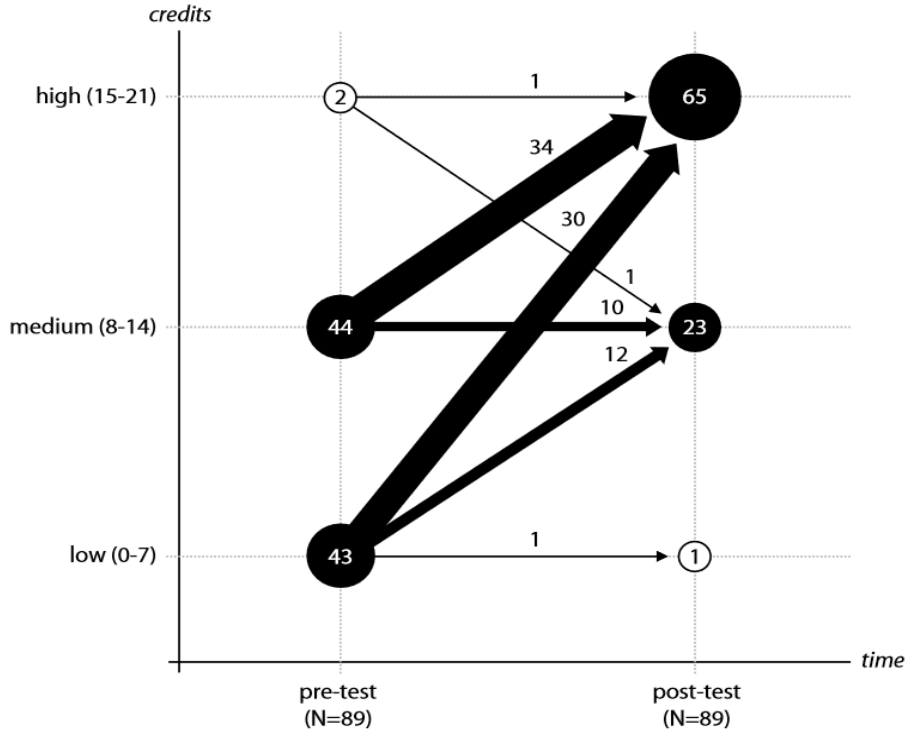

Figure 5.2. Pretest to posttest progression of categorized scores

5.3.7. Concluding remarks

In summary, we see that students' results improve between pretest and posttest, not only in total but also if we look separately at the three different building blocks: knowledge and skills application; creative scenario design; and critical scenario evaluation. Sustainability proves to be the trend most referred to in the tests. This may be so because earlier geography lessons paid attention to the human-environment relationship and the concept of sustainability, as they are at the core of school geography. Another reason might be that sustainability has been hot topic in Dutch society over the last few years. Low students' scores are found in creative scenario design in both the pretest and posttest. Indeed, most student scenarios appear rather one-dimensional. This might be related to the newness and complexity of the scenario design task: it is the most innovative element of the lessons as it requires the use of both knowledge and imagination. Some students, however, did create more substantial, interesting scenarios. This difference confirmed our interest in making a more in-depth analysis of students' scenario sketches of urban futures. We present the results of this analysis in the next section.

5.4. Results of the Analysis of the Scenario Sketches

In this section we present results which answer the second sub-question: *What combinations of prior geographical knowledge and skills, knowledge of trends, and imagination are visible in students' scenarios?*

For this qualitative analysis, we selected six sketches from those that students designed in the third lesson of the lesson series. We looked at the combined use of the first and the second building block: knowledge and skills application and creative scenario design. Since the phase of evaluation comes after the sketching, the third building block of critical scenario evaluation is not included in this analysis. We analyzed whether the imagination is creative, which is the case if it is both novel −defined as surprisingly new − and effective, by serving a purpose (Bruner,1962; Cropley, 2001). First, we evaluate the three sketches with low scores, and then the three sketches with the highest score.

5.4.1. Sketches with a low score

Concerning imagination, the sketches with the lowest scores show elements that are probably intended to be novel but that already exist in current cities. Examples of this in Figure 5.3 are rainwater storage and urban farming. Other elements were novel, such as the jetpacks, with which students pictured themselves flying to school, enabled by new technology. However, although new, this concerns disconnected novelty, which is novelty that is not embedded in an urban structure or related to spatial developments.

Figure 5.3. Example of a scenario sketch with a low score

An urban spatial structure is missing in the low scoring sketches. Also, we see no integrated urban functions and features, such as a dense transport network, high-end shops and high-rise apartments. Students have not used prior geographical knowledge and skills. What we see are

persons and disconnected objects, such as flying persons, houses, and a school (see Figure 5.3). Knowledge of trends is visible to a certain extent and related to different geographical dimensions. For example, in Figure 5.3 solar panels represent the trend of sustainability, referring to the natural dimension used in geography education. However, the trends and dimensions are not connected to other spatial scales (e.g., regional, national).

Although the sketches have many shortcomings, it is important to notice that they do show students' divergent thinking. For example, the jetpacks in Figure 5.3 do not illustrate unregulated self-expression, but they show the result of divergent thinking, also referred to as 'variability': "doing things differently from the usual, regardless of accuracy, meaning, sense, significance or interestingness*"* (Cropley, 2001, p. 14). Divergent thinking and variability are the first steps towards effective, creative imagination (Finke, Ward, & Smith, 1992).

5.4.2. Sketches with a high score

The three best-scoring sketches show creative imagination: divergent thinking that is both novel and embedded in an urban structure in which the elements are connected. The commercial drones highway in Figure 5.4 illustrates this. In one of the other high scoring sketches, students drew a park in the center of the city, instead of commercial functions, and defended their choice by referring to the importance of social cohesion. These are examples of the production of variability by building novel structures. Students' new ideas and their spatial implications express a narrative: they tell a story. Claiming the most expensive space in a city for a park expresses students' priorities and opens a perspective for new possibilities and different choices.

In the three best-scoring sketches, we see a spatial, urban structure with typical urban functions: for example, a university, high-rise buildings, or a business center. In Figure 5.4, the extra spatial layer in the air is connected to the urban structure, which shows awareness of a city as a system in which different dimensions − economy, nature, culture, politics − claim space. Other sketches use a map to illustrate spatial structure. The sketches also display relationships with other cities or spatial scales, for example by means of the 'international' business center mentioned in Figure 5.4. Students made use of their prior geography knowledge and integrated knowledge of trends in their sketches of urban futures: sustainability is for example part of Figure 5.4 by means of sustainable energy sources. Although this is encouraging, there is still room for improvement even in these stronger examples of scenarios: certain elements of the scenarios, such as the drones highway, can be questioned about their exact relevance, and it would be interesting to explore further dilemmas and contradictions within scenarios and between scenarios.

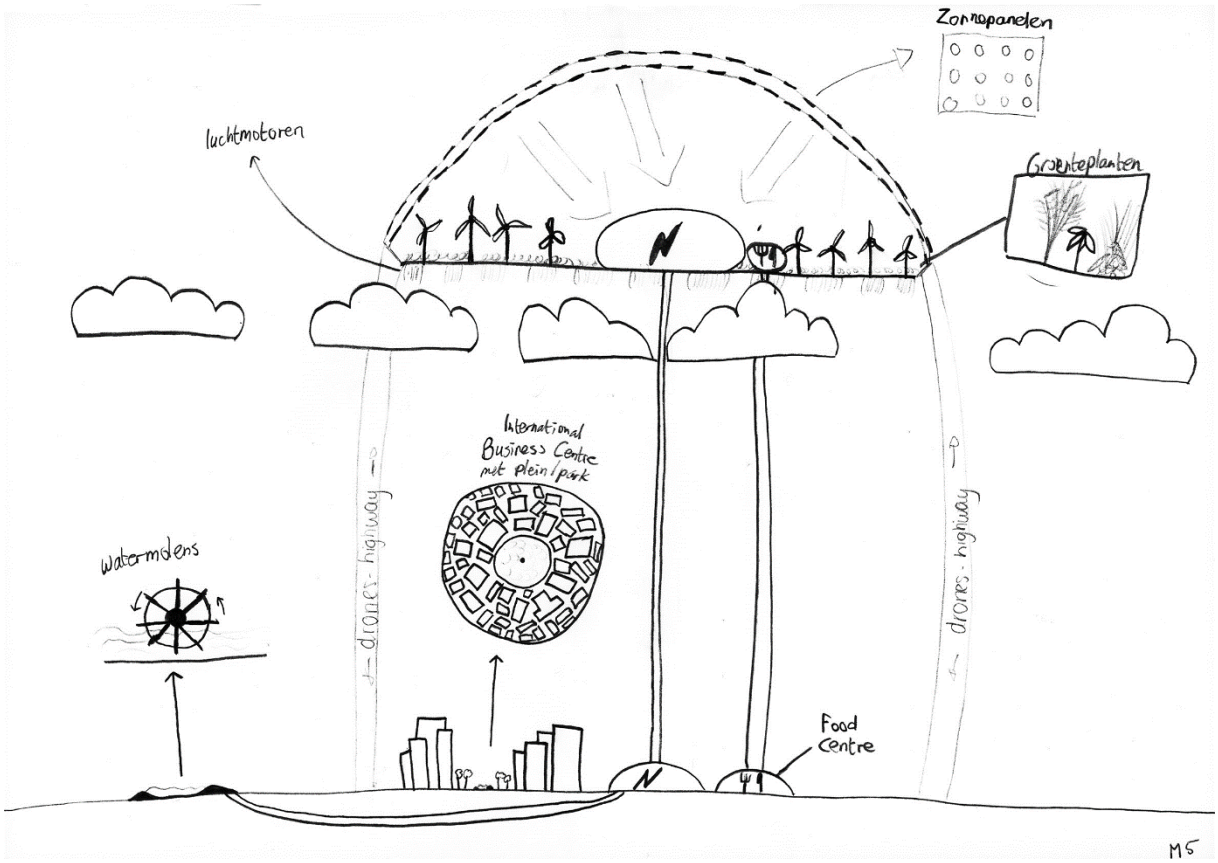

Figure 5.4. Example of a scenario sketch with a high score

5.4.3. Concluding remarks

In summary, in the sketches with the lowest score students are hardly able to combine imagination with prior geographical knowledge and skills. In the best sketches, students are able to combine imagination with systematic geographical thinking, making the novelty effective and thus creative. The best sketches pay attention to several urban functions, to spatial relationships in the city and the city's connections with other spatial scales and places, thereby showing aspects of a geographical approach (Van der Vaart, 2001; Van der Schee, 2007; Solari, Solem, & Boehm, 2017).

We end our analysis with a final remark about the Dutch school context. Formally, the Dutch geography curriculum offers possibilities for more creative learning activities such as sketching spatial changes. In practice, however, this is not common in secondary school geography. Most teachers direct the curricular freedom they formally have towards the high stake, final, central exams (Pauw & Béneker, 2015). Currently, these exams hardly include higher order thinking skills such as creativity. Where, for example, the French geography exams include the drawing of croquis, the Dutch exams currently lack such open, higher order thinking assignments.

5.5. Conclusion and Discussion

5.5.1. Conclusion

In this study, we have presented the results of a research study concerning students' scenario thinking on urban futures. Our main research question was*: To what extent are upper secondary school students able to think in terms of scenarios for urban futures?* In this section, we answer our research question in the conclusion and then briefly debate possible consequences in the discussion. We also consider the limitations of this present study and make suggestions for further research.

The results show that students' abilities to critically and creatively envision futures improve significantly: after the intervention, students were able to sketch and evaluate more and better scenarios. An improvement is in line with expectations. But what is encouraging is that this improvement took place in a short amount of time, in a regular school context although working with an approach that is very different from usual lessons. Also, the results show improvement for students departing from different starting levels, as shown in Figure 5.2. Our results can assist others in their attempts to practice the kind of critical and creative education pledged for by both geography educators and futurists (Hicks, 2012a; Inayatullah, 2008; Krause et al, 2017; Lambert & Morgan, 2010; Roberts, 2013; Slaughter & Beare, 2011).

Although critical and creative thinking is visible in the students' results, the use of both knowledge and imagination could be developed further.

- Concerning knowledge and skill application, we saw that students easily picked up on the newly introduced trends which seemed to assist them in expressing ideas on tomorrow's cities. Also, once stimulated to use prior geographical knowledge and skills, most students were able to reason about how trends could work out globally, nationally and in a specific local spatial contexts. Scores on the knowledge and skill application questions more than doubled. A positive result, but these questions were intended to prepare for the main task, of creative scenario design.

- Concerning creative scenario design, we saw how students became more able to generate imaginative scenarios during the intervention, mainly by means of divergent thinking. This is an important result, given the newness of the explicit use of imagination in school geography and teachers' risk-averse pedagogy. Taking a 'risk' by using students' imagination enables teachers to better understand and appreciate students' perspectives on futures. Based on personal perspectives, students' navigate, interpret and draw meaning from their environments (Hopwood, 2011). In scenarios we see these perspectives applied to future times in students' narratives for tomorrow's cities. Such narratives that encompass both imagination and knowledge can contribute to "'a sense of place': a feeling for the personality of a place and what it might be like to live there" (McPartland, 1998, p. 346).

Although these first innovative steps are rewarding, students did not make all their divergent thinking effective: often their imaginative scenarios lacked embeddedness in a spatial context. The purposes of the newly imagined scenarios for urban futures were not always addressed. It appeared very complex for students to think about urban futures while using knowledge about the world as a system in which tomorrow's cities will have their place.

- Regarding students' capacities to critically evaluate scenarios we saw improvement whereby students showed an increased use of both knowledge and values in their argumentation. This indicates that students developed enough knowledge and also the skills to reason about futures from different perspectives.

In summary, the first rewarding steps towards envisioning futures have been taken: students are able to use knowledge and divergent thinking in scenario thinking. Improvement of the scenarios is possible, if students learn how to make better use of prior geographical knowledge to integrate divergent thinking into the spatial contexts of tomorrow's cities.

5.5.2. Discussion

Our conclusion suggests a stronger stimulus for students to use prior geographical knowledge and to think conceptually about futures. The participating teachers, who evaluated the lessons as relevant, practicable and challenging, also consider that more knowledge and systematic thinking should be used as the next step in students' learning process. For example: comparing Moses' focus on structure in New York's urban planning with Jacobs' focus on creativity, provides food for thought to students (Flint, 2011; Sennett, 2018) that can help them to deepen their thinking about scenarios. Everywhere there are local place and space issues with opposing interests and viewpoints. Examples of these issues can be discussed with students to help them bridge the gap between concrete, local experiences and a more abstract and systematical perspective.

Using more conceptual knowledge should, however, not reactivate the reflex to 'teach' futures. When the teacher provides only theoretical knowledge on tomorrow's cities by lecturing, students can easily switch to a "schoolwork mode" (Scardamalia & Bereitner, 2017, p. 66) and uncritically follow authoritative information to successfully perform the assigned task. Instead, scenario thinking needs active students, who can use knowledge and imagination to create scenarios. Fortunately, the use of mental images is not new to school geography (McPartland, 1998; Scoffham, 2013). To combine the teaching of new knowledge while at the same time providing scope for students' own thoughts is both a science and an art (McGee & Fraser, 2008). Scaffolding, the instructional strategy that can support this combination, starts with an intriguing design, and in class it requires high-quality feedback that stimulates thinking,

imagination, and reflection. The teacher asks seemingly simple feedback questions, with no single answer, that trigger deep thinking and may start transformative learning (Illeris, 2007; Kelly, 2008; Mezirow, 1997) that challenges and changes our comprehension of the world as we know it. For example, in our research, students with fairly simplistic scenarios of urban futures were asked to outline how food supply would be organized in their envisioned future cities. This simple question triggered a thinking process about food production, transport, distribution, and waste. Thinking through these aspects of urban futures confronted students with taken-for-granted assumptions (such as: 'tomorrow's cities will have sufficient food supply') and activated them to develop more profound scenarios.

A final point of discussion concerns the assessment of scenario thinking. Assessing creative and critical thinking has been an explicit hurdle for teachers in futures education in school geography (Pauw & Béneker, 2015). In our research, we took two steps to gain more insight into evaluating scenario thinking. First, we used a test with authentic, open assignments that assessed critical and creative thinking. Second, we evaluated creativity in sketches through teamwork, as suggested in the literature on creativity in education, in order to support validity and reliability. If authoritative exams include assignments that assess higher-order thinking, this can raise the likelihood of teachers taking up on their role in geography education that explores futures.

5.5.3. Limitations of the study

A limitation of the study is the relatively small number of participating students, which restricts the statistical power of our analyses. And, although an effect did probably occur after the intervention, there was no control group to check this, since there is no regular futures education in secondary geography education with which to compare our experiment. Our results might also have been influenced by the limited training time of the teachers who had to work with materials they had not developed themselves or used before. The series itself was limited to five lessons, which probably influenced the results of students. Finally, there might have been an effect of the pretest on the posttest performance. However, the marked degree of progression between pretest and posttest suggests that it concerns more than a pretest effect.

5.5.4. Recommendations for future research

More experiments like ours are desirable, to increase insight into how students combine knowledge and imagination in critical and creative scenario thinking, and how we can stimulate this.

Supplementary research is also necessary on how students use reflection skills during scenario thinking: for example, when they evaluate preferred futures. The results from research on pedagogy for argumentative writing might be helpful, given the similarities between argumentative writing and scenario thinking, both of which are critical, creative and reflective processes. Research on students' argumentative writing shows how learning-through-observation was more effective than learning-through-practice (Couzijn, 1995; Rijlaarsdam et al., 2008).

A final recommendation for further research concerns the balance between the complexity of the real world and students' coping capacity. This is necessary because exploring futures can be intellectually and emotionally overwhelming (Rogers & Tough, 1996; Kelly, P., 2006). We saw students' emotions during scenario thinking, varying from enthusiasm to resistance. Future research could bring more insight into students' affective reactions and how these can

contribute to constructive, empowering thinking about futures. For example in our research, some students results were so promising that a local authority invited students to present their ideas to the City Council. Futures education should aim for this kind of rewarding, empowering result.

Chapter 6. Conclusion and Discussion

The aim of this thesis was to discover how education about futures in school geography can be improved. In order to make sense of the world, students should also explore futures. Geography education offers them a suitable knowledge and skill base to start from, but this base needs to be employed effectively in order for such exploration to be successful. Therefore, the main research question of this thesis was:

How can students' envisioning of futures in school geography be enhanced?

To answer this question, the present study went from problem analysis in Chapters 1, 2 and 3 to a design phase in Chapter 4 and an experiment in schools, reported in Chapter 5. This final Chapter 6 offers a description of the conclusions of the separate studies (6.1) and an answer to the main research question (6.2). Recommendations clarify the implications for geography teachers (6.3). In the final section, reflections on the studies' limitations are presented and recommendations for further research are made (6.4).

6.1. Findings from Separate Studies

Chapter 1 described the hurdles that futures education encounters, despite its urgency, its potential, and the attempts that have been made to get education about futures off the ground.

Current transformative times require education that teaches forward-looking responses. In a geography class, students express ideas about futures that are often little empowered. There is an urgent need for students to be educated in futures thinking, but mainstream school geography pays insufficient attention to futures. Therefore, two central fields of expertise have been brought together: futures education and geography education. Futures education, a subfield of the academic field of futures studies, offers the expertise to explore multiple global futures as a context for choice. It provides concepts and approaches that enable students to move away from outdated industrial era worldviews towards integrated forward-looking worldviews (Hicks, 2012a). Its key aim is to develop thinking over a longer timespan (Slaughter & Beare, 2011) by combining the study, imagination and evaluation of multiple futures. "The notion here is that we cannot move towards a future we prefer, unless we are able to imagine it" (Hicks, 2012a, p. 55). Geography education is explicitly put forward by futurists as suitable for futures exploration (Hicks, 2007; Hicks & Gidley, 2012) because school geography provides geographical knowledge and skills, from local to global and concerning multiple dimensions such as nature, culture, economy and politics (International Geographical Union Commission on Geographical Education [IGU-CGE], 2019). Geography education literature also offers pedagogies for imagining and anticipating futures (Roberts, 2011).

However, even though conceptual frameworks and possible approaches for futures exploration are available in both fields of expertise, their research agendas indicate that empirical study about conditions for teaching about futures is still in its infancy. Therefore, this thesis has explored ways in which students can study, imagine, and evaluate futures of key geographical issues.

Chapter 2 outlined and analyzed the current status of futures approaches in Dutch geography education, in order to increase insight into the initial situation this study intended to improve.

For the analysis of futures education in the Netherlands, a mixed method approach was used. First, we looked at three different types of educational materials in a quantitative analysis. We analyzed parts of: 1) the syllabus: the formal, intended curriculum; 2) geography textbooks; and 3) geography examinations. It became clear that the intention of working future-oriented – which is stated in the visionary document behind the syllabus – is not followed through in the syllabus, textbooks and examinations. In the latter documents, futures are mostly displayed as fixed and used indirectly, as contexts for the correct application of information. The open exploration of futures is hardly ever seen. Subsequently, these finding were discussed with various stakeholders, such as geography textbook authors, teacher educators, and teachers. In this second part of the study, we used a qualitative approach. Stakeholders identified the following determining explanatory factors for the absence of a futures perspective: institutional constraints; vagueness about how to practice futures education; and ambivalence – a feeling of both support and hesitation – among members of the community of geography educators.

What followed from this study is that futures-oriented geography education would benefit from alterations in a national educational system that currently focuses too narrowly on strict output testing. Moreover, more clarity is needed as to what purpose futures education serves, and how it can be practiced in school classes. A ready to use, coherent, tested approach could serve as a starting point for teachers and could stimulate futures education to be taught beyond the small community of progressive geography teachers who already teach about futures in an explorative manner. Lastly, teachers need to be educated and trained in a more interactive way about teaching futures, which includes students' input, in order to truly enhance students' learning and thereby increase the quality of geography education.

Chapter 3 focused on international discourses about futures, in search for ways to enhance futures exploration in education. Three categories of documents were analyzed (close reading).

The first category concerned international documents about what are called 'twenty-first century skills' in education. Four documents were studied, which were published by the OECD, the EU, the US P21 and the Singapore Ministry of Education, and which depict a future world that is complex and uncertain; a world of fierce competition and rapid technological change. The key argument shared by the documents is that twenty-first century skills, such as critical thinking, creative thinking and communication, prepare young people for the future. Although it makes sense to develop these skills, two shortcomings of the approaches were identified: they take for granted a fixed future image and they give the impression that skills and content are separable. It seems as if any content can be used for practicing these skills, while a good combination of (often complex or specific) subject knowledge and skills is necessary (Rotherham & Willingham, 2009).

Secondly, four international policy documents and position papers about geography as a school subject were selected. It concerned internationally respected, authoritative documents, two of which represented the supranational scope and the other two related to geography education in a national context. These documents share the image of a future as being full of demanding, urgent, global problems. This problematic state of the planet seems to legitimize the inclusion of geography in the school curriculum. There is a substantial overlap with the twenty-first century skills reports that were analyzed in the first stage of this study, since many of the skills are readily applicable in geography classes. The geography documents, however, place more emphasis on content and values. Knowledge about regions in

perspective − in terms of human and nature, near and far − is seen as essential to prepare students for futures. One of the policy documents (IGU-CGE, 2019) states that:

> studying geography helps people to understand and appreciate how 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. Geography is therefore a vital subject and resource for twenty-first century citizens living in a tightly interconnected world. It enables us to face questions of what it means to live sustainably in this world. (p. 5)

Values such as diversity and equity, traditionally associated with geography education (Smith, 2000), express a broader perspective than the neo-liberal twenty-first century skills frameworks that were studied.

Thirdly, Chapter 3 presented the discourse of futures in the academic field of futures education, resulting from the analysis of authoritative publications that explicate the foundations of the relatively new field. It showed how key concepts, such as multiple futures, imagination and anticipation, offer possibilities for thinking geographically about futures with students. From the perspective of futures education, two immediate observations can be made about both the twenty-first skills frameworks and the geography policy documents. First, both sets of documents employ a fixed, specific, undiscussed image of the future. Second, none of the documents include a plea for engagement with futures in education.

The main conclusion of chapter 3 is that geography education can be enriched by taking concepts and tools from the field of futures education seriously. Geographical subject knowledge can offer the substantive connection between the instrumental approach of the twenty-first century skills documents and the deeper messages of futures education. For example, exploring climate change requires a profound understanding of processes in the atmosphere, as well as critical and creative thinking in multiple scenarios. This implies that geography education should not only profit from what futures education offers but should also draw upon the knowledge base within its own field. Geographical subject knowledge has an important role to play in futures education (Bell, 2009; Hicks, 2007). This links up with the recent discussion in geography education about powerful knowledge (Béneker, 2018; Lambert, 2014; Maude, 2016). Moreover, innovative pedagogies for an open, challenging way of teaching and learning have been developed by geography educators (e.g., Martin, 2011; Roberts, 2013). Unfortunately, these pedagogies are currently underused in most schools.

Chapter 4 introduced a set of three design principles for futures-oriented school geography and an intervention, in the form of a lesson series. An Educational Design Research (EDR) approach was used. During the development and tests, two balances were studied: the balance between the use of knowledge and imagination, and the balance between students' self-guidance and teachers' guidance.

First, three tentative design principles − scenario thinking, student voice, and scaffolding – were formulated, based on the futures education and geography education literature described in chapter 3:

- *Scenario thinking* is referred to as a suitable approach for the exploration of multiple futures, among which are probable, possible, and preferable futures (Bell, 2009; Hicks, 2007; Slaughter & Beare, 2011). Knowledge and imagination are key elements for the

exploration of these complex scenarios. The developed scenarios serve as a context for conversations about what is preferable, for whom, and why;

- *Student voice* refers to the involvement of students' personal knowledge and viewpoints about futures while developing scenarios. Besides intellectual reasoning, affective processes are involved, as futures thinking brings along feelings such as hopes and fears (Rogers & Tough, 1996);

- *Scaffolding* is a teaching approach that allows for both teacher support and autonomy of students (Van de Pol, 2012). Teachers design open tasks for scenario thinking and remain responsible for the management of the learning environment. They help the students where appropriate.

Guided by these tentative design principles, two prototypes of lesson series about urban futures were developed. The first prototype focused on the extent to which students can rely on their prior knowledge and self-guidance during scenario thinking about tomorrow's cities. The students' results showed rather stereotypical, simple scenarios, with simple solutions to spatial dilemmas in urban futures. Students seemed to have neglected or forgotten their prior knowledge during scenario thinking. They expressed disempowerment in outcries such as 'How should I know?'. Possibly, they did not recognize earlier gathered knowledge and skills as relevant, since they had to apply them in such a different task: not as an end result, but as a starting point for scenario thinking. After the teacher provided some information about trends and activated prior knowledge, students then made better use of such knowledge as input for designing scenarios about urban futures. Students apparently could not fully depend on their autonomous use of knowledge for the complex task of scenario thinking.

Based on the lessons learned from the first prototype, the teacher's guidance and input were increased in the second prototype. More instructions and resources were used to improve students' critical and systematic thinking about urban futures without frustrating their creative thinking and self-guidance. Teachers activated prior knowledge and provided a set of resources about four trends in urban futures: sustainability, individualization, deregulation and technology development. The students' results indicated that more guidance and input contributed to better scenarios that showed more prior knowledge, knowledge of trends and imagination.

The exploratory design study mainly showed that it is possible to strike a workable balance – for teachers as well as for students – between knowledge input and imagination and between students' self-steering and teachers' guidance. Hence, the final lesson series was based on the second prototype. The tentative design principles were still considered relevant, but were refined according to insights gained from teaching the lessons during prototyping. For scenario thinking, input of subject knowledge proved indispensable, and creative thinking appeared to be a stepwise process that needed to be stimulated and directed. For student voice, similarly, a stepwise process was needed: students first acknowledged and explicated their own ideas on futures and then put these ideas in perspective, by consulting other voices and subject knowledge. Finally, scaffolding turned out to be feasible but demanding, also because the exploration of futures was new to teachers. It was difficult to teach about inherently uncertain futures in an innovative, open way, while avoiding two pitfalls: teachers should not teach a fixed future but neither should they allow the exploration of futures to be too shallow. To assist students and teachers in combining openness and profoundness, a divergent assessment was added at the end of the lessons of the second protype and the final lesson series. The test assignments were relatively open and challenged students to show their

competences in thinking about urban futures using knowledge and imagination. This summative test did not only measure students' abilities in futures exploration but also stimulated them to follow the lessons carefully.

Chapter 5 reported on an intervention study that displayed student's abilities to envision scenarios of urban futures. To generate student results, we used the lesson series developed and tested in Chapter 4.

The study consisted of a quantitative phase and a subsequent qualitative phase. In the quantitative phase, we measured to what extent upper secondary school students were able to think in terms of scenarios for urban futures. We used a lesson series of five lessons and a pretest and posttest design, for which we developed a case study assessment. The assessment concerned an authentic spatial design question in the medium-sized Dutch city of Almere and measured students' ability to: 1) apply knowledge and skills; 2) use both knowledge and imagination for scenario design; and 3) critically evaluate scenarios. The results showed that students' abilities to critically and creatively envision futures improved significantly between pretest and posttest: after the intervention, students were able to sketch and evaluate more and better scenarios. Students easily picked up the introduced trends, which seemed to assist them in expressing ideas on tomorrow's cities. Also, once stimulated to use their prior geographical knowledge and skills, most students were able to reason about trends and ways they could work out in a specific spatial context. Their scores on knowledge and skill application questions more than doubled. Concerning creative scenario design, we saw how students became better in generating imaginative scenarios, but often these lacked purposeful embeddedness in a spatial context.

In the qualitative phase, we analyzed scenario drawings that students made halfway into the lesson series, in order to learn more about students' scenario thinking. We looked at the combinations of prior geographical knowledge and skills, knowledge of trends, and imagination. We saw how students managed to design scenarios but then found it difficult to embed these in the spatial structures of tomorrow's cities. Students did not relate their scenarios to urban spatial issues: it often remained unclear for what problem in tomorrow's cities their scenarios provided a solution. It appeared to be too complex for most students to think about different geographical relationships or different spatial scales. However, some students did embed their ideas in a broader context.

In summary, the lesson series resulted in first steps for envisioning futures: students were able to use knowledge and divergent thinking in scenario design. Further development of students' scenarios is probably possible, if students can learn how to make better use of their geographical knowledge and imagination during scenario thinking.

6.2. Conclusion and Discussion

From an analysis of policy documents and educational materials, this study has shown that the importance of education about futures in school geography is widely endorsed, but the elaboration is still in its infancy. Using an intervention, this study has shown that students' envisioning of futures in school geography can be enhanced by the combination of scenario thinking, student voice, and teachers' scaffolding. Under specific conditions, in a well-considered approach, students in geography lessons were able to think meaningfully about multiple futures. In terms of content, the approach was characterized by an integrated use of prior and new geography knowledge and the use of imagination about multiple alternatives

for tomorrow's cities. In terms of the learning and teaching method, the approach focused on the integration of students' self-steering and teachers' support.

It should be noted that this study does not show what results could have been made with other geographical themes or with different choices in terms of the teaching and learning strategies. The intervention in the present study focused on scenarios for urban futures, but exploring, for example, multiple expert visions of futures for global health or about migration might have led to different results. Moreover, these results do not tell how students' envisioning of (urban) futures in school geography can *best* be enhanced. This study found a feasible approach, based on key literature, and is intended to stimulate others to develop more and different approaches for futures-oriented school geography.

Envisioning futures: uncommon, difficult but gaining momentum

The present study showed that the open kind of teaching and learning required for futures exploration is uncommon practice in geography education. The intervention showed that both students − in their ways of using knowledge and imagination – and teachers – during scaffolding – had difficulties with exploration of futures. Although future times are mentioned in the aims of school geography on a curricular level, exploration of futures by students, stimulated by appropriate content, assignments, and pedagogy, is currently the exception, rather than the rule. At times, promoting education about futures in school geography almost seemed a mission impossible, but fortunately it was an educative one. Two aspects of the difficulties appeared relevant in the present study: the innovation itself was a major challenge and there was a mismatch with the context of current school geography in which it needed to be implemented.

- The innovation of futures envisioning was not only *new,* but also *complex*, focused on an *uncertain domain* and *not fully clear*, in the sense that the exact teaching and learning procedures took shape during the study;

- The context of school geography, even apart from futures study, might be considered outdated. Mainstream educational materials implicitly prepare students for a business-as-usual future, by telling them about the way the world works. Common school practice is still focused on lower-order thinking skills instead of on the higher- order thinking needed for futures thinking.

Futures exploration therefore required students and teachers to take multiple, fundamental steps forward, so as to achieve higher-order relational thinking about uncertain future urban worlds, that face not one, but multiple alternative futures that need to be explored.

The mismatch was, as said, no surprise. Higher-order thinking and more specifically relational thinking is, even apart from futures, difficult for students. Futures involves extra challenges for students, since futures interdependencies of different places and processes on multiple scales are not factual. Futures uncertainty is difficult to respond to in a sensible manner, for everyone, even experts, as illustrated, for example, in the struggle to find appropriate policies for the Covid-19 pandemic. This difficulty, combined with the importance of relational thinking about futures, was a main reason to initiate the attempt to enhance envisioning of futures. This study confirms that futures exploration was, and is, not easily fitted into existing programs of school geography, and explains how to handle the difficulties that occurred during the envisioning of futures. This study aimed to reduce the

newness and unclarity of the envisioned futures, in order to enable students and teachers to be better equipped for their inherent complexity and uncertainty.

It is important to note that futures exploration seemed to gain momentum in society in the last years before the end of this study. The missing futures dimension in education has been a concern for only a select group for many decades (Hicks, 2012a; Beare and Slaughter, 2011), but, in recent years attention for futures seems to have increased. Hence, raising awareness of how 'the global is in the local' and 'the future is in the present' may be somewhat easier than it was a decade ago. All students have personally been experiencing the consequences that globalization can have during the Covid-19 pandemic. And there are more remarkable, visible major global processes going on, visible in major global changes, such as a the growing economic inequality and China's increasing role in the world. In this study, students indicated that their biggest concern about futures is sustainability. Exploring futures might assist them in constructive thinking about sustainability. This study has not found a panacea for envisioning futures. However, it does offer some important stepping stones that can help students and teachers to envision futures in school geography.

Students' futures awareness: in development

An influential factor in enhancing the envisioning of futures was the extent to which adolescents recognized its importance. Were they aware of the influence they have on futures, and the other way around? At times in the present study, students seemed to prefer the denial of futures: not only was the envisioning of futures new and difficult, it also would not appear on their final exams. Sometimes futures exploration made them moan and groan, while at other times, students became captivated and expressed enthusiasm and eagerness. Although it remains unclear whether students' futures awareness was there from the beginning, teaching and learning at least explicated it and possibly expanded it, since nearly all students in the present study showed progression in their envisioning of futures.

The extent to which students show futures awareness seemed to be a matter of both their *ability* − more cognitively connotated, having the necessary knowledge, skills and imagination – and *willingness* − more affectively connotated, making the effort to share their thoughts about futures. Broadly speaking, there seemed to be four categories of students in this study: the students who were 'willing and able' from the beginning of the study; the ones initially 'unwilling and unable'; and the ones in between these two categories. The ones willing and able might have had some futures awareness from the beginning. During the study, these students eagerly thought about alternative futures. There was still a lot to learn, as much of the content (trends in urban futures, food supply in urban futures) and the approach (using imagination combined with knowledge) was new to them too.. The students in the two in-between categories, might be considered the ones for relatively 'quick wins' in enhanced envisioning of futures. These students are either able or willing to analyze and imagine futures, but this potential might remain unused, if it is not picked up in educational settings. Self-evidently, the students that are neither able nor willing to explore futures, need expert attention concerning the content, skills and pedagogy of futures thinking in order to extend their cognitive capacities and overcome affective avoidance. Although tentative and broad, such categories can assist in finetuning approaches to futures envisioning.

It is important to note that probably all students' thought about futures is instantly valuable in at least two ways. The students' thoughts offer teachers information about what is and what is not yet understood, imagined, and evaluated about futures. This is essential information for the formative evaluation and extension of students' knowledge and skills necessary for

futures exploration. Moreover, fresh perspectives that spring from young minds can offer new ways of seeing and anticipating futures. During this research, fresh perspectives on futures thinking were aimed at, by integrating viewpoints from experts in adjacent fields. For example, artistic ideas about futures that were used in the lessons and feedback on the lesson series was given by a creative designer, an urban planner, and a journalist in a panel evaluation. Although different experts would have given other insights, the multidisciplinary thinking that was achieved in this study enriched the understanding of futures envisioning. This enrichment also came from the 'multi-generational thinking' that was achieved by thinking about futures together with young students. The experience of discovering alternative, radically different perspectives on futures in the present study was valuable and rewarding. But it will take more time and effort to further stimulate and achieve a systematic exchange of futures ideas between expert teachers and students during school geography.

Concerning students' futures awareness, there is more to be done, as it remains unclear – and even doubtful – that students' envisioning had already reached its full potential in this single intervention in the course of just these few lessons. It is important to find out what levels of ability and willingness for futures envisioning students can achieve, by focusing on different geographical issues, through other interventions and with students at various levels. Moreover, it should be noted that, although students' futures awareness was explicated and possibly extended, this was only shown for the short term. It remains unclear whether something of a 'futures disposition' was reached, whereby student's awareness of futures became more persistent. Futures education literature makes the distinction between "surface and deep learning" (Lombardo, 2009, p. 88), in which the latter has a lasting impact. This kind of transformative learning possibly occurred, but was not covered in the present study.

Geography teachers: in a split

The teachers involved in this study can be considered role models for futures teaching, as they were qualified and determined to make the innovation work. Yet, getting envisioning done, remained very difficult. However, some aspects of this difficulty diminished: the innovation became less new to teachers, and their own understanding of futures education was enlarged during the study. A better preparation of the teachers ahead of the start (a point on which we also reflect in section 6.4) could have made a difference. Possibly, a profound preparation of the teachers and more time for them to practice the innovation would have led to stronger results. Currently, the fact that the lesson series is so new to teachers probably influenced the results. If teachers were to perform such lessons a second or third time, the data collected could provide a better insight into the results of the approach and its strengths and weaknesses. This assumption is supported by those teachers who participated in the present study and who kept giving the lessons about urban futures afterwards, since they report improved students' scenarios.

Some aspects of futures exploration are permanently difficult but still worth the effort: futures will always be open and complex. It is interesting to look at the difficulties that are expected to be neither easily dissolved, nor permanent: those that arose from the educational context. The teachers in this study were innovators, as well as being responsible members of a conventional, inflexible educational system. They made strong efforts to enhance futures envisioning, while at the same time feeling responsible for students conditioned to be in search of fixed, correct answers. This double role, possibly always part of transformations, at times turned into a problematic split.

The split, between innovative futures exploration and conventional teaching directed at fixed answers, is problematic in two ways. It could imply that the futures dimension is only explored in the classes of the best qualified and most determined teachers. Although this has not been extensively researched in this study, nevertheless during panel evaluations with members of the education community, the participants did indeed conclude that the extent to which futures were explored varied, depending on the initiative and capability of the teacher. Moreover, it is doubtful whether and how the educational context, which keeps teachers teaching lower-order thinking, is going to change. In this study, we saw how rhetorical statements about education acknowledge that 'the future is in the hands of youth', but at the same time, little attention is paid to envisioning. Implicitly, this situation, including the split of innovative teachers, appears to be accepted by the community of educators. Already during initial teacher education, geography teachers in training are confronted with the question how to perform in the existing system, while at the same time innovating it. This is not a simple matter, since "the futures perspective is not just an add-on, but something that interpenetrates the fabric of teaching and learning. It is a style of mind rather than another curriculum module" (Beare & Slaughter, 2011, p. 98).

6.3. Recommendations for the Geography Education Community

Based on the insights gathered from the literature and the experience gained in our research project, five issues have been identified that are considered vital for the successful implementation of futures in school geography. In this section, these five recommendations are presented and explored.

I. *Make sure students practice their relational thinking about future worlds;*

II. *Foster non-cognitive processes in futures education as a partner to intellectual reasoning;*

III. *Make open classroom dialogues about futures more common;*

IV. *Cherish small steps when working towards futures-oriented geography education;*

V. *Educate teachers for futures-oriented geography education.*

These five recommendations all relate to the conclusions and the three design principles resulting from this research, although the strength of the connection varies. While the recommendations could benefit from a more innovative educational policy, they do not depend on it, as they are viable in current educational contexts.

I. Make sure students practice their relational thinking about future worlds

During the lesson series designed for the present study, there was too little time to practice thinking about relations and systems. It takes more than just a few lessons to develop some understanding of relations and systems in current and future worlds. When challenged to think in scenarios about tomorrow's cities, students did not know where to begin. Prior knowledge about urban areas could have been a logical starting point, but students did not seem to tap into this knowledge base for tasks about futures. This initially resulted in stereotypical, overdramatic student scenarios that overlooked gradual change and context. Examples are completely sustainable or totally segregated cities. In their underpinnings of stereotypical scenarios, students showed little ability for geographical relational thinking,

which can be described as “analyzing, explaining and/or predicting the relationships that cause regional change on different scales and the interaction between them” (Karkdijk, Admiraal & Van der Schee, 2019, p. 404). Instead, students seemed to ‘defend’ their scenarios in an emotional, rather than a substantive way, with remarks such as “our scenario is not perfect but as good as it gets”. The scenarios improved when the teachers started to give students more instructions and also provided resources about trends, i.e. in the tryout of the second prototype. Guided by instructions, students reasoned about multiple functions, actors, activities, artefacts, dimensions, and spatial scales during their design of urban futures scenarios. More students seemed to grasp the idea of thinking about interconnections in future worlds, from local to global scales. But although the scenarios improved in general, the level of sophistication varied. Many scenario sketches still showed disconnected elements of future worlds such as jet packs flying students to school in future times. Since students did not embed these suggestions in spatial contexts or relate them to future challenges, the strength of these ideas was diminished.

So how can these scenario results, that vary in sophistication, best be interpreted? The scenarios can be considered semi-finished: although they show credible futures thinking, further development remains desirable. It is no surprise that students found the exploration of multiple futures difficult, because it demands the utmost of students’ intellectual capacities, especially given futures’ uncertainty. Students need geographical knowledge and skills, as well as a sound understanding of spatial relations − in other words, they need ‘geographical awareness’ (Hoekveld, 1969; Van der Vaart, 2001). Geographical knowledge, one of the key elements of futures exploration, can be divided into different types of knowledge, such as “Knowledge that enables young people to follow and participate in debates on significant local, national and global issues” and “Knowledge that gives students some power over their own knowledge” (Maude, 2016, pp. 74-75). To enhance the study, the imagining and evaluation of futures in school geography education, it should become clear which different types of knowledge are needed.

At the start of the intervention, students showed insufficient factual and abstract knowledge to think about tomorrow’s cities. The lessons were intended to stir up student’s prior general knowledge and to develop their factual knowledge about urban futures, by providing resources and factsheets. The lessons were aimed at stimulating new ways of thinking about future worlds by requiring scenario design for multiple urban futures as systems, with internal and external relations. The results of the study showed how students had indeed developed ways of looking at the world that were new to them. Students, for example, addressed futures issues by designing drone highways and extra spatial layers up in the air to generate green energy. The results also showed that students incorporated more relationships into spatial contexts. The distinction between different kinds of geographical knowledge may offer possibilities to improve subsequent designs and may lead to more profound futures-oriented geography education.

To develop students’ abstract geographical thinking about futures, it is important to make students aware of relationships and systems in future worlds. Van der Vaart (2001, p. 17) argues that “Major spatial relations – both natural and social − are still an indispensable ingredient for geographical insight in the world. This also applies to geography education”. Literature confirms students’ limited ability to think in terms of relations (Karkdijk et al., 2019) and systems (Cox, Elen, Steegen, 2019, 2020; Favier & Van der Schee, 2014). Students have difficulty seeing the broader picture, as well as the position of and relations between specific parts of a spatial system. Exam results show that relational thinking remains

difficult for Dutch geography students throughout their secondary school careers (Karkdijk, Van der Schee & Admiraal, 2013).

Students' limited relational thinking ability about futures can be illustrated with the results of a Dutch research study, that focuses specifically on futures of the Netherlands in 2040 (Adang, Notté & Van der Schee, 2010). Dutch students, aged 12 to 15, drew 700 maps of the Netherlands as it might look in 2040. They also wrote an explanation about their map and filled out a survey. These maps (see Figure 6.1 for an example) describe a future of the Netherlands with elements such as windmills, greatly expanded cities and technologically advanced infrastructure. The results also show examples of students' relational thinking beyond the descriptive elements: they expect more environmental challenges for the Netherlands. Flooding is the most prominent challenge. In their conclusion, the researchers note how students mainly *describe* elements in future landscapes, but only to a lesser extent manage to explain *why* these specific elements occur there. One prominent geographical approach that seems to require more attention in geography classes is a change of scale during the analysis of relationships. While many students, for example, drew regions on their maps, such as 'working areas' or 'areas for nature', only a few students zoom in on a smaller scale and spell out why these areas are there and what their role is in the larger system. Students who zoomed out to a supra-national scale, by looking at relations with Europe and including the global scale, were the exception. The map that was evaluated best mentioned China's economic rise as a driving factor behind the enlargement of Rotterdam harbor. More often, the researchers came across unlikely imagined situations. Students, for example, did not see why enlarging the Dutch territory might be regarded as a problem by Germany and Belgium.

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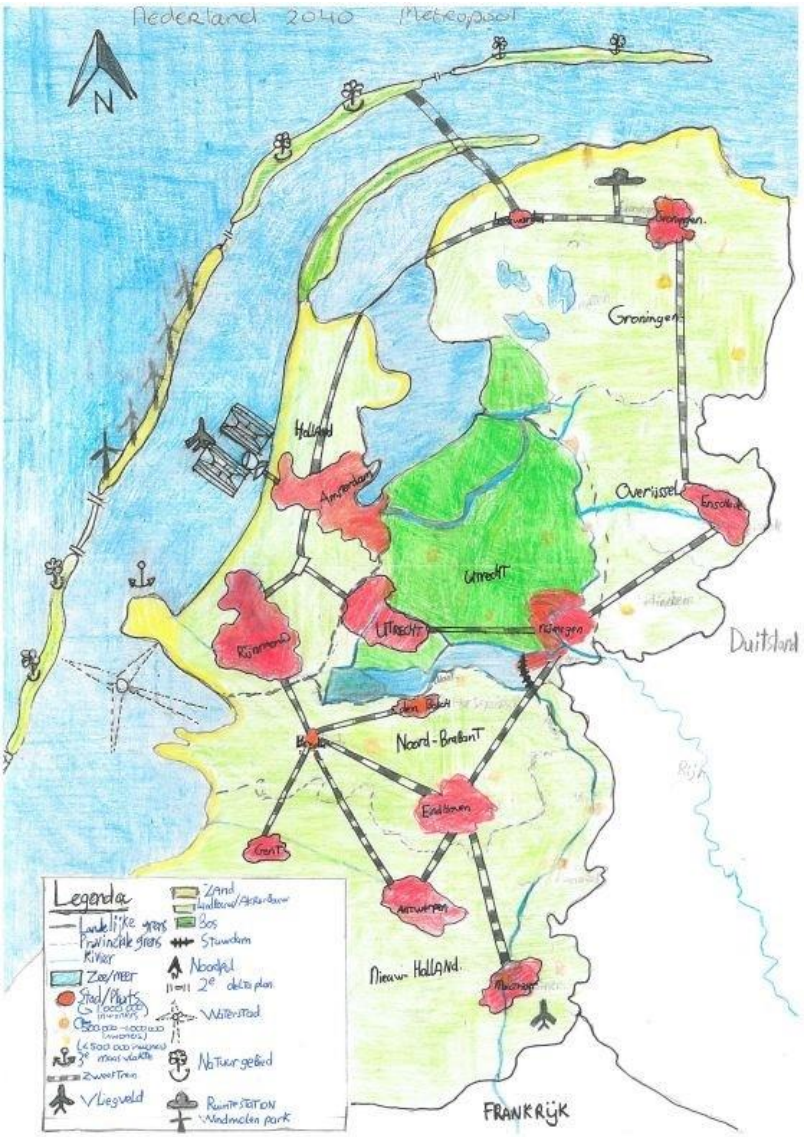

Figure 6.1. Map of the Netherlands in 2040 made by a student of the school Melanchton Schiebroek

In summary, the present study confirms previous research about students' limited inclination to engage in and ability for profound relational thinking. This challenge has been on the agenda of geography educators for decades, and the question, therefore, remains: What is needed to improve students' relational and system thinking about futures? Students apparently need more practice in relational thinking to make their intellectual and imaginative futures exploration blossom. Teachers can make the difference here if they "foster students' relational thinking in geography lessons, exercises and assignments that present complex regional problems to students and not only linear relationships" (Karkdijk et al., 2019, p. 419). More discussion about these themes in geography classes are recommended (Adang et al., 2010; Favier, 2011; Karkdijk et al., 2019). Discussions enable students to practice geographical reasoning and relational thinking, guided by an expert teacher. Self-evidently, when teaching and learning innovates, assessment should innovate accordingly, which is a recurring element in most of the recommendations.

What starting points can be used? Opportunities can be found in current textbooks, in students' semi-finished results, and in the example of the Dutch Geo Future School initiative. The analysis of Dutch textbooks in chapter 2 showed that most assignments in current textbooks do not yet encourage the practice of relational thinking (Pauw & Béneker, 2015). However, a small number of bigger assignments in these textbooks − unfortunately often found at the end of chapters and labelled as 'extra' − offer possibilities for relational thinking about futures. By means of such exercises, students can practice and develop a "systems disposition" (De Vane, Durga & Squire, 2010, p. 14), defined as "a set of attitudes to be focused on thinking in complex relationships" (Karkdijk et al., 2019, p. 419). Moreover, students' semi-finished scenarios, as shown in Figure 6.1, offer good starting points for further analysis and relational thinking.

II. Foster non-cognitive processes in futures education, as a partner to intellectual reasoning

Many students found it odd to use non-cognitive, affective, personal ideas and feelings during futures exploration. Although feelings such as hope, fear, irritation and joy were present during the lessons, it was not easy to use them in a task-related, productive manner. This might be due to the traditionally cognitive orientation that Dutch school geography has in the centrally assessed national curriculum (Bijsterbosch, 2018; Krause, Béneker, Van Tartwijk, Uhlenwinkel & Bolhuis, 2017). Students' discomfort with 'thinking with feeling' (Newton, 2014) about futures is seen more often (Kelly, P., 2006; Saunders & Jenkins, 2012). But besides being odd and uncomfortable, feelings can fuel futures thinking, as they can dig up a network of memories and associations that can stimulate divergent thinking. Divergent thinking is a first step towards creativity. When thinking is not only divergent, but also novel (surprisingly new) and purposefully embedded in the context (e.g., of tomorrows' cities), it can be considered creative (Cropley, 2001; Newton, 2014). Feelings can connect students to memories of earlier experiences that help to imagine different, new futures. Although futures do not exist, memories can help to create 'fictive experiences' through imagination. Besides the imaginative opportunities feelings offer, there are more reasons to consider affective processes during geographical futures education. Addressing feelings can assist students in moving beyond the stereotypical assumptions that were often heard in the present study, such as 'technology will solve all problems', or 'back to nature for a green future'. Students tend to focus on such simplifications to keep the real complexity of futures at bay. Although these simplifications may be due to a lack of knowledge, they may also be unconscious, "feeling-driven shortcuts" (Maiese, 2016, p. 4), in which students choose what intuitively seems right. Based on feelings, options are filtered, often unconsciously (Djamasbi, Strong & Dishaw, 2010). Moreover, students seemed to, deliberately, choose simplifications as 'safe havens' to mitigate feelings of anxiety, responsibility or vulnerability while considering uncertain futures (Saunders & Jenkins, 2012). A few students even gave nonsense answers, in order to avoid the risk of ridicule (Thompson & Perry, 2005). It seems adolescents experience a huge responsibility for making the 'right' choices for their futures, which makes them afraid of failure (Eckersley, 2011, cited in Robertson 2018, p. 19). Those feelings are understandable, since considering futures scenarios, confronts students with their roles as citizens, employees, consumers, and community members in dynamic, individualized, and globalized futures. Geography education should help students to develop some overview of the non-cognitive aspects involved in the way they relate to futures and teach them how to benefit from the interplay between cognition and emotion.

The question is: During futures exploration in geography classes, how can non-cognitive processes, such as feelings, be addressed and fostered? Fortunately, despite its current cognitive orientation, there are many possibilities for the use of affective processes in school geography. "One of the aims of geography education is that students learn to deal with changes, learn lessons from past developments and anticipate possible changes in the future" (Krause, Smit & Béneker, 2019, p. 31). What can help, is providing lessons in which students can use their experiences (Bennetts, 2005; International Geographical Union Commission on Geographical Education, 2019), values (Hoekveld, 1998; Smith, 2000), and emotions (Bosschaart, 2015) during futures exploration.

Teachers involved in futures education need to acknowledge that the stream of affect continuously influences their students' thinking process (Slovic, Finucane, Peters, & MacGregor, 2004; Picard et al., 2004). Students' feelings, ideas, and attitudes can be used to connect geographical knowledge to personal meaning (Béneker & Van der Vaart, 2008). Teachers can work with affective reactions by:

- *Evoking* affective reactions with the help of creative resources, when divergent thinking fails to appear. In the present study, for example, the Disney animation Wall-E was used to inspire thinking about dystopian futures. Another creative resource was the concept of "the incredible shrinking man" by Dutch designer Arne Hendriks, which suggests to shrink humans for the sake of sustainability.

- *Diminishing* affective reactions when these appear unproductive and overwhelming, with the help of factful resources. In the present study, for example, students expressed feelings of disempowerment towards futures (e.g., "I have no influence on the future anyway."), and strong rejections of specific futures scenarios (e.g., "bullshit!", in reaction to a peer's futures scenario). Feelings about futures were put in perspective with the help of a resource set that contained graphs, maps, and other data about the four trends: sustainability, technology development, individualization, and deregulation.

- *Managing* a positive and safe classroom atmosphere. In a classroom environment in which teachers and students trust each other, students are more inclined to take risks and express unexpected responses, which benefits creativity.

III. Make open classroom dialogues about futures more common

To develop open classroom dialogues about urban futures was easier said than done. Although all participating teachers endorsed the importance of dialogic teaching (Scott, Mortimer & Aguiar, 2006), it remained a tough task to listen to students and really take students' remarks seriously and use them during teaching. The openness of futures led to a wide range of student responses, which triggered teachers to demarcate. The participating teachers in the present study felt an urge to share their ideas and knowledges about urban futures with students, even if this would come at the expense of the dialogue. One teacher, for example, said, during the evaluation of the lesson series, that she considered it a shortcoming that teachers only presented a few examples of futuristic cities to inspire students. Although, in general, sharing such examples can be helpful, they can get in the way of students' own perspectives on futures (Newton, 2014) and make the interaction shift from dialogic to authoritative (Schuitema, Radstake, Van de Pol & Veugelers, 2017). What further complicates open dialogues about futures is that students find it complex to explicate their personal ideas and use these as a starting point for futures exploration. Having ideas is not the

same as formulating a logic or expressing a somewhat coherent imaginative world (Eisner, 1982).

The question is: How can students be assisted to take part in classroom dialogues about futures? To make sure that students' minds are not clogged with authoritative futures scenarios too soon, a teacher can begin a dialogue with a focus on students' prior knowledge and understanding. An emphasis on the progress that is already made can make futures thinking appear as the feasible, next step. From there, and with an uptake of students' input in the dialogue, the teacher can look ahead to the goals yet to be achieved, a process called "feed-forward" (Hattie & Zierer, 2017, p. 89). By making classroom dialogues, discussions and presentations more common, a climate of expression and exchange can be created. In most Dutch geography classes the focus is currently not on discussion or presentation by students (Béneker & Van der Vaart, 2010; Krause et al., 2017). But it will empower futures thinking if teachers more often initiate dialogue and discussion by, for example, posing intriguing questions, structuring discussions, stimulating student contributions by 'mild teachers' guidance' − such as simply nodding or saying things as 'yes, continue' when a student is on the right track – and organizing debriefings to summarize and evaluate. In this way, student voices can be heard in a productive manner.

A final remark about enlarging students' roles in the process and results of futures thinking, concerns the evaluation of education. Assessment should also encompass students' ideas about futures if students are expected to participate in high quality classroom dialogues. Assessment needs to innovate accordingly, by going beyond reproduction and application towards students' own analysis, evaluation and creation of futures. Divergent assessment (Bijsterbosch, 2018) enables students to demonstrate their intellectual and creative capacities.

IV. Cherish small steps towards futures-oriented geography education

The teachers in the present study were not always satisfied with the results of scenario thinking. However, it might be that, when educators evaluate semi-finished results with a focus on the progression made, some dysfunctional pressure is taken off the challenging ambition. This does not mean the stakes should be lowered; on the contrary. But scenario thinking is quite demanding. It requires relational thinking, divergent thinking, dialogue, and discussion at the same time. The challenge is to stay away from teaching fixed futures, a form of 'deliverology' (Pring, 2013, cited in Lambert and Hopkin, 2014, p. 75). Instead, teachers should scaffold small steps towards higher-order futures thinking attained by the students themselves. Moreover, the definition and evaluation of learning outcomes need to change accordingly.

The question is: How can geography educators assist students in making progress in an attainable and visible way? Distinguishing and acknowledging the importance of explicated, incremental steps can help to make clear what progress is made, and what is yet to be achieved. Most students in the present study took multiple important and difficult steps in futures exploration in just a few geography lessons. They defined personal ideas about futures and reasoned about actors, activities, artefacts, functions, dimensions, and scales, and their interrelatedness in futures as a system. They imagined creative futures (divergent, novel, and embedded) and reflected on these futures using knowledge, imagination and moral ethical reasoning. Not all students were equally successful in all steps, but almost all students, regardless of their initial performances in the pretest, made progress.

First steps, such as the expression of ideas about futures, could probably already be practiced early on in a student's school career. Children in elementary school already solve problems in creative ways, simply because they lack the knowledge to completely comprehend all situations they run into (McPartland, 1998; Newton, 2014). In many countries, basic knowledge about actors, activities, artefacts, functions, dimensions and scales is already part of the early secondary school curricula and this knowledge can be applied to support thinking in multiple futures. Ambitions, however, should be adjusted to the competencies of students at different levels and ages. The results study showed that even the participating students in the ages of 16 to 18 years found it hard to embed novel ideas in futures, as it requires sufficient knowledge, relational thinking, and imagination. Focus should, therefore, be on progress made and semi-finished products should be seen as valuable work in progress.

V. Educating teachers for futures-oriented geography education

All five teachers involved in the research said that they only felt ready for the innovation *after* having performed the lessons series. The intervention was challenging, due to its newness, contextual factors and its complexity. When focusing on the complexity of the innovation, the participating teachers encountered two main problems: the difficulty of combining their geographical knowledge with futures' uncertainty and the challenge of addressing tumultuous group dynamics. All participating teachers were equipped with the necessary profound subject knowledge base, and with enough teaching experience. At times, however, these capabilities seemed to get in the way of leaving the initiative to the students. Especially the most experienced teacher found it hard to sit 'on her hands': she felt frustrated about not being allowed to provide more assistance to students in their struggles during scenario thinking. Fortunately, the hard work was eventually rewarded: one of the students was allowed to present his scenario at the local council meeting.

The challenging and evocative intervention at times resulted in tumultuous group dynamics. Although this is not something new to teachers, it was nevertheless challenging. Since the tumult was intended, teachers could not prevent it or cut it short. The complex task that arose was to address and contain commotion at the right moment. Up to what point is a discussion functional? Moreover, within these lively classroom environments, tailored feedback and directions had to be given. But the approach did not provide a strict and linear 'recipe' for making futures exploration work. Although flexible and possibly resilient, the broadness sometimes made the approach hard to grasp at short notice, for both teachers and students. One teacher commented: "even the clearest instructions become a blur when there is too much new information".

The question is: What contribution can teacher education make to the necessary profound subject knowledge and thorough pedagogical competence in order to help teachers address these challenges? Van Boxtel (2017) distinguishes three aims when educating teachers of geography, economy, history and social science: acquiring knowledge of the core, goals, and function of the school subject; acquiring knowledge of the difficulties that students run into; and acquiring knowledge about tools and subject-specific strategies and instruments. In terms of the core knowledge, in order to use it flexibly teachers in education need to develop the ability for sophisticated relational thinking about past, current and future worlds as interrelated systems. It may be helpful for teachers to realize that the knowledge they need for futures exploration is, for the main part, not something new or extra. Notions such as people-place, society-space, local-global, man-environment and nature-culture are already part of the current geography curriculum and applicable during the exploration of future times. In terms of the difficulties students run into, teachers need to learn how to anticipate the specific

problems that can arise during combining intellectual and imaginative thinking about the future. For example, students did not use prior knowledge and felt disempowered from the start. Teachers in education should be trained to help students overcome their disempowerment by themselves, instead of taking complexity and hurdles away from students (Biesta, 2018). In terms of tools and instruments, educators at teacher training institutes should model futures-oriented education, by refraining from 'deliverology' themselves. Moreover, scaffolding with the teacher in training during internships can help new teachers to extend their abilities to teach about futures (Van Velzen, 2013). Another way to 'teach what you preach' about innovative futures education is with the help of dialogues, for example about research results. When teachers consider the results of futures-oriented geography education and critically reflect on what and how they want to teach, this can strengthen their confidence and authority (Westbroek, de Vries, Jongejan, Kaal & Pauw, 2018). Finally, teachers can benefit from reflection on their convictions and experiences and exchange of good practices in order to incorporate new practices into their own routines (Bijsterbosch, 2018). Such reflection can contribute to the dialogue about the future of geography education at large and the extent to which it needs to innovate.

6.4. Reflections and Recommendations for Further Research

This thesis started with a study of geography textbooks, educational documents, and discussions with stakeholders, followed by a design study and an intervention study. However, it is important to acknowledge the limited extent to which geographical education research can provide 'hard' evidence (Firth & Brooks, 2018), because 'what works', 'best practice', and 'effective teaching' are always contextual (Roberts, 2010). More empirical research about futures-oriented geography education will, however, make teaching and learning more 'evidence-informed' (Hargreaves, 1996; Nelson & Campbell, 2017). This study has been an attempt to contribute such evidence. Of course, within the scope of the study, decisions had to be made pertaining to, amongst other things, the research method. Such decisions were made thoroughly, but alternative approaches and further questions will always remain. Following on from the conclusions and discussion, this section therefore reflects on the limitations of (the context of) the present study. Also, related recommendations for further research are made.

Firstly, the present study is limited in terms of focus and scope. The number of consulted stakeholders could have been bigger, as well as the number of documents and textbooks studied. Moreover, the intervention, in which three design principles were tested, had a limited scope in terms of time (five lessons), the number and type of participants (142 students and three teachers in an upper secondary school), and context (urban futures). The study might have been extended with more or other futures education techniques, besides scenario thinking. Moreover, more lessons would have been welcome, since the intervention was experienced by the teachers as hasty. This hurried atmosphere could possibly also have been diminished if the teachers had had more training and more practice prior to the study. The participating teachers only attended a 2-hour session, as more time for training was not available in their schedules. An extended number of participant features could have been analyzed as potential factors influencing futures-oriented geography education. More attention could have been paid to differences among students – with, for example, higher or lower geography scores – and differences among teachers – with, for example, more or less teaching experience. In general, teacher and student participation was limited, and more participants could have extended the results. Moreover, this study focused on urban futures, but a focus on other contexts, with other issues, might lead to different results.

The present study of geography textbooks and the intervention study being situated in the Netherlands are other limitations. The intervention took place in Dutch schools and focused on a local scale, of Dutch urban futures. A more international perspective could have led to different outcomes. An international perspective might have been appropriate, given the international orientation of prevailing geography education. The present study made clear how much effort it took students to relate developments in tomorrow's Dutch cities to other spatial scales. This may imply that students also find it difficult to think about urban futures on an international scale; these difficulties were not studied or addressed within the scope of the present study. It should also be noted that the Dutch educational context, with its focus on measurable results, was not optimal for futures-oriented geography education, as described in chapter 2. Even though the geography curriculum has offered possibilities for futures thinking since 2007, the textbooks and exams focus on lower-order thinking rather than on the higher-order thinking needed for futures education.

Thirdly, the present study could have benefited from the use of additional research approaches. A school practice-oriented method was chosen: classes were observed; prototypes were tested; and student results, such as sketches and assessment answers, were analyzed. Students and teachers could have also been involved in other ways, for example by means of thinking-aloud protocols, focus groups, semi-structured interviews and panel discussions. The present study could have benefited from these techniques in order to enlarge the role of students and teachers in the research and adjust the design for futures-oriented geography to their needs.

Below, some recommendations are made to address some of these limitations and work towards a more robust and evidence-informed futures orientation in school geography.

- ***Research into the use of knowledge and imagination during futures exploration***

The present study focused on futures exploration which involved knowledge and imagination. Concerning *knowledge*, the assumption is that, in order to imagine futures, students need both concrete knowledge of a specific context and more abstract conceptual knowledge. More insight is needed into how different types of geographical knowledge (Maude, 2016) can contribute to the design of educational material for futures exploration and the teaching and learning process during futures education. "Powerful reasoning in geography is relating and combining abstract knowledge (that inspires questions asked and perspectives chosen), conceptual and systematic knowledge (mainstream geographical body of knowledge), and knowledge of very concrete cases, gained through observation or other forms of data gathering" (Béneker & Van der Vaart, 2020, p. 6). Concerning *imagination*, the assumption is that students take several steps from divergent thinking, of which some are novel, to purposeful use of novel ideas, which is called "creativity". More insight is needed into what divergent ideas students use in what ways these are considered novel, and how the transformation to creativity is made. Literature about different ways to use imagination in the educational context (Pelzer & Versteeg, 2019) can be of help. A specific point of interest in futures imagination that needs further research is the engagement of affective responses. Research into affective responses to futures thinking by adults (e.g., Rogers and Tough,1996) could also be carried out amongst adolescents.

The Dutch Geo Future School initiative could provide possibilities for researching what knowledge and imagination is provided and used, and to what experiences and results this leads. In Geo Future Schools, students analyze, imagine, and evaluate futures for real challenges in society, in cooperation with companies, governmental and, science institutions

that provide case studies with geographical questions and data (Adriaens, 2018). Input of different types of knowledge can be planned, monitored, and evaluated. Steps of imagination could be monitored and evaluated. Research steps are, for example, the analysis of the modules used in the Geo Future School on different kinds of knowledge and different kinds of imagination. Moreover, surveys, panel evaluations, and interviews provide information about the experiences of teachers and students. Teachers could evaluate the modules concerning knowledge and imagination and suggest improvements. Students participating in futures-oriented initiatives could be asked to reflect on what they used and needed during futures exploration, which could be related to different types of knowledge and imagination during or after the reflection. Finally, an analysis of the results achieved in the Geo Future School modules could contribute more insight on the extent to which the aims of futures exploration are met.

- ***Research into the complex teacher performance during futures-oriented lessons***

All five teachers involved in the present research study only felt ready for the innovation *after* having performed the lessons series. This self-image of not being ready for futures education is seen more frequently (Bateman, 2012; Pauw & Béneker, 2015). Further research monitoring the development of teachers' abilities might enlarge insight into what teachers need to increase their confidence and ability to teach geographical futures. Research about how teachers can scaffold students' learning with regard to subject matter also seems to be in its infancy (Van de Pol, Volman, & Beishuizen, 2010). Teachers could, for example, reflect on their experiences with different kinds of feedback on students' work (Hattie & Zierer, 2017) and with different ways of debriefing (Leat & Kinninment, 2000), given the key role of feedback and debriefing in explorative thinking about futures. Students could be asked to reflect on what teacher assistance they consider helpful during futures-oriented geography education.

It is important to map how teacher training institutes currently prepare student teachers for teaching about futures from the beginning of their careers. Supplementary to initial teacher training, further research could focus on training experienced in-service teachers. It could be interesting to seek cooperation with teacher educators in countries with comparable educational systems who are also attempting to develop geographical futures education and seem to meet with similar hurdles (Bateman, 2012; Gidley, Bateman & Smith, 2004; Hicks, 2012a).

- ***Research into possibilities of cooperation with academic geographers***

Contributions of academic geographers about urban futures (Hajer, 2017; Hajer & Versteeg, 2019; Hemel, 2016) have been of great value to the present study. Research that outlines possibilities of intensified cooperation with academic geographers could contribute to the ambitions of keeping futures exploration in school geography up-to-date and extending its effectiveness and meaning. As a first step, an inventory could be made of recent academic publications about the futures of global issues. Subsequently, further possibilities for cooperation, such as joint research projects or curriculum development concerning futures-oriented geography, could be investigated and discussed.

- ***Multidisciplinary research in secondary schools***

Cooperation with educators from related subjects, such as history, economy and social sciences, can focus on interdisciplinary themes, such as globalization and citizenship and the

future time perspective. With educators from the natural sciences, possibilities for interdisciplinary learning about sustainable futures can be explored. Given the importance of narratives in creative futures thinking, cooperation with language education experts can also offers various possibilities. Research could, for example, look at students' augmentative writing about futures (Couzijn, 1995; Rijlaarsdam et al., 2008) or at the specific narratives and metaphors that students construct (Kaal & Dönszelmann, 2018). Geography education literature (McPartland, 1998; Rogers, 2013) refers to the possibilities of stories, narratives, and metaphors in more imaginative geography education.

- ***Research into assessment possibilities of futures-oriented geography***

To innovate assessment in accordance with the ambition of more explorative and imaginative futures-oriented education, possibilities of divergent assessment (Bijsterbosch, 2018) should be explored, in order to allow students to demonstrate their intellectual and creative capacities concerning futures. The present study assessed capacities by means of sketches and a case study test, but more possibilities, such as essays, posters, or oral assessments, need to examined.

- ***Research into student's understanding of major global developments***

Finally, an interesting question for further research is how major global issues – such as increased climate change and the Covid-19 pandemic – influence students' ideas about futures. The awareness that the environment is more than just an inexhaustible 'décor' is growing (Hicks, 2018; Latour, 2019), including among a group of adolescents. Geography knowledge and skills provide an excellent base for teachers and students to perform a joint creative exploration of sustainable futures. Stimulating futures thinking can be considered to be "the central role of geography in the twenty-first century. Geography is the subject closest to what is just about to be, what is just about to happen" (Dorling & Lee, 2016, p. 9).

Geographers have traditionally gone beyond the frontiers of lived experiences to explore what lies ahead for future generations (Robertson, 2018). The intention is not to colonize futures, of which futurists are sometimes accused (Sardar, 1993). The aim is to diminish ignorance and to open students' eyes to alternatives and informed choices (Slaughter & Beare, 2011). With the intelligent and creative exploration of futures, students can discover new geographies, map new routes, and travel new directions towards preferable futures. This rewarding geographical quest is to be continued.

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Summary

Introduction

Geography education aims to teach students how the world works. This is an important ambition, but, given the current global issues, it can no longer be considered sufficient. In order to make sense of the fast changing world, with issues such as climate change and food security, geography education also needs to look ahead. What future times can be expected, based on current knowledge? And what alternative 'futures' can be thought of, if not only knowledge is used, but also imagination? What futures are preferred, by whom and why? And what could be first steps in the preferred direction? For the exploration of such questions, geography education offers students a suitable knowledge and skill base. Students can learn to consider future worlds, from local to global, taking into account multiple dimensions such as nature, culture, economy and politics.

The geography education literature offers concepts and innovative approaches that can support futures-oriented geography teaching and learning, but these are currently underused. In many lessons, the description and explanation of the current world leaves little room for the exploration of futures. A scientific discipline that can be of help is futures studies and its subdiscipline, futures education. In these fields, concepts and approaches are being developed that stimulate the study, imagination, and evaluation of multiple futures. The present study intends to clarify how school geography can become more futures oriented, by integrating expertise from the field of futures studies and futures education. The central research question is: How can students' envisioning of futures in school geography be enhanced? An answer to this question was developed in several phases that will be explained here.

First research phase

The first phase of the study looked at the extent to which current geography education can be considered 'futures-oriented'. First, the focus was on the state of play in Dutch geography education, and subsequently on international publications about geography education and futures education.

Different types of Dutch educational materials showed, in a quantitative analysis, that the intention of working future-oriented can be seen in the vision document (on which the curriculum is based), but that the exploration of futures is scarcely seen in the curriculum itself, the textbooks, and the examinations. Textbooks mostly display fixed futures with a pessimistic undertone. These findings were evaluated with the stakeholders − such as

geography textbook authors, teacher educators, and teachers. The results of this panel evaluation were analyzed using a qualitative approach. The conclusion was that futures-oriented geography education seems to be constrained by a national educational system that focuses too narrowly on reproduction and a rather simple application of knowledge, including in final exams. Moreover, more clarity is necessary about why futures exploration is important in school geography and how it can be practiced. Teachers need to be educated about how to explore futures with students. A ready to use, coherent, tested approach could serve as a starting point for teachers and could stimulate the teaching of futures education beyond the small community of progressive geography teachers who already teach about futures in an explorative manner.

To obtain the foundations for enhancing futures oriented geography education, international discourses about futures in education were studied, by close reading three categories of documents: international documents about '21st century skills' in education; international policy documents and position papers about geography as a school subject; and authoritative publications from the academic field of futures studies and its subdiscipline futures education. This led to the following conclusions:

- The documents about the 21st century skills depict a future world that is complex and uncertain, full of fierce competition and rapid technological change. Although it makes sense that skills such as critical and creative thinking are considered relevant in such futures, the approaches that focus on 21st century skills show two shortcomings: they take for granted a fixed future image; they give the impression that skills and content are separable, while a good combination of (often complex or specific) subject knowledge and skills is necessary to make sense of the world.
- The international policy documents and position papers about geography as a school subject share the image of a future as being full of demanding, urgent, global problems. The inclusion of geography in the school curriculum seems to be legitimized, by the problematic state of the planet. There is a substantial overlap with the 21st century skills reports, since many of these skills are readily applicable in geography lessons. The geography documents, however, place more emphasis on content and values. Knowledge about regions in perspective − in terms of human and nature, near and far − is seen as essential to prepare students for futures. Values such as diversity and equity, traditionally associated with geography education, broaden the perspective.

- Authoritative publications from the fields of futures studies and futures education show how key concepts − such as multiple futures, imagination and anticipation – offer possibilities for thinking, also geographically, about futures. From the perspective of futures education, two immediate observations can be made about both the 21st century skills frameworks and the geography policy documents. First, both these sets of documents employ a fixed, specific, undiscussed image of the future. Second, none of the documents include an explicit plea for engagement with futures in education.

  The main conclusion of the first phase of this study is that geography education pays insufficient attention to future times and can be enriched by concepts and tools from the field of futures education. The uptake of futures education concepts could enable geography education to use its subject knowledge and skill base more extensively. This links up with the recent discussion in geography education about the key role of 'powerful knowledge'. Existing innovative approaches for more open geography education can support futures exploration.

Second research phase

To provide more clarity about the design and the results of futures-oriented geography education, the second phase of this study aimed at the development and test of an approach for upper secondary education. An Educational Design Research (EDR) approach was used to develop a set of three design principles for futures-oriented geography education, as well as an intervention, in the form of a lesson series. First, three tentative design principles − *scenario thinking*, *student voice*, and *scaffolding* – were formulated, based on futures education literature and geography education literature:

- *Scenario thinking*, consistently thinking in terms of multiple scenarios for futures, is referred to in futures education literature as a suitable approach for the exploration of multiple futures. Knowledge and imagination are key elements for the exploration of multiple scenarios, such as probable, possible, and preferable scenarios. The developed scenarios serve as a starting point for conversations about what is preferable, for whom, and based on what motives;
- *Student voice* refers to the involvement of students' personal knowledge and viewpoints about futures during scenario thinking. Besides intellectual reasoning, affective processes are involved, as futures thinking brings along feelings, such as hopes and fears;

- *Scaffolding* is an educational approach that assists teachers in supporting students while at the same time respecting students' autonomy. Teachers design open tasks for scenario thinking that provide scope for students' self-guidance. During lessons, teachers help the students when appropriate.

Guided by these tentative design principles, two prototypes of lesson series about urban futures were developed and tested in two upper secondary school geography classes. During the development and tests, two balances were studied: the balance between the use of knowledge and imagination, and the balance between students' self-guidance and teachers' guidance.

The first prototype focused on the extent to which students can rely on their prior knowledge and self-guidance, during scenario thinking about urban futures. The upper secondary school students in the class in which the prototype was tested designed rather stereotypical scenarios, with simple solutions to spatial dilemmas in urban futures. Students seemed to have neglected or forgotten their prior knowledge during scenario thinking. Hence, based on the lessons learned from the first prototype, in a second prototype, the teacher's guidance was increased. More instructions were given to the students and resources were provided about four trends in urban futures: sustainability, individualization, technology development, and deregulation. This second prototype was also tested in an upper secondary school class. This time, students designed more substantive scenarios that showed more prior knowledge, knowledge about the trends, and imagination.

The exploratory design study showed that it is possible to strike a workable balance – for teachers as well as for students – between knowledge and imagination and between students' self-guidance and teachers' guidance. The tentative design principles and the final lesson series were refined somewhat. For example, the input of trends was done earlier in the lesson series, to provide a substantial impulse to students' scenario thinking.

In a subsequent intervention study, the abilities of students to envision scenarios of urban futures were examined. The intervention took place in three schools, in five classes with 142 participating upper secondary school students. The intervention concerned a series of five geography lessons, with learning tasks in which students first studied creative visions about futures as well as trends, and subsequently developed scenarios for urban futures. Before and after the lesson series, students took the same test: a case study assessment regarding an topical, authentic spatial design question in the Dutch city of Almere. The test required students to: 1) apply knowledge and skills; 2) use both knowledge and imagination for

scenario design; and 3) critically evaluate scenarios. The results showed that students' abilities to critically and creatively envision futures improved significantly between pretest and posttest. Students easily picked up the four introduced trends and most students were able to reason about trends and the different ways in which urban futures could be affected by them. Moreover, students became better at generating imaginative scenarios, but often their innovative scenarios lacked purposeful embeddedness in a spatial context. The intervention also showed that both teachers and students had difficulties with moving away from familiar ways of teaching and learning. Using knowledge and imagination to think beyond current understandings turned out not to be easy.

In order to learn more about students' scenario thinking, scenario drawings that students made halfway into the lesson series were analyzed, using a qualitative approach. The combinations of prior geographical knowledge and skills, knowledge of trends, and imagination were analyzed. We saw how students managed to design scenarios but then found it difficult to embed these in the spatial structures of tomorrow's cities. Students did not relate their scenarios to urban spatial issues: it often remained unclear for what problem in tomorrow's cities their scenarios provided a solution. However, there were also some students who did embed their ideas in a broader context. For example, in one scenario, students proposed a huge central park in the city in the future − which can appear as an attractive idea in itself – and this proposal became stronger when students related a central park to the importance of social cohesion in future urban areas. The lesson series resulted in first steps for envisioning futures in school geography. Probably, the scenarios could be developed further, if students could learn how to make better use of their geographical knowledge and imagination during futures exploration.

Conclusions and recommendations

This study showed how students in geography lessons − under specific conditions, in a well-considered approach − were able to think about multiple futures. In terms of content, the approach (developed in the explorative design study) was characterized by the use of both knowledge and imagination while thinking about multiple alternatives for tomorrow's cities. In terms of the teaching and learning method, the approach was characterized by the balanced integration of students' self-guidance and teacher's guidance. Although students were able to develop scenarios, the open kind of teaching and learning required for futures exploration was difficult for both students and teachers. Futures-oriented geography education requires

clear, feasible steps towards more open and explorative learning about futures, and this study aims to give examples of such steps.

The difficulties that were met during futures-oriented education in this study were consistent with previous research. Higher-order thinking is, even apart from taking futures into account, difficult for students. The extent to which students showed futures awareness seemed to be a matter of both their *ability* − more cognitively connoted, by having the necessary knowledge, skills and imagination – and *willingness* − more affectively connoted, by making the effort to share their thoughts about futures. It is important to note that futures thinking about geographical issues will remain challenging, even with ability and willingness. The Covid-19 pandemic illustrates how complex it is to find appropriate responses to such a complex, uncertain global issue. Besides confirming the difficulty of futures exploration in school geography, the present study provides an analysis of these difficulties and an approach, consisting of design principles and a lesson series that aims to stimulate others to practice and develop futures-oriented school geography.

The first experiences with the approach also led to some recommendations that could assist geography educators and students during the envisioning of futures. These are summarized here. First and foremost, there needs to be time to *practice* the envisioning of futures in geography education. After all, it takes more than just a few lessons to develop some understanding of relations and systems in current and future worlds. Moreover, *affective processes need to be fostered* during futures explorations, since scenario thinking encompasses both intellectual reasoning and feeling. If *classroom dialogues* about futures were to become more common, students could, during these conversations, practice intellectual reasoning and the use of feelings in futures thinking. The next recommendation concerns the *appreciation of small steps* of progress, and provide tailored feedback to semi-finished scenarios, as this can elevate students' higher order thinking about futures. Finally, the *education of geography teachers* concerning futures-oriented teaching needs to be improved, in cooperation with teacher training institutes.

Concerning further research, more empirical study about futures-oriented geography education is needed, as the present study is limited in terms of its focus, urban futures, and scope, with limited teacher and student participation and situated in the Netherlands. Moreover, the use of different research approaches and different ways of student and teacher participation could have extended the results. Suggestions for follow-up studies will be briefly mentioned here. Students' thinking about futures requires more attention, and could

focus, for example, on *students' understanding of major global developments*. To what extent did, for example, increased climate change and the recent COVID-19 pandemic change students' ideas about futures? And what can be said about the *different types of knowledge and imagination* that students use during futures exploration? Additionally, research into *the complex teacher performance* during futures-oriented lessons is necessary. Research into possibilities of *cooperation with academic geographers* could be valuable, in order to make futures education more up-to-date and effective. *Multidisciplinary research in secondary schools* concerning futures-oriented education could also offer possibilities: for example, cooperation with language education experts, in order to analyze the narratives that students construct during scenario thinking. Finally, research into the *assessment possibilities* of futures-oriented geography is necessary, in order to innovate assessment towards more divergent assessment.

Geographers have traditionally gone beyond the frontiers of lived experiences, to explore what lies ahead for future generations. The intention of futures-oriented geography education is to diminish ignorance and to open students' eyes to alternatives. With the intelligent and creative exploration of futures, students can discover new geographies, map new routes, and travel new directions towards preferable futures. This rewarding geographical quest is to be continued.

Samenvatting

Inleiding

Aardrijkskundeonderwijs wil leerlingen leren hoe de wereld in elkaar zit. Dit is een belangrijke ambitie, maar niet langer toereikend, gezien de huidige mondiale problemen. Om inzicht te krijgen in de snel veranderende wereld, met vraagstukken zoals klimaatverandering en voedselveiligheid, moet aardrijkskundeonderwijs ook vooruit kijken. Welke toekomst kunnen we met de kennis van nu verwachten? En welke alternatieve 'toekomsten' zijn er denkbaar, als niet alleen kennis maar ook voorstellingsvermogen gebruikt wordt? Welke toekomsten worden wenselijk geacht, door wie en waarom? En wat kunnen eerste stappen in de wenselijke richting zijn? Voor de verkenning van zulke vragen biedt aardrijkskundeonderwijs leerlingen een geschikte basis van kennis en vaardigheden. Leerlingen kunnen leren om na te denken over de wereld van morgen, van lokale tot mondiale schaal en rekening houdend met meerdere dimensies zoals natuur, cultuur, economie en politiek.

Vanuit de literatuur over aardrijkskundeonderwijs zijn concepten en innovatieve onderwijsbenaderingen beschikbaar, die toekomstgericht aardrijkskundeonderwijs kunnen helpen vormgeven, maar deze worden te beperkt benut. In veel lessen laat het beschrijven en verklaren van de bestaande wereld maar weinig ruimte voor het verkennen van toekomsten. Een wetenschappelijke discipline die hierbij een verschil kan maken is *futures studies,* met als specifiek relevante deeldiscipline *futures education.* Binnen deze disciplines zijn concepten en benaderingen ontwikkeld, die de studie, verbeelding en evaluatie van verschillende toekomsten stimuleren. Dit proefschrift beoogt te verduidelijken hoe de toekomstgerichtheid van aardrijkskunde kan worden verbeterd, met behulp van de inzichten uit *futures studies* en *futures education*. De centrale onderzoeksvraag is: hoe kan de studie, verbeelding en evaluatie van toekomsten door leerlingen in het aardrijkskundeonderwijs worden verbeterd? Deze vraag is onderzocht in verschillende fasen, die hierna worden toegelicht.

Eerste onderzoeksfase

In de eerste fase van het onderzoek is onderzocht in hoeverre het huidige aardrijkskundeonderwijs 'toekomstgericht' te noemen is. Hierbij lag de nadruk allereerst op de stand van zaken in het Nederlandse aardrijkskundeonderwijs en vervolgens op internationale publicaties over geografieonderwijs en toekomstgericht onderwijs.

Uit een kwantitatieve analyse van curriculumdocumenten, lesmethoden en examenopdrachten uit het Nederlandse aardrijkskundeonderwijs, bleek dat de intentie om toekomstgericht te werken wel terug te vinden is in het visiedocument (waarop het curriculum is gebaseerd) maar nauwelijks in de syllabus, de lesmethoden en de examens. Lesmethoden tonen veelal vastliggende toekomstbeelden met een pessimistische ondertoon. Deze bevindingen werden geëvalueerd met leden van de aardrijkskunde-vakgemeenschap, zoals auteurs van aardrijkskundeboeken, lerarenopleiders en leraren. De resultaten van deze panelevaluatie werden met behulp van een kwalitatieve benadering geanalyseerd. De conclusie was dat toekomstgericht aardrijkskundeonderwijs lijkt te worden belemmerd door een nationaal onderwijssysteem dat te nauwgezet focust op reproductie en tamelijk eenvoudige toepassing van kennis, ook in het eindexamen. Bovendien is er meer duidelijkheid nodig over waarom toekomstverkenning belangrijk is bij aardrijkskunde en hoe het vorm kan krijgen. Docenten moeten opgeleid worden voor toekomstverkenning met leerlingen. Een bruikbare, samenhangende, aan de onderwijspraktijk getoetste aanpak zou als uitgangspunt kunnen dienen voor leraren en zou ertoe kunnen bijdragen dat toekomstgericht onderwijs een breder bereik krijgt, dan alleen de kleine gemeenschap van progressieve aardrijkskundedocenten die al op een exploratieve manier lesgeeft over de toekomst.

Om bouwstenen voor toekomstgericht aardrijkskundeonderwijs te inventariseren, werden internationale benaderingen van de toekomst in het onderwijs bestudeerd. Drie categorieën documenten werden geanalyseerd: internationale documenten over *21st century skills* in het onderwijs; internationale beleidsdocumenten en *position papers* over aardrijkskunde als schoolvak; gezaghebbende publicaties uit het academische vakgebied *futures studies* en hierbinnen de specifieke deeldiscipline *futures education*. Dit leidde tot de volgende conclusies:

- De documenten over *21st century skills* schetsen een toekomstige wereld die complex en onzeker is, vol felle concurrentie en snelle technologische veranderingen. Hoewel het logisch is dat vaardigheden zoals kritisch en creatief denken binnen een dergelijke toekomst als relevant worden gezien, vertonen de benaderingen die op *21st century skills* gericht zijn, twee tekortkomingen: ze gaan uit van een vastliggend toekomstbeeld en ze wekken de indruk dat vaardigheden en inhoud los van elkaar te zien zijn, terwijl een goede combinatie van (vaak complexe of specifieke) vakkennis en vaardigheden nodig is om de wereld beter te begrijpen.

- De beleidsdocumenten en *position papers* uit de internationale aardrijkskundegemeenschap gaan uit van een vergelijkbaar toekomstbeeld: een wereld vol veeleisende, urgente, mondiale problemen. De opname van aardrijkskunde in het schoolcurriculum lijkt te worden gelegitimeerd door de problematische toestand van de planeet. Er is een aanzienlijke overlap met de documenten rond de 21st *century skills*, aangezien veel van deze vaardigheden goed toepasbaar zijn in aardrijkskundelessen. De aardrijkskundedocumenten leggen echter meer nadruk op inhoud en waarden. Zo wordt kennis over regio's in perspectief (mens en natuur, dichtbij en veraf) gezien als essentieel om leerlingen voor te bereiden op de toekomst, terwijl waarden als diversiteit en gelijkheid (traditioneel met aardrijkskundeonderwijs geassocieerd) het perspectief verbreden.
- Gezaghebbende publicaties uit de vakgebieden *futures studies* en *futures education* laten zien hoe sleutelbegrippen − zoals verschillende toekomsten, verbeelding en anticipatie − mogelijkheden bieden voor het denken, ook geografisch, over toekomsten. Vanuit het perspectief van *futures education* vallen twee eerste waarnemingen op, ten aanzien van zowel de *21st century skills* benaderingen als de aardrijkskundedocumenten. Beide soorten documenten lijken de toekomst te zien als vaststaand. Bovendien houdt geen van de documenten een expliciet pleidooi voor toekomstgericht onderwijs in de zin van het daadwerkelijk open verkennen van verschillende toekomsten.

De belangrijkste conclusie van de eerste fase van dit onderzoek is dat het aardrijkskundeonderwijs onvoldoende aandacht besteedt aan de toekomst en verrijkt kan worden met concepten en instrumenten uit het domein van *futures education*. Het gebruik van *futures education* begrippen zou het aardrijkskundeonderwijs in staat kunnen stellen om de eigen basis van kennis en vaardigheden beter te benutten. Dit inzicht sluit aan bij de recente discussie in het aardrijkskundeonderwijs over de belangrijke rol van '*powerful knowledge'*. Bestaande innovatieve benaderingen voor meer open aardrijkskundeonderwijs kunnen de verkenning van verschillende toekomsten ondersteunen.

Tweede onderzoeksfase

Om meer duidelijkheid te kunnen bieden over het ontwerp en de resultaten van toekomstgericht aardrijkskundeonderwijs, was de tweede fase van het onderzoek gericht op de ontwikkeling en het uittesten van een aanpak voor de bovenbouw van het voortgezet onderwijs. Een *Educational Design Research* (EDR) benadering werd gebruikt om een set

van drie ontwerpprincipes voor toekomstgericht aardrijkskundeonderwijs te ontwikkelen, evenals een interventie, in de vorm van een lessenserie. Als eerste stap werden drie voorlopige ontwerpprincipes geformuleerd − *scenario thinking, student voice* en *scaffolding* – gebaseerd op literatuur over toekomstgericht onderwijs en aardrijkskundeonderwijs:

- *Scenario thinking*, het consequent denken in termen van verschillende toekomstscenario's, wordt in de *futures education* literatuur genoemd als een geschikte benadering voor de verkenning van verschillende toekomsten. Kennis en verbeelding zijn sleutelelementen voor de verkenning van verschillende scenario's, zoals waarschijnlijke, mogelijke en wenselijk scenario's. De ontwikkelde scenario's dienen als de basis voor gesprekken over wat wenselijk is, voor wie en vanuit welke motieven.
- *Student voice* verwijst naar het betrekken van de persoonlijke kennis en standpunten van leerlingen over toekomsten, tijdens scenariodenken. Naast intellectueel redeneren zijn affectieve processen betrokken, aangezien denken over toekomsten gevoelens met zich meebrengt, zoals hoop en vrees.
- *Scaffolding* is een didactische aanpak die docenten helpt om leerlingen te ondersteunen en tegelijk beoogt leerlingen veel autonomie te laten behouden. Docenten ontwerpen open taken voor scenariodenken die ruimte bieden voor zelfsturing door de leerlingen. Tijdens de les helpen docenten de leerlingen wanneer nodig.

Op basis van deze voorlopige ontwerpprincipes werden twee prototypes van lessenseries over 'de stad van de toekomst' ontwikkeld en uitgeprobeerd in twee bovenbouwklassen in het voortgezet onderwijs. Tijdens het ontwikkelen en testen werden twee evenwichten onderzocht: het evenwicht tussen het gebruik van kennis en verbeelding en het evenwicht tussen de zelfsturing van leerlingen en de sturing door de docenten.
Het eerste prototype richtte zich op de mate waarin leerlingen kunnen vertrouwen op hun (voor)kennis en zelfsturing tijdens scenariodenken over de stad van de toekomst. De VWO-5 leerlingen in de klas waar het prototype werd getest, ontwierpen nogal stereotype scenario's, met eenvoudige oplossingen voor ruimtelijke dilemma's in 'de stad van de toekomst'. Leerlingen leken hun voorkennis te hebben verwaarloosd of te zijn vergeten tijdens het scenariodenken. Op basis van de ervaringen met het eerste prototype, werd in het tweede prototype de input van de docent vergroot. De docent gaf meer instructies en leverde bronnen aan, over vier trends in stedelijke toekomsten: 'verduurzaming', 'individualisering', 'technologisering' en 'een veranderende rol van de overheid'. Ook dit prototype werd getest

in een VWO-5 klas. Ditmaal ontwierpen leerlingen inhoudelijkere scenario's, die meer voorkennis, kennis over de trends en voorstellingsvermogen toonden.
Deze verkennende ontwerpstudie liet zien dat het mogelijk is om een werkbaar evenwicht te vinden – voor zowel docenten als leerlingen − tussen kennis en verbeelding en tussen de zelfsturing van leerlingen en de sturing door docenten. De voorlopige ontwerpprincipes en de uiteindelijke lessenserie werden vervolgens enigszins bijgeschaafd. Zo werd bijvoorbeeld de input over trends eerder in de lessenserie aangeboden, om het scenariodenken van de leerlingen een inhoudelijke stimulans te geven.
Op de ontwerpstudie volgde een interventiestudie, waarin onderzocht werd in welke mate leerlingen in staat waren om zich scenario's van stedelijke toekomsten voor te stellen. De interventie werd uitgevoerd op drie scholen, in vijf klassen met 142 deelnemende VWO-5 leerlingen. Het betrof een serie van vijf aardrijskundelessen, met leertaken waarin leerlingen eerst creatieve toekomst-ideeën en trends bestudeerden en daarna scenario's ontwikkelden, voor de 'stad van de toekomst'. Voor en na de lessenserie maakten de leerlingen dezelfde *casestudy*-toets over een actueel, daadwerkelijk bestaand ruimtelijk ontwerpvraagstuk in de stad Almere. In de toets werd leerlingen gevraagd om: 1) kennis en vaardigheden toe te passen; 2) zowel kennis als verbeelding te gebruiken voor scenario-ontwerp; en 3) scenario's kritisch te evalueren. De resultaten van deze toets lieten zien dat het vermogen van deze leerlingen om kritisch en creatief toekomstbeelden te schetsen, significant verbeterde tussen de pretest en de posttest. Leerlingen pikten de vier geïntroduceerde trends gemakkelijk op. De meeste leerlingen waren in staat tot redeneren over de trends en over de verschillende manieren waarop deze in 'de stad van de toekomst' invloed kunnen hebben. Bovendien werden de leerlingen beter in het ontwerpen van innovatieve scenario's. Vaak misten hun innovatieve scenario's echter een doelgerichte inbedding in een ruimtelijke context. De interventie liet ook zien dat zowel docenten als leerlingen moeite hadden met het loskomen van bekende manieren van lesgeven en leren. Kennis en voorstellingsvermogen gebruiken om voorbij bestaande denkbeelden te komen, bleek niet eenvoudig.

Om meer te leren over scenariodenken door leerlingen, werden scenariotekeningen onderzocht, die leerlingen halverwege de lessenserie hadden gemaakt. In een kwalitatieve analyse werd gekeken naar de combinaties van geografische voorkennis en vaardigheden, kennis van trends en voorstellingsvermogen. We zagen hoe leerlingen erin slaagden scenario's te ontwerpen, maar vervolgens moeite hadden om deze in te passen in ruimtelijke structuren van toekomstige steden. Leerlingen relateerden hun scenario's niet aan stedelijke,

ruimtelijke vraagstukken: het bleef vaak onduidelijk voor welk probleem in de ‘stad van de toekomst’ hun scenario's een oplossing boden. Maar er waren ook enkele leerlingen die hun ideeën wel in een bredere context plaatsten. Zo werd het voorstel om een groot, centraal park aan te leggen in de stad van de toekomst − wat op zich al een aantrekkelijk idee kan zijn – sterker, toen de leerlingen het centrale park in verband brachten met het belang van sociale cohesie in toekomstige stedelijke gebieden. De lessenserie leverde eerste stappen op van toekomstgericht denken bij aardrijkskunde. Waarschijnlijk is verdere ontwikkeling van de scenario's mogelijk, als leerlingen leren hoe ze hun geografische kennis en voorstellingsvermogen beter kunnen gebruiken bij toekomstverkenningen.

Conclusies en aanbevelingen

Deze studie toont aan hoe leerlingen in aardrijkskundelessen − onder specifieke voorwaarden, in een weloverwogen aanpak − in staat zijn geweest om na te denken over verschillende toekomsten. Inhoudelijk werd de aanpak (ontwikkeld in het verkennend ontwerponderzoek), gekenmerkt door het gebruik van zowel kennis als voorstellingsvermogen, bij het denken over verschillende alternatieven voor ‘de stad van de toekomst’. Qua methode van doceren en leren werd de aanpak gekenmerkt door een gebalanceerde integratie van zelfsturing door leerlingen en docentsturing. Hoewel de leerlingen tot scenariodenken in staat waren, bleek de open manier van doceren en leren die vereist is voor toekomstverkenningen, moeilijk voor zowel docenten als leerlingen. Toekomstgericht aardrijkskundeonderwijs vraagt om heldere, haalbare stappen richting meer open en onderzoekend leren over toekomsten en deze studie beoogt voorbeelden te bieden van dergelijke stappen.

De hindernissen die zich voordeden tijdens toekomstgericht onderwijs in deze studie, waren in lijn met eerder verricht onderzoek. Hogere orde denken is, zelfs los van toekomstgerichtheid, moeilijk voor leerlingen. De mate waarin leerlingen toonden dat ze zich bewust waren van het belang van toekomstgericht denken, leek afhankelijk van zowel hun capaciteiten – meer cognitief, door het beschikken over de benodigde kennis, vaardigheden en voorstellingsvermogen − als hun bereidheid – meer affectief, door het zich inspannen om gedachten over toekomsten te delen. Belangrijk om te benadrukken hierbij, is dat toekomstgericht denken over geografische vraagstukken uitdagend zal blijven, zelfs met bekwaamheid en bereidheid. De Covid-19 pandemie illustreert hoe ingewikkeld het is, om adequaat te reageren op zo’n complex, met onzekerheden omgeven, mondiaal vraagstuk. Dit

proefschrift bevestigt niet alleen de moeilijkheden van toekomstverkenningen in het aardrijkskundeonderwijs, maar biedt ook een analyse van deze hindernissen en een aanpak, bestaande uit ontwerpprincipes en een lessenserie, die beoogt anderen te stimuleren om toekomstgericht aardrijkskundeonderwijs uit te voeren en te ontwikkelen.
De eerste ervaringen met de aanpak leverden ook enkele aanbevelingen op, die onderwijsgeografen en leerlingen kunnen helpen bij toekomstgericht aardrijkskundeonderwijs. Deze worden hier kort benoemd. In de eerste plaats is er tijd nodig om toekomstverkenningen in het aardrijkskundeonderwijs te *leren gebruiken*. Het vraagt immers meer dan een paar lessen, om enig begrip te ontwikkelen van relaties en systemen in huidige en toekomstige werelden. Daarnaast is *aandacht voor affectieve processen* nodig tijdens toekomstverkenningen, want scenariodenken omvat zowel intellectueel redeneren als het omgaan met gevoelens. Wanneer *dialogen* over toekomsten in de klas vaker gevoerd worden, kunnen deze bijdragen aan zowel het oefenen van intellectueel redeneren, als het benutten van affectieve reacties ten aanzien van toekomsten. De volgende aanbeveling betreft het waarderen van *kleine stappen*. Gerichte feedback op tussenproducten, zoals scenario's met onvoldoende diepgang, kan het hogere orde denken van leerlingen naar een volgend niveau tillen. Tenslotte moet de *opleiding en nascholing van docenten* ten aanzien van toekomstgericht lesgeven verbeterd worden, in samenwerking met lerarenopleidingen.
Vooruitkijkend naar vervolgonderzoek kan worden vastgesteld dat meer empirisch onderzoek naar toekomstgericht aardrijkskundeonderwijs nodig is. De huidige studie is beperkt in termen van de focus − stedelijke toekomsten − en reikwijdte − met een beperkte deelname van docenten en leerlingen, allen in de Nederlandse context. Bovendien had het gebruik van andere onderzoeksbenaderingen en andere manieren van leerlingen- en docentenparticipatie de resultaten kunnen uitbreiden. Hier wordt kort een aantal suggesties voor vervolgonderzoek benoemd. Het denken van leerlingen over de toekomst verdient meer aandacht en kan zich bijvoorbeeld richten op *het begrip van leerlingen ten aanzien van grote mondiale ontwikkelingen*. In welke mate heeft, bijvoorbeeld, toegenomen klimaatverandering en de recente COVID-19 pandemie de toekomstbeelden van leerlingen veranderd? En valt er iets te zeggen over het gebruik van *verschillende typen kennis en voorstellingsvermogen* door leerlingen, tijdens toekomstverkenningen? Ook is onderzoek nodig naar de *complexe activiteiten van docenten tijdens toekomstgerichte lessen*. Hiernaast kan onderzoek naar de mogelijkheden tot *samenwerking met academische geografen* waardevol zijn, om toekomstgericht onderwijs meer eigentijds en effectief te maken. *Multidisciplinair onderzoek op middelbare scholen* naar toekomstgericht onderwijs kan ook mogelijkheden bieden,

bijvoorbeeld de samenwerking met experts op het gebied van taalonderwijs, om verhalen te analyseren die leerlingen construeren tijdens scenariodenken. Tenslotte is onderzoek nodig naar de *mogelijkheden voor assessment* van toekomstgericht aardrijkskundeonderwijs, zodat de toetsing innoveert in de richting van divergent toetsen.

Geografen gaan van oudsher over grenzen van het bekende heen, om te onderzoeken wat er voor toekomstige generaties in het verschiet kan liggen. Het doel van toekomstgericht aardrijkskundeonderwijs is om onwetendheid te verkleinen en de ogen van leerlingen te openen voor alternatieve perspectieven. Door middel van slimme en creatieve toekomstverkenningen, kunnen leerlingen nieuwe werelden ontdekken, nieuwe routes uitstippelen en nieuwe richtingen inslaan, koersend op wenselijke toekomsten. Deze waardevolle geografische zoektocht wordt vervolgd.

Dankwoord

Onderzoek doen en een proefschrift schrijven: voor mij was het een ware ontdekkingsreis. Gelukkig maakte ik de reis niet alleen en nu het proefschrift is afgerond, is het tijd voor een dankwoord.

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Waardevol is voor mij het onderwijs dat ik geef, met behulp van hetgeen ik leerde in dit onderzoekstraject. Het proefschrift is nu klaar, onderzoek en onderwijs zijn dat nooit. Wordt vervolgd, laat de les beginnen.

Appendix 1: Lesson plans Prototype 1

Lesson 1 – Prototype 1

Objectives. Students can:
- Formulate how Amsterdam's futures could bring improvement or deterioration;
- Explain the importance of futures thinking in geography lessons;
- Build and underpin an outline of a possible future city in which several artifacts, actors, and activities are expressed.

Description in phases

Phase 1: Introduction (10 min.)
Students individually write down answers to brainstorm questions about futures:
1) Suppose you meet someone who can predict futures, what would you ask?
2) If futures look bright, what improvement do you hope for, for Amsterdam in 2025?
3) If futures look bad, what deterioration do you fear for Amsterdam in 2025?
The answers are briefly discussed, to stir up reasoning about futures.

Phase 2: Information (15 min.)
The teacher explains the aim of the lesson series: the design of multiple scenarios of urban futures. The necessity of scenario thinking, in general and more specifically within the Dutch geography curriculum, is highlighted. Preferably, the necessity is formulated by students themselves, guided by the teacher. Questions to guide the conversation can be:
- What uncertainties, risks, possibilities and chances do you see for futures?
- What role does futures thinking play in your geography exams?
- Have you heard of new solutions to the global issues of futures? If so, what are they?

The teacher makes sure both geographical knowledge and imagination are acknowledged as a means to achieve scenario thinking. The role of disciplinary and personal knowledge is also acknowledged.
Prior geographical knowledge is activated and arranged, using 4 questions: 1)What do you see in the city? Name artifacts; 2)Who makes' the city? Write down actors; 3)What is done in a city? Write down activities; 4)What *kind of* artifacts, actors and activities do you see in the city? Economic, political, cultural and/or natural?
Imagination is activated by means of two short videos about an example of what is considered to be a smart city, Masdar City (UAE), and an example of what is considered to be a creative city, Almere (The Netherlands).

Phase 3: Main task (20 min.)
The teacher provides several types of candy to small groups of students to build an outline of what is called a 'Sweet City'. Students built an outline of a future city. They discuss actors, activities and (economic, political, cultural and natural) developments, make choices that are visible in their outline, and formulate underpinnings.

Phase 4: Presenting and discussing the outlines (10 min.)
Students pitch and underpin their outline in 3 minutes. The outlines are compared in a discussion, led by the teacher, with the help of questions such as: What similarities and differences do the outlines show? What are the advantages and disadvantages of the different outlines? What dilemmas were met during the process of outlining and how can these be dealt with?

Phase 5: Reflection (5 min.): Students write down their learning outcomes of the lessons.

Lesson 2 – Prototype 1

Objectives. Students can:

- Describe in their own words the developments of sustainable development and economic development;
- Describe future scenarios for Amsterdam on the basis of a framework that combines the two developments of, respectively, sustainable development and economic development.

Phase 1: Introduction (10 min.)
Students describe what they remember from last lesson. The teacher makes sure the relevance of scenario thinking is put forward (in general and, more specifically, in the geography curriculum). The information about the concepts of the smart and the creative city is extended, by sharing critical voices of geographers concerning the concepts. This models 1) critical thinking; and 2) that 'reasonable people can reasonably disagree'. The teachers ends the orientation with as short conclusion of the lessons so far.

Phase 2: Information (10 min.)
The teacher introduces working with developments and trends and explains two developments: 'sustainable development' and 'economic development'. The teacher explains that a combination of these two developments in futures can be studied by combining them in a framework of an x and a y axis, with one development on the X axis and the other on the Y axis. An example of such a framework from a KNAG-presentation is used (see the website www.geografie.nl/atlas-van-de-toekomst. Be aware: in the KNAG-example of the framework, sustainable development is specified as 'climate change'). Students are instructed to design scenarios. The teacher suggests they present the scenarios in a sketch map, a mind map, or a short video. The teacher shows examples of a sketch map (Hicks, 2012b) and of a short video.

Phase 3: Main task (25 min.)
Student discuss how the two developments can influence Amsterdam in 2050. After the open conversation about what is possible in futures, students focus on 'sustainable development' and 'economic development' and think about scenarios. The teacher suggests: one probable and one preferable scenario. The teacher suggests developing a sketch map, a mind map or a short video for the presentation of the two scenarios of Amsterdam in 2050, influenced by the two developments. The teacher aims to provide clarity and also scope for other options, and that is why instructions are given in terms of 'suggestions'.

Phase 4: Presenting and discussing the scenarios (10 min.)
Students present their scenarios. The teacher focuses on consistency and underpinning. Questions can be: What developments influence the future city in this scenario, and in what way? What is probable and why? What (other, stronger, less strong development) is possible? What is preferable, for whom (actors, activities)? What similarities and differences do the scenarios show? What are the advantages and disadvantages? What dilemmas were met during the process of scenario thinking and how can these be dealt with?

Phase 5: Reflection (5 min.)
Students write down their learning outcomes of the lessons. Students get a homework assignment: write a short story (100-200 words) about their personal life in a preferred future in 2025 (which deliberately is a shorter, less abstract, time span than during the scenario thinking task).

Lesson 3 – Prototype 1

Objectives. Students can:
- Describe an image of their personal life in 2025;
- Describe the trends of 'individualization' and 'governmental deregulation';
- Describe future scenarios for Amsterdam in 2050 on the basis of a framework of two developments and trends, chosen out of four possibilities: 'sustainable development', 'economic development', 'individualization' and 'governmental deregulation';
- Develop and underpin a video that presents a preferable future for Amsterdam in 2050.

Phase 1: Introduction (10 min.)

Students read out (their homework) stories about their personal lives in 2025 (in groups, or a few examples are read for the entire class). The teacher makes sure all students hear multiple stories.

Phase 2: Information (5 min.)

The teacher highlighted elements in these stories that could refer to the four developments and trends: sustainable development, economic development, individualization, and governmental deregulation. The teacher distinguishes between the developments already used in prior lessons and the two new trends.

Phase 3: Main task (25 min.)

Students develop storylines that express preferred scenarios, based on a framework of their two chosen developments or trends out of four: 'sustainable development', 'economic development', 'individualization', and 'governmental deregulation'.
The teacher presents a line-up of five drawn scenes and a voice over, about a fictive adolescent 'Sam in Amsterdam' in 2050. The teacher provides the icons used in this example to students and stimulates them to draw new ones.
- Students discuss four developments and trends and choose two;
- Students combine the developments and trends and develop futures scenarios. Elements that suit their preferred futures become part of the story line;
- Students draw their stories and make a 'voice over';
- Students film the stories, including images and the voice over.

Phase 4: Presenting and discussing the scenarios (10 min.)
Students present their scenarios. The teacher focuses on consistency and underpinning. Questions can be: What developments and trends are chosen and why? How do these developments and trends influence the city in this scenario? What is preferable, for whom (actors, activities)? What similarities and differences do the scenarios show? What are the advantages and disadvantages? What dilemmas are met during the process of scenario thinking and how can these be dealt with?

Phase 5: Reflection (10 min.)
Two activities:
- a written evaluation survey of the three lessons;
- a short, concluding conversation to summarize the aims and results of the series together. The verbal expressions of the students, in the words they actually spoke during the lessons, are used in this concluding conversation.

Appendix 2: Lesson plans Prototype 2

Lesson 1: Introducing futures thinking and becoming engaged – Prototype 2
Objectives. Students can: - describe their personal images of futures; - explain how ideas about futures are related to different contexts (in different times, at different places and of different persons); - list three building blocks for futures thinking: knowledge, imagination and values.
Description in phases
Phase 1: Introduction (10 min.) - Students fill out a questionnaire; - The teacher converses with students about whether they perceive futures thinking as useful and why or why not, and relates their answers to the aim and approach of the lesson series: thinking in multiple futures, with knowledge, imagination, and values. Phase 2: Information (10 min.) The teacher explains the aim and approach of the lesson series, by: 1) sharing information about the approach and the final aim of the series: advice to a fictive future mayor. Students will need knowledge, imagination, and (clarity about) values to think and advise about futures; 2) showing a videoclip about how the mobile phone was seen as something unnecessary and strange back in 1999. Key message: We can't completely foresee what futures will be like; 3) asking questions that trigger students to actively participate and openly express ideas and questions that arise when they think about futures. Phase 3: Instruction (5 min.) The teacher gives instruction about the main task of the lesson: students can choose between three introductory futures oriented tasks: 1. an interview, focusing on personal ideas about futures; 2. a study of resources (two articles and one mind map), focusing on futures scenarios expressed by a scientific, a commercial, and a governmental institution; 3. a design assignment, focusing on creative thinking. Students work on (provided, per task differing) work sheets that include several steps. Phase 4: Main task (20 min.) Students work in small groups. The teacher guides the process (in terms of content and group dynamics). To motivate students, the teachers emphasizes that futures thinking brings opportunities and choices as well as responsibilities for learners: each student needs to actively participate. Phase 5: Debriefing (10 min.) In a teacher-led debriefing, students share their outcomes of the interviews, resource study, and/or creative ideas. The teacher makes sure to: - explain how students' different answers are related to different contexts (in different times, at different places and of different persons); - focus on/inform after knowing the implications of their insights and ideas for urban futures. What does it mean? Students write down their learning outcomes of the lessons. Phase 6: Closure[1] (5 min.)

[1] Lesson 1,2,3,4 and 5 were performed on successive days. This resulted in relatively short orientation and closure phases, as continuation was easier compared with using (more regular) settings, in which there can be one or more days in between the lessons.

The teacher ensures a procedural closure (shares compliments, informs after and lists remaining questions, etc.); Homework assignment: study of resources about futures. The resources (two articles and one mind map) present futures scenarios expressed by a scientific, a commercial, and a governmental institution. Students:1) select (minimally) one optimistic and one pessimistic element in their futures vision; 2) describe what the selected (optimistic and pessimistic) elements could imply for (life in) urban futures. Descriptions can be made in text or in images (for example sketches/photos).

Lesson 2: Different perspectives on futures – Prototype 2

Objectives. Students can:

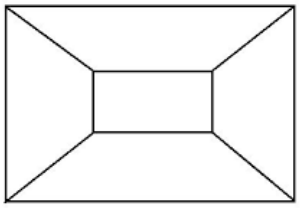
- describe examples of (elements of) futures scenarios expressed by a scientific, a commercial and a governmental institution;
- distinguish between optimistic and pessimistic elements in published scenarios, as well as in their personal futures ideas;
- explain how the labels 'pessimistic' and 'optimistic' are context-related (time, place, person);
- inspect whether differing perspectives also include shared elements.

Phase 1: Introduction (5 min.)

The teacher welcomes the students and briefly recalls: we have started futures thinking, and we are going to continue today.

Phase 2: Information and instruction (15 min.)

- A few students share examples of selected optimistic and pessimistic elements from the resources.
- Explicitly discuss how these are related to contexts.
- Instruct students to work on a group task, called 'placemat'.
- Students:
  - *write* their homework outcomes;
  - *read* each other's homework outcomes;
  - *explore* the different outcomes, in dialogue by asking questions (and, possibly, some debate);
  - *inspect/work towards* agreement: what statements about futures are shared?;
  - *list* the shared statements (if found/developed) in the central box of the placemat.



Students can learn how different perspectives can be legitimate (illustrated by the resources and exploration with their peers), and that common ground can often be found in different perspectives.

Phase 3: Main task (20 min.)

Students autonomously work on the main task 'placemat', that leads towards the participation of all students. The teacher guides the process (in terms of content and group dynamics).

Phase 4: Debriefing (15 min.)

Students pitch their learning outcomes, mentioning: 1) optimistic and pessimistic elements and the consequences discussed; 2) their shared statements. The teacher explains how neither optimistic nor pessimistic is good or bad and emphasizes the importance of looking at contexts. The teacher explains how perspectives/labels can be more sensible/knowledge based, more emotion/values based, or a mix.

Phase 5: Closure (5 min.):

The teacher ensures a procedural closure (shares compliments, informs after and lists remaining questions, etc.);

Homework assignment: 1) read the text titled: 'Future images: a matter of perspective?', about pronounced optimistic voices and pessimistic voices; 2) Write a slogan, a very short future statement (like the examples of artist Douglas Coupland, see reading text); 3) Bring your slogan on an A4 page to the next lesson.

Lesson 3: Multiperspectivism and context awareness in futures thinking – Prototype 2

Objectives. Students can:

- recognize a diversity of optimistic and pessimistic elements in formal and published scenarios as well as in their personal futures ideas;
- explain how the labels 'pessimistic' and 'optimistic' are context related (time, place, person);
- inspect whether differing perspectives also include shared elements;
- explain that multiple geographical dimensions are involved in urban futures' food supply.

Phase 1: Introduction (5 min.)

- students informally share their slogans about futures (these were formulated as homework).

Phase 2: First task (10 min.):

This concerns a group task that involves physical movement and is led by the teacher.

a. students position their slogans in a set of axes on the classroom floor: the vertical axis went from 'optimism' to 'pessimism', and the horizontal axis from 'innovative' to 'conservative';
b. students consider the extent to which the position of their slogan in the framework represents their way of approaching futures in general;
c. students take a physical position in the set of axes.

Phase 3: Debriefing group task (10 min.):

The teacher invites students to reflect on their position and uses their reflections to illustrate the influence of contexts (in different times, at different places and of different persons).

Phase 4: Information and instruction individual study task (10 min.):

The teacher 1) recalls the central aim of the lesson series: thinking in multiple futures, with knowledge, imagination and values; 2) summarizes how the emphasis, in the last 2.5 lessons, has been placed on futures *images* and their relatedness to person, time and context; 3) tells that, in the next few lessons the emphasis will be on *knowledge* about futures and, more specifically, about urban futures; 4) introduces the theme 'food supply in urban futures', that brings up geographical questions about different dimensions (economy, politics, nature, culture) and scales (from local to global).

Phase 5a: Second task (20 min.):

It concerns an individual study task.

1. A set of infographics is provided to the students. They scan the infographic;
2. Students choose one (out of five) infographics in which one research question is explored:
   I. What is the influence of competition for space on food production?
   II. What kind of relation do consumers have with their food?
   III. How sustainable is our food supply?
   IV. What developments are seen in the production of food?
   V. What are the consequences of globalization on food supply?

Students work on a (provided) answer sheet that stimulates geographical thinking, by focusing on multiple dimensions (economy, politics, culture and nature) of the food supply issue, on multiple scales (from the local, urban scale to the global scale). The task is ambitious: there is a lot of relevant information and the geographical dimensions (that are mostly concretized throughout the lessons to artifacts, actors and activities) are explicitly mentioned here.

Phase 5b: An alternative second creative task, for a group of 1-5 (volunteering) students (20 min): The teacher sends 1-5 students out of the school. They are asked to choose a specific place and sketch a drawing to answer the question: What do you expect this place to look like in 2030? This alternative creative assignment is called 'mindscaping'. The aim of the assignment is: 1) to

differentiate by providing different tasks; 2) to create examples of sketched futures images for use as examples in the next, fourth lesson.

Phase 6: Closure (5 min.)
The teacher: 1) asks students to hand in their work (to check for misconceptions); 2) ensures a procedural closure (shares compliments, informs after and lists remaining questions, etc.); 3) homework assignment: to re-read the resources from Lessons 1,2 and 3: two articles, a mind map, a reading text and today's infographics. The next lesson will be about four trends in urban futures: technology development, sustainability, individualization and deregulation. The resources already provide written material about these trends.

Lesson 4: Trends in urban futures – Prototype 2

Objectives. Students can:

d. List four trends that are considered to be influential in urban futures: technology development, sustainability, individualization, and deregulation;
e. Describe and explain for one trend, its:
    a. key features;
    b. recent past,
    c. occurrence in current and future cities;
    d. occurrence or its absence in other places (zoom out).

Phase 1: Introduction (10 min.)

1. Students present their 'mindscape'-sketches with their ideas about the futures of their school's surroundings. The sketches are projected/visible to peers. What do we see and why?
2. The teacher relates (visible) elements from the sketches to four (more abstract) trends that will be studied in this lesson: technology development, sustainability, individualization, and deregulation.

Phase 2: Instruction (10 min.):

- Students work in what are called expert groups (each of 4 members);
- One group studies one trend. Finally, the expertise will be shared/presented (in this or the next lesson), so all students are informed about all four trends;
- Students receive a (provided) set of resources about all four trends, consisting of maps, graphs, images and texts. Use of the resources is obligatory;
- They produce a poster presentation.

The instructions students receive are:
Keep the trend you are working on, a secret for other groups, so your peers have to guess what your poster is about. Answer the following questions on your poster:

1. How can the trend best be described?
2. What are the features of the trend and which key concepts relate to the trend? Present descriptions and examples of features and concepts.
3. How can the trend be seen in Dutch cities? For example in Amsterdam?
4. The trend is fairly new. How was this different in other times, such as in the recent past?
5. Zoom out and analyze: Is the trend seen in other places? Or is it rather unique to the Dutch city? What explanation can you think of?

The teacher advises students to split tasks, for optimal use of time and talents.

Phase 3: Main task (25-35 min.):
Groups of students autonomously work on the poster presentation. The teacher guides the process (in terms of content and group dynamics). Be aware: the trend of governmental deregulation is the most abstract to students. The group developing this poster may be in need for more teacher assistance.

Phase 4: Debriefing (0-10 min.)
Whether there is time to debrief depends on the time it takes to develop the posters. Ideally, one or two posters are presented today and the others in the next lesson. Instruct students to take notes about the trends and ask questions during the presentations. Debriefing aims at the development of sufficient understanding of all four trends by all students to develop scenarios for urban futures.

Phase 5: Closure (5 min.):
Ensure a procedural closure (share compliments, inform after and list remaining questions, etc.). Homework assignment: prepare the presentation of your trend and read text 2, about trends and scenarios.

Lesson 5: Analyzing first drafts of scenarios of urban futures with peers – Prototype 2

Objectives. Students can:

- Describe and explain with respect to four trends: technology development, sustainability, individualization, deregulation, their;
    - key features;
    - recent past,
    - occurrence in current and future cities;
    - occurrence or absence in other places (zoom out).
- Describe examples of how the trends can influence food supply in urban futures;
- Name and explain (the rough outlines of) two opposing scenarios: preferable and not preferable;
- Give and receive peer feedback;
- Advise a fictive mayor of a future city about preferable urban futures: what knowledge, imagination and values are important for a future mayor?

Phase 1: Introduction and information (10 min.)

Posters (that had not been presented in the previous lesson) are presented. The teacher instructs students to take notes about the trends and ask questions. Presentations aim at the development of sufficient understanding of all four trends by all students in order to develop scenarios for urban futures.

Phase 2: Information (5 min.)
The teacher presents an educational clip about Masdar City in the United Arab Emirates, as an example (not 'the future') of a highly technologized urban project that is interpreted as a 'sustainable' project by some, and as a 'commercial' project by others.

Phase 3: Main task (40 min.)
The task consists of three phases. The teacher guides phasing and time.
A. In couples, students choose a trend and apply the trend to the theme of food in the city supported by a provided worksheet (10 min.). The worksheet includes the following steps:
- Choose a trend;
- Reason about changes;
- Structure the reasonings in two opposing (roughly outlined) scenarios (preferable/ not preferable);
- Label each scenario with a title;
- Motivate why one scenario is preferable and the other is not.

B. During a "speed date" (20 min.), students 1) pitch their preferable scenario; 2) provide each other quick feedback. In four rounds, each student pitches two times and gives feedback two times. The aims are to strengthen their scenarios/scenario thinking and to practice the skill of giving and receiving feedback;
The teacher structures the speed date in terms of time management. The teacher can ask for questions or points of discussion (if considered meaningful) after the second and fourth round.
C. Students formulate their advice to a fictive mayor of a future city (10 min.). The assignment intends to stimulate students to summarize what they considered essential for urban futures. The teacher provides three flip overs, each with one question: 1) Knowledge: What does a future mayor need to know?; 2) Imagination: What creative images does a future mayor need to bear in mind?; 3) Values: What does a future mayor need to protect or strengthen in the interest of urban futures?

Phase 4: Closure (5 min.)
Ensure a procedural closure (share compliments, inform after and list remaining questions, etc.).
Homework assignment: Read text 3, about spatial developments in urban areas. Students are reminded to ask their questions in the next lesson, also concerning the other resources handed out.

Lesson 6: Designing scenarios for urban futures – Prototype 2

Objectives. Students can:
- Sketch a scenario for urban futures;
- Evaluate the lesson series in a personal reflection.

Phase 1: Introduction and instruction (5 min.)

The teacher welcomes the students and informs after answering any questions about the resource materials that were handed out during the lessons.

The teacher informs students that the lesson will consist of two big tasks.
The teacher instructs students to clear their desks for the first task: sketching a scenario, that contains:
- Knowledge about actors, artefacts and activities: what can be seen in urban futures?
    - Elements referring to food in urban futures (production, consumption and waste);
- Imagination; What creative images come to mind about urban futures?
- Values; What do you consider important to protect or strengthen in urban futures? Or maybe you expect values to be under pressure? How is this visible?

The teacher emphasizes that the task is not about drawing skills, it is the content of the scenario that counts.

Phase 2: First task (30 min.):
Students sketch individually and silence.
Drawing materials are provided.
Students hand in the sketch after 30 minutes.

Phase 3: Second task (20 min.):
In couples, students make short videotapes (3-5 minutes) in which they complete four sentences:
1. *What I considered important in this lesson series is:*
2. *What I learned considering this eye-opening insight is:*
3. *I hope that the future considering this insight will be:*
4. *A first step in a good direction can be:*

The videotapes are digitally handed in to the teacher, at the end/after the lesson.

Phase 4: Closure/Reflection (5):
Ensure a procedural closure (share compliments, inform after and list remaining questions, etc.).
Point at the upcoming assessment and instruct students about its preparation.