Master Thesis

The impact of a professional development training on primary school teachers' knowledge, attitude and behavioral intention towards teaching higher-order thinking skills

Cogito, ergo sum

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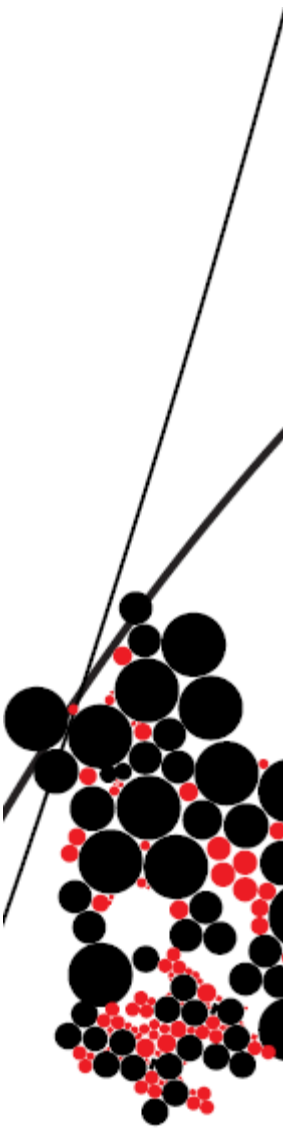

Abstract

As the pace of developments in society is accelerating, jobs in the field of education become more challenging. The present study evaluates the impact of a newly developed two-day professional development training on primary school teachers' knowledge, attitude and behavioral intention towards teaching higher-order thinking skills. Participants in this study were twenty-seven primary school teachers divided into an experimental group (N = 13) and a control group (N = 14). The study entails a quasi-experimental pretest posttest control group design using questionnaires at two points in time. Results show that the training had a positive effect on the development of metacognitive knowledge. In addition, as a result of the training, positive effects were found for teachers' self-efficacy. Though the timespan of the study was relatively short, hopeful results are found and valued as promising for future research on professional development in stimulating higher-order thinking. The main practical contribution of the study is the promotional video on teacher professional development training in teaching higher-order thinking skills. The video contributes to awareness and acknowledgement of valuable professional development programs in the field of teacher learning, which is needed to prepare young individuals for challenging daily and future lives.

Keywords: higher-order thinking, teacher development, professional development, experiment

Introduction

The accelerating pace of globalization and internationalization of economy will rapidly transform our daily and future lives. Preparing young people for jobs that do not yet exist (Voogt & Roblin, 2012) is challenging for todays' and future education. According to WRR (2014), Dutch Scientific Council for Government Policy, current education is lacking in preparing students for future economy as required future skills are insufficiently taught. Hence, today's educational policymakers are challenged to design future curricula by including not only valuable knowledge but additional valuable skills accordingly (Thijs, Fisser & Van der Hoeven, 2014). To be able to actively participate in future society (Ananiadou & Claro, 2009, as cited in Voogt & Roblin, 2012), cognitive skills as communicative, problem-solving, analyzing and information mediation skills to, for example, judge validity and reliability of sources are required (Voogt & Roblin, 2012; Pithers & Soden, 2000). It has become increasingly important to develop young individuals' cognitive skills (Pithers & Soden, 2000), as students will be exposed to global developments in social and technological domains more and more.

The additional skills required for future well-prepared individuals are commonly referred to as 21st century competences or 21st century skills. This term is widely conceptualized and integrated in models as P21 and enGauge (Voogt & Roblin, 2012; Ramirez & Ganaden, 2008). The skills are associated with higher order skills and behaviors needed to handle complex problems and unpredictable situations (Westera, 2001) and therefore are considered valuable in today's changing and globalizing society (Thijs et al., 2014). Among others, examples of 21st century skills are: creative thinking, critical thinking and problem-solving skills.

The last-mentioned cognitive skills are commonly referred to as higher-order thinking skills (HOTS), a term originating from Blooms Taxonomy (developed 1956), later revised by Anderson and

Krathwohl and others (2001). Higher-order thinking skills are defined as the cognitive processes entailing: analyzing and making sense of information; evaluating the value of information; and creating and criticizing solutions for real-life problems (Anderson et al., 2001). Additional examples of higher-order thinking processes include making comparisons, developing research questions, creating arguments, identifying assumptions and establishing causalities (Zohar, 2006). Educational designers argue that it is important for all educational sectors to teach students to think well (Pithers & Soden, 2000).

To comply with 21st century skills such as higher-order thinking skills, school curricula need a drastic change (Voogt & Roblin, 2012). Students of today and tomorrow need different instruction then twenty or thirty years ago in order to be prepared for future economy (King, Goodson & Rohanni, 1998). A change is needed as complex real-life problems demand solutions obtained by individuals who are able to use higher-order thinking skills (King et al., 1998; Pithers & Soden, 2000). With regards to primary education, this means that teachers need to adapt their teaching strategy and focus on teaching thinking. Unfortunately, however, many teachers find it difficult to include higher-order thinking strategies or strategies that are directed towards inquiry learning in their daily education, mainly because teachers' attitude towards such teaching strategies is in general negative (Ivie, 1998, Thijs et al., 2014). Additionally, teachers lack knowledge on teaching HOTS as most teachers are not clear on teaching thinking and therefore seem incapable of helping students to develop thinking (Pithers & Soden, 2000; Thijs et al., 2014; Zohar & Schwartzer, 2005).

Redesigning the thinking curricula requires professional development of teachers, for which teachers' knowledge and attitudes have significant implications (Zohar & Schwartzer, 2005). Moreover, teachers' intention to teach thinking skills will be stimulated through professional development activities (Thijs et al., 2014). However, primary school boards experience practical

limitations such as lack of time and budget for teachers' professional development (Appleton & Kindt, 1999; Thijs et al., 2014; Nordlöf, Hallström, & Höst, 2017; Van Aalderen-Smeets, Walma van der Molen & Asma, 2012). Although available time for professional development is limited, its effect is promising in the educational field.

The importance of teacher professional development (TPD) is stressed by Whitworth and Chiu (2015), who concluded that teacher learning led to an improvement in the quality of education and learner's achievement. Especially for the implementation of changes, teachers need well-defined TPD to support their role and manage ambiguity (Allen & Penuel, 2015). To successfully implement a change on teaching of higher-order thinking skills, TPD-programs need to focus on 1) knowledge, 2) attitude and 3) behavioral intention. First, teachers need an understanding of all facets of teaching HOTS (Thijs et al., 2014). Second, teachers' attitude has a major impact on their teaching, as attitude implies the psychological intention to evaluate concepts in attribute dimensions as harmful-beneficial (Ajzen, 2001; Ajzen & Fishbein, 2000). Finally, behavioral intentions indicate teachers' individual readiness to perform a given behavior (Ajzen, 2002), which in the current study, entails the implementation of HOTS development activities in their lessons.

In this study, we evaluate the impact of a newly developed two-day professional development training. The design of the training is short as the study is limited by both the time span of this research thesis and the available time from primary school teachers to participate in this study. However, though realizing the effects measured are yet initial findings, we hope to find promising results on professional development as a result of the training. Therefore, we evaluate the impact of a newly developed two-day professional development training on primary school teachers' knowledge, attitude and behavioral intention towards teaching higher-order thinking skills.

Theoretical Framework

The focus of this study is primary school teachers' knowledge, attitude and behavioral intention. These three variables will be explained in more detail in this framework through exploration of relevant theories.

Knowledge

Teachers' knowledge strongly affects their instructional practice and influences the learning of their students (Zohar & Schwartzer, 2005). Sufficient knowledge about HOTS and its teaching is crucial for successful implication of teaching HOTS (Retnawati, Djidu, Apino, & Anazifa, 2018). Moreover, lack of knowledge about HOTS, limit teachers to adequately asses students HOTS (Yen & Halili, 2015). Current studies indicate that teachers' knowledge in the context of teaching HOTS is generally low (Barak & Shakhman, 2008; Thijs et al., 2014; Zohar, 1999; Zohar & Schwartzer, 2005; Retnawati et al., 2018).

In the following, the framework of the knowledge dimension of Bloom's taxonomy (1965) is used to stress the importance of teachers' professional development on teaching HOTS. The knowledge dimension (see Table 1) categorizes four domains relevant for the cognitive process: factual, conceptual, procedural and metacognitive knowledge (Krathwohl, 2002).

Table 1

Knowledge Dimension of Blooms Revised Taxonomy

A. Factual Knowledge **–** The basic elements that must be known to be acquainted with a discipline or solve problems in it.
Aa. Knowledge of terminology
Ab. Knowledge of specific details and elements
B. Conceptual Knowledge **–** The interrelationships among the basic elements within a larger structure that enable them to function together.
Ba. Knowledge of classifications and categories
Bb. Knowledge of principles and generalizations
Bc. Knowledge of theories, models and structures
C. Procedural Knowledge **–** How to do something; methods of inquiry, and criteria for using skills, algorithms, techniques and methods.
Ca. Knowledge of subject-specific skills and algorithms
Cb. Knowledge of subject-specific techniques and methods
Cc. Knowledge of criteria for determining when to use appropriate procedures
D. Metacognitive Knowledge **–** Knowledge of cognition in general as well as awareness and knowledge of one's own cognition.
Da. Strategic knowledge
Db. Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge
Dc. Self-knowledge

(Krathwohl, 2002)

Factual knowledge

As factual knowledge involves knowledge on basic elements (Krathwohl, 2002), teachers need to have knowledge on the terminology and elements of higher-order thinking for successful classroom practices. To foster student learning, teachers must have an understanding of the concept (Borko, 2004). While some teachers are familiar with Bloom's taxonomy and try to engage students in higher-order thinking (Yen & Halili, 2015; Zohar, 1999), the majority of primary school teachers do not clearly understand the term HOTS and find it difficult to give a clear definition of higher-order thinking (Retnawati et al., 2018). On the contrary, few teachers integrate the stimulation of HOTS in their classroom instructions unconsciously without knowing the original term for it (Zohar, 1999).

Nevertheless, previous studies indicated that teachers' deeper understanding of the concept higher-order thinking can encourage student engagement in higher-order thinking activities (Yen & Halili, 2015). Student engagement is required as the 21st century skills are associated with behaviors

and skills that are required to cope with future complex problems in unfamiliar situations (Westera, 2001). However, unfortunately, the lack of teachers' factual knowledge leads to ineffective instruction in classroom practice (Zohar, 2006).

Conceptual knowledge

Conceptual knowledge empowers teachers to find relationships between basic elements of HOTS within a larger structure. Within the school curriculum, 21st century skills are best integrated when found throughout the entire curriculum in a cross-disciplinary nature (Voogt & Roblin, 2012). Moreover, teachers need to establish the relationship between teaching HOTS and students' future professional lives. As high-level thinking enables students to process information for a relevant action in unfamiliar situations (Heong et al., 2012), students can benefit from skills such as decision-making, explaining, and evaluating, thus ensuring personal growth in future private and professional life (King et al., 1998). Although teachers acknowledge the importance of teaching HOTS for students' cognitive development, most teachers consider this development only appropriate for high-achieving students (Zohar & Schwartzer, 2005). Nevertheless, HOTS are considered valuable for every individual student as they increasingly encounter unfamiliar problems in the changing society (Yen & Halili, 2015).

Procedural knowledge

To accomplish adequate teaching of HOTS, teachers must not only acquire subject-knowledge but also pedagogical knowledge on how to develop thinking skills in learners (Barak & Shakhman, 2008). Procedural knowledge is knowledge on how to do something (Krathwohl, 2002) and therefore equips teachers with practical knowledge for teaching higher-order thinking skills. In practice, there are two approaches to teach HOTS in class: 1) the infusion approach, in which thinking skills are infused in a

specific content and 2) the separate-subject approach in which HOTS are presented as a set of skills (Zohar & Schwartzer, 2005; Fisher, 1999). Both approaches involve adequate design and execution of instructional approaches in which students are stimulated to use higher-order thinking skills (Zohar, 1999).

According to Blooms Taxonomy, teaching HOTS promotes skills such as evaluating and creating rather than just rote learning (Collins, 2014). Although few teachers are willing to incorporate teaching activities about higher-thinking and problem solving, most teachers feel inadequately competent to teach HOTS (Ivie, 1998; Zohar & Schwartzer, 2005; Thijs et al., 2014). Teachers lack the pedagogical knowledge for development of effective instruction, as most teachers' knowledge on teaching thinking strategies is inadequate (Zohar & Schwartzer, 2005; Fisher, 1999; Yen & Halili, 2015). Consequently, it is important to support teachers' procedural knowledge development by training and provide teaching materials and strategies that support teaching HOTS (Collins, 2014).

Metacognitive knowledge

Metacognition entails one's knowledge, understanding of knowledge, and control of the cognitive system (Zohar, 1999). According to Flavell (1979) the two components of metacognition are 'metacognitive knowledge' and 'metacognitive regulation'. Those components are regulated by the metacognitive strategies: (1) evaluation, to indicate metacognitive knowledge transfer; (2) self-monitoring, to indicate control of own cognitive system; and (3) planning, to indicate cognitive awareness to adapt behavior (Veenman & Elshout, 1999). In this study, those three metacognitive strategies form the framework for analysis of metacognitive knowledge.

As metacognitive knowledge of thinking involves thinking about thinking, this type of knowledge is extremely valuable in designing new learning activities for teaching HOTS (Zohar,

1999). Nevertheless, several studies point out that teachers' metacognitive knowledge of cognition in general and awareness of one's own cognition (Krathwohl, 2002), for comprehensive teaching of HOTS is lacking in most teachers (Zohar, 1999; Zohar, 2006; Barak & Shakhman, 2008; Zohar & Schwartzer, 2005). Teachers do not possess knowledge on the control and regulation of metacognition and therefore seem to be incompetent in designing comprehensive learning activities for teaching HOTS (Zohar, 1999). The development of self-regulatory learning skills, such as teachers' ability to reflect on classroom practice, is highly important in their professional development to establish changes in practice (Timperley, 2008; Zohar, 2006).

Attitude

Attitude is the psychological tendency to evaluate concepts as good-bad, likeable-dislikable and harmful-beneficial (Ajzen, 2001; Ajzen & Fishbein, 2000). The conceptualization of attitude is the core of Fishbein's Expectancy-value model (Fishbein, 1963; Ajzen, 2001) in which an individual's attitude toward a concept, such as HOTS, is determined by the subjective norms of the individual, in interaction with the individual's strength of memory (Ajzen, 2001).

Most teachers believe that teaching higher-order thinking skills is only important for cognitive development of high-achieving students (Zohar & Dori, 2003). Moreover, teachers feel insufficiently equipped to apply teaching strategies focusing on stimulating HOTS (Thijs et al., 2014). Those perceptions of cognitive and behavioral control are addressed in the study of Wijnen, Walma van der Molen and Voogt (*in progress)*. In the following, the attitude components (see figure 1) resulting from their conceptualization of attitude: perceived relevance, low-achieving students, self-efficacy and context-dependency (Wijnen et al., *in progress)* will be explored extensively.

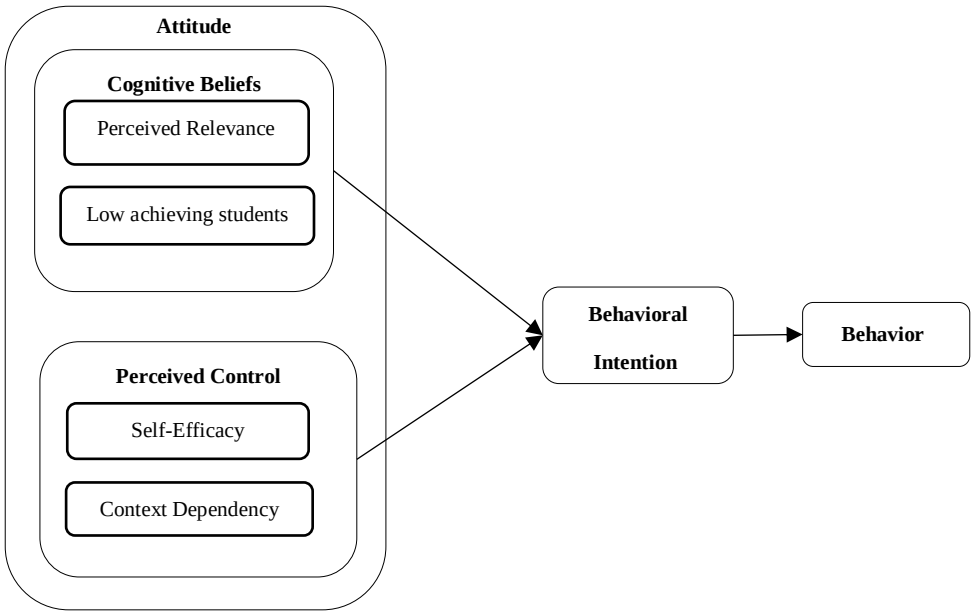

Figure 1. Conceptualization of primary school teachers' attitude toward teaching higher-order thinking skills (Wijnen et al., *in progress*).

Perceived Relevance

Cognitive beliefs of teachers toward teaching HOTS entail the perception of perceived relevance and teachers' beliefs about low achieving students' ability and strongly affects intention to teach HOTS (Zohar & Schwartzer, 2005). Perceived relevance is the extent to which teachers believe it is important and relevant to teach HOTS at primary schools for the development of their students (Wijnen et al., *in progress*). Perceived relevance triggers motivation to learn through professional development training (Gaines et al., 2019).

In current primary classroom environments, perceived relevance of teaching HOTS is questionable for most teachers (Zohar, Vaaknin & Degani, 2001). Teachers do not acknowledge the importance of teaching thinking skills as they find the main goal of teaching primary school students is

the transmission of knowledge (Zohar & Schwartzer, 2005). Teaching thinking is often considered to interfere with primary teaching goals and seen as a waste of time (Zohar & Schwartzer, 2005).

Unfortunately, teachers do not feel responsible for student development of cognitive activities such as higher-order thinking (Ivie, 1998), and thus the perceived relevance of teaching HOTS is generally low. Professional development training can influence perceived relevance when corresponding with teachers' own teaching philosophies (Emo, 2015). Hence, while designing the training we explained teaching strategies on HOTS in accordance to the current teaching strategies on teaching 21st century skills using familiar terms and definitions.

Low achieving students

When teaching students to think, instruction and the roles of teacher and students are interchangeable as teachers are no longer the source of information (Zohar & Schwartzer, 2005). Resultingly, the role of the teacher shifts to coach when stimulating thinking processes (Prawat, 1992) as analyzing, evaluating and creating. Additionally, teaching all students to think is relatively new in the curriculum of primary schools as in the past only high achieving students were considered competent thinkers (Resnick, 1987). The shift to coach and acknowledgement of all students as capable independent thinkers remains difficult for teachers (Zohar & Schwartzer, 2005).

Although some teachers do perceive some of their students as capable thinkers, unfortunately, the majority of teachers only value high-achieving students as capable independent thinkers and believe that teaching HOTS is only appropriate for high-achieving students (Zohar & Dori, 2003; Zohar & Schwartzer, 2005). Nevertheless, as the educational system changes by changing demands, HOTS must be thought to all students in all learning subjects (Zohar et al., 2001). Previous studies showed that programs on HOTS are beneficial for low-achieving students, while also having positive

effects on high-achieving student outcomes (White & Frederiksen, 1998; Pogrow, 1988; Zohar & Dori, 2003). As teachers' beliefs strongly influence their instructional practices, negative beliefs about low-achieving students may have consequences in teaching higher-order thinking in classroom environments (Zohar et al., 2001). Therefore, including pedagogical beliefs about low-achieving students in the professional development training by emphasizing that development of thinking skills is important for all students in primary schools is major important while designing the training.

Self-efficacy

Perception of behavioral control emphasizes teachers' self-efficacy and their context-dependency. Both variables are studied to be useful predictors for the likelihood of enactment of actual behavior (Armitage & Conner, 2001; Armitage & Cristian, 2003; Ajzen, 2002). Teachers' self-efficacy indicates teachers' ability to teach (Armitage & Conner, 2001; Bandura, as cited in Nordlöf et al., 2017). Self-efficacy is the cognitive perception of controlling behavior by internal factors such as confidence and fear (Armitage & Conner, 2001).

The development of thinking skills in current class appear to be ineffective (Ramirez & Ganaden, 2008) because teachers' self-efficacy on teaching HOTS is low (Thijs et al., 2014). Nevertheless, studies on teachers' professional development showed higher student achievement as a result of confidence gain of teachers (Lumpe, Czerniak, Haney, & Beltyukova, 2012). According to Volante (2006), practical focus in professional development programs positively influences teachers' self-efficacy. Therefore, in this study we focus on both theoretical and practical implication for HOTS in primary schools. Hence, focus on teachers' self-efficacy in teacher professional development programs is a prerequisite for successful implementation of teaching HOTS in primary schools.

Context Dependency

Context dependency refers to contextual factors in classroom environments that influence instructional approaches. Unfortunately, for most teachers, teaching depends on contextual factors as time and available resources, which they cannot control (Nordlöf et al., 2017; Van Aalderen-Smeets et al., 2012). Also, collegial interaction, materials and available budget are contextual factors influencing teaching (Appleton & Kindt, 1999). Teachers' context dependency is a strong predictor of intention to teach (Van Aalderen-Smeets et al., 2012), hence diminishing context-dependency is related to increased sense of being in control (Asma, Van der Molen, & van Aalderen-Smeets, 2011).

In the context of teaching HOTS, current used methods do not include materials on higher-order thinking (Thijs et al., 2014). Resultingly, designing additional thinking activities for classroom practices costs time and money. Furthermore, while teaching HOTS, additional time for proper individual thinking for each student is required (Zohar & Schwartzer, 2005). Since contextual limitations seem to affect the frequency of teaching HOTS, we believe that diminishing context-dependency as a result of professional development training will increase the amount of time spent on HOTS activities in classroom practice.

Behavioral Intention

Actual change in teaching and learning in practice is partly determined by behavioral intention of teachers to implement teaching HOTS. Although professional development programs provide the required opportunities for teachers to gain new insight and practical examples of higher-order thinking activities in classroom environments (Thijs et al., 2014), intention to behave differently starts at teachers' individual readiness (Ajzen, 2001).

As studied in Ajzen's Theory of Planned Behavior (1985), behavioral intention is influenced by an individual's cognitive and affective attitude, subjective social norm and perceived behavioral control. Cognitive perception emphasizes the concern on attribute value (Ajzen, 2001), as Voogt and Roblin (2012) confirm by acknowledging that teachers are required to understand the need of 21st century skills in the curriculum. Affective perception concerns the perceived satisfaction or anxiety of teaching of higher order thinking skills (Ajzen, 2001). The behavioral control of an individual stresses the importance of volitional control in predictions for behavior (Ajzen, 2001), rather than self-efficacy which merely addresses the degree of anticipated difficulty (Bandura, as cited in Ajzen, 2001). With regard to those individual factors, behavioral intention is considered to be the antecedent of behavior (Ajzen, 2002) and therefore assumed as the predictor of primary school teachers' behavior in teaching HOTS.

Research Question and Hypotheses

The main goal of this research was to gain more insight into the effects of a short professional development training on teaching higher-order thinking skills in primary schools. The following research question guided this research:

What is the effect of a newly-developed two-day professional development training on primary school teachers' a) knowledge, b) and attitude towards HOTS and c) behavioral intention to teach higher-order thinking?

The following hypotheses guided this study. First, it is hypothesized that, teachers who engage in our professional development training are likely to develop more a) factual, b) conceptual and c) procedural and knowledge on teaching HOTS, when compared to a control group of teachers who did not engage in our professional development training. Additionally, it is expected that the training will have a positive effect on the development of metacognitive knowledge.

Second, regarding attitude towards HOTS, it is expected that teachers who engage in our professional development training change their attitude towards their cognitive beliefs by increasing perceived relevance (1) and decreasing beliefs about low achieving students (2). With regard to attitude towards the perceptions of behavioral control, we expect increased self-efficacy (3) and decreased context-dependency (4), when compared to a control group of teachers who did not engage in our professional development training.

Finally, it is hypothesized that teachers' behavioral intention to teach higher-order thinking in their class increases after the professional development activities, compared to a control group of teachers who did not receive the training.

Scientific and Practical Relevance

While professional development training influences teachers' instructional practices (Timperley, 2008), there is still much unknown about the elements relevant for successful teacher professional development for teaching higher-order thinking skills (Zohar & Schwartzer, 2005). In this study, the elements on teachers' knowledge, attitude, and behavioral intention in the context of teaching higher-order thinking skills are investigated to contribute to scientific evidence on effective professional development programs.

In practice, primary teachers do not focus on teaching higher-order thinking skills (Ramirez & Ganaden, 2008; Thijs et al., 2014; Ivie, 1998). Therefore, a more in-depth understanding of teachers' knowledge, attitude and behavioral intention to teach higher-order thinking skills can lead to improved instructional practices on cognitive processes. This study contributes to the professionalization of teachers for teaching HOTS in primary education by introducing a short newly developed TPD-training. The practical contribution of this study is both a promotional video-taped intervention and practical tips and tricks provided during the intervention. Furthermore, results will provide evidence-based input for further development of additional professional development programs.

Method

Respondents

Six primary schools in the Netherlands participated in this study. Respondents in this study (*N* =27) were a sample of the primary school teachers in the East part of the Netherlands (age range: 21 - 63). Almost all the respondents in the sample were female (*N* = 26) as there was only one male respondent in the sample. Detailed characteristics of the respondents are listed in Appendix IV. Most teachers in this sample teach class 1 (13.8%), class 2 (13.8%), or class 6 (13.8%). The primary school teachers engaging in this study, participated voluntarily. Respondents for the experimental study were grouped by convenience sampling. Fourteen respondents in this study were part of the control group, and thirteen respondents were part of the experimental group.

Design

The quantitative study was explorative, as the aim was to gain insight in primary teachers' knowledge, attitude and behavioral intention. The study entailed a quasi-experimental pretest posttest control group design using questionnaires at two points in time as presented in Figure 3.

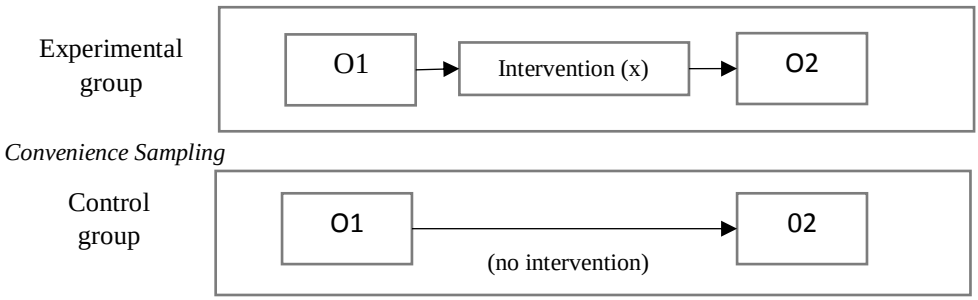

Figure 3. Model quasi-experimental research design.

*note: O1 is the pre-test measurement, O2 is the post-test measurement.

The quasi-experimental design is often used for inquiry at school level, in which two groups are compared (Furtak, Seidel, Iverson & Briggs, 2012). Based on willingness to participate in the physical training sessions, teachers were assigned to either one of two conditions; (1) experimental group, participating in the professional development program or (2) control condition, not participating in the professional development program.

Procedure

Boards of primary schools that participated in this study were approached individually by the researcher by e-mail and informed with the purpose of this study. Schools were provided with options to sign-up for (1) participation in a training and (2) participation in control group. Teachers participating in the training, signed-up voluntarily. During the two-day professional development intervention, teachers were trained in teaching HOTS at their school location. The second training sessions took place within approximately two weeks after the first training session.

Respondents from the experimental group filled out the pretest individually, at the start of the first training session and the posttest individually, at the start of the second training session. In both cases, the trainer was present. The training was offered to two separate experimental groups. The first training sessions of one experimental group was filmed for research and promotional purposes.

Respondents from the control group were asked to fill out pre- and posttest individually with an interval of two weeks. In both cases, the researcher was present to carry out and collect the questionnaires.

Ethical considerations

The research protocol was checked and approved by the BMS Ethics Committee of the University of Twente. Boards of primary schools participating in the study were approached by e-mail and informed of the content and ethical considerations of the study. Respondents in both experimental and control group were informed beforehand about the details of the study and were asked to confirm participation by signing a consent form. Respondents participating in the experiment were briefed on the filming during the training. Options for both approval and disapproval for use of video was included in the consent form. The consent form noted that it was possible to quit at any given moment, without consequences, should the respondent feel uncomfortable during the study. Data derived during the study was analyzed anonymously.

Measurement Instruments

The instruments in this study consisted of questionnaires conducted at two points in time. The quantitative data derived from questionnaires gained insight in primary school teachers' a) knowledge, b) attitude and c) behavioral intentions towards teaching higher-order thinking skills as data derived from questionnaires are easily generalizable to the population (Endedijk & Bronckhorst, 2014).

Results helped us to test research hypotheses and answer the main research question, as both experimental and control group were provided with identical questionnaires both pre- and posttest. The questionnaire consisted of two separate parts: (1) measuring knowledge and (2) measuring attitude together with behavioral intention. We separate the two questionnaires as information from statements on attitude (Wijnen et al., *in progress*) is likely to influence respondents' knowledge on teaching higher-order thinking. Metacognitive knowledge was assessed for experimental group only, as to measure the impact of the training, using a separate (3) questionnaire on metacognitive

knowledge. In the following section, questionnaire items on knowledge, attitude and behavioral intention are described in more detail.

Knowledge

Knowledge of teaching higher-order thinking skills was assessed by seven questions about teachers' knowledge on teaching higher-order thinking skills (see Appendix V). In the questionnaire, two questions regarded factual knowledge (e.g. "What are the six levels of Bloom's Taxonomy?"), two questions regarded conceptual knowledge (e.g. "Why do you think it is relevant to teach higher-order thinking?") and three questions regarded procedural knowledge (e.g. "Rewrite the following traditional student assignments"). The knowledge-test was validated consulting experts and piloting several versions of the test with primary school teachers. Responses were assessed using a rubric (Appendix VI), developed by the researchers consulting experts. The maximum score on the knowledge test was 25; points were distributed over the factual (max. score = 9), conceptual (max. score = 8) and procedural (max. score 8) knowledge dimensions (see Appendix VI).

Metacognitive knowledge on teaching higher-order thinking skills was assessed using a self-reporting measurement instrument (see Appendix VII) including six questions on metacognitive strategies (1) evaluating, (2) monitoring and (3) planning. Respondents from the experimental group, reflected on development of metacognitive knowledge by reporting positive or negative attitude towards development of cognition. In the questionnaire, respondents were provided with opportunities to explain any possible self-reflection on metacognitive strategies (e.g. "I discovered my weaknesses in teaching HOTS, namely…"). The questionnaire was assessed by indicating percentages of self-reported, positive attitude towards development metacognitive knowledge supported by comments from teachers of the experimental group.

Attitude

Attitude towards teaching higher-order thinking skills was assessed using a questionnaire with a 5-point Likert scale on agreement. Respondents were asked to score twenty statements on attitude ranging from 1 (strongly disagree) to 5 (strongly agree) (see Appendix VIII). The questionnaire contained four statements on perceived relevance (e.g. "I think it is crucial for students' learning to stimulate higher-order thinking."), six statements on low achieving students (e.g. "I think we can expect little higher-order thinking from 'weak' students."), four statements on self-efficacy (e.g. "I am able to ask questions to students which stimulate higher-order thinking.") and six statements on context-dependency (e.g. "To me, the size of the class determines whether I will stimulate students' higher-order thinking.") The validated instrument is developed by Wijnen et al. (*in progress*) in which factor-analyses were conducted. The twenty items are presented unstructured to prevent bias. A detailed overview of questions organized by factors is presented in Appendix IX.

Behavioral intention

Intention to teach higher-order thinking skills in class was assessed using a questionnaire with a 5-point Likert scale on agreement. Statements as 'I ask my students questions to stimulate higher-order thinking' are presented. Respondents were asked to score eight statements on agreement ranging 1 (strongly disagree) to 5 (strongly agree) (see Appendix VIII). The statements that were used in this study have been developed and validated by Wijnen et al. (*in progress*) as a result of extensive literature study and adapted to the current study.

The intervention

TPD-programs are proven to be effective for improvement in instructional practices and enhanced knowledge on new teaching strategies and tend to have a positive effect on student outcomes (Borko, 2004; Desimone, Smith & Phillips, 2013). The aim of the professional development training was to improve primary school teachers' knowledge, attitude and behavioral intention towards teaching HOTS. The focus of each intervention part is presented in Table 2.

The intervention in this study was developed based on existing literature on professional development (Timperley, 2008; Borko, 2004) acknowledging the importance of the training to be short to overrule practical limitations (Thijs et al., 2014) and fit within the current timespan. After consulting experts, the final improved version included both theoretical and practical information on stimulating HOTS in primary education (for handouts of the training see Appendix I). The newly developed short professional development training consisted of two meetings covering two days. Each meeting lasted two hours and was offered to thirteen primary school teachers in the experimental condition from three different primary schools.

Table 2

Overview of the training categorized by focus on 1) knowledge, 2) attitude and/or 3) behavioral intention.

Part of Training	**Content**	**Focus**	**Component**
Introduction	Problem statement	Attitude	Perceived Relevance
	Current and Future Education	Behavioral intention	Low-achieving Students
Theory	Blooms' Taxonomy	Knowledge	Factual
	Higher-order thinking skills		Conceptual
			Procedural
	Higher-order thinking assignments	Attitude	Self-efficacy
			Context-Dependency
Practical assignment	Executing higher-order thinking task	Knowledge	All
		Attitude	All
		Behavioral intention	
Reflection	Presentation	Attitude	Self-efficacy
	Reflection of assignment	Knowledge	Metacognitive
Take-home assignment	Designing higher-order thinking tasks	Behavioral intention	
Evaluative meeting	Evaluation of take-home assignment	Knowledge	Metacognitive
	Evaluation of training	Attitude	All
		Behavioral intention	

Key Elements in the training

The training included the key elements (1) theoretical information and (2) practical information on teaching higher order thinking, to stimulate teachers' knowledge, attitude and behavioral intention. The interactive nature of the training, including group assignments and group discussions, encouraged teachers' desire to learn. Additionally, the training contained an (3) evaluation-part in which a plenary discussion on both products (e.g. developed assignments) and process (e.g. development of metacognitive knowledge) was included.

Detailed description of the training

Results from theoretical framework were used to develop the intervention, the two-day professional development training on teachers' knowledge, attitude and behavioral intention towards teaching higher-order thinking.

Figure 2. QR-code directing to the video of the training.
* only in Dutch

The training consisted of two sessions (see Figure 2 for videotaped training) of approximately two hours. During the first session, after approving participation by signing the consent form, respondents began by filling out questionnaires on knowledge, attitude and behavioral intention. During the first part of the initial session, teachers were provided with the problem statement and theoretical information on teaching HOTS to broaden knowledge and strengthen attitude. Respondents were presented with definition statements on higher-order thinking along with practical examples on how to stimulate HOTS during different teaching activities in classroom environments.

In the second part of the first session, respondents were actively involved in a training activity about executing a higher-order thinking task including cognitive skills analyzing, evaluating and creating. The task (Appendix II) entailed the development of a sports complex suitable for five alternative sports such as underwater hockey and quidditch. After analysis of these sports and evaluation of options, respondents created a future sports complex in groups of approximately five. To highlight the importance of critical and creative thinking as part of the design process, respondents were asked to present both design and design process at the end of the training.

Ending the first training session, respondents were asked to design similar higher-order thinking tasks before the next training session. The take-home assignment was handed out in clear

formats (see Appendix III) and focusses on behavioral intention. Working in duos, respondents were able to choose between 1) redesigning existing materials or 2) designing new materials and asked to bring the designs to the second training session.

After two weeks, the second training session started with filling out questionnaires on knowledge, attitude, behavioral intention and metacognitive knowledge accordingly. During this session, we focused on respondents' metacognitive knowledge and behavioral intention as we conducted group discussion on difficulties and successes when designing and executing higher-order thinking assignments in classroom environments. The assignments designed after the first training session are presented plenary as the power of the community improves learning when related issues are discussed collectively to empower professional growth (Zohar, 2006). At the end of the training, respondents were thanked for participation and informed on further developments of the study.

Result of the intervention

During the first meeting of the professional development training, teachers were provided with the take-home assignment on designing higher-order thinking assignments. Some of the assignments are presented to show transfer of training and effects of the training on practical implementation.

Two teachers choose to redesign an existing assignment for geography on creating a farm in groups of four students. A complete assignment description can be found in Appendix X. Teachers guided the students in HOTS: analyzing, evaluating and creating. As students were enthusiast and creatively working on the assignment, both teachers valued the assignment as successful.

An example of an individually, newly designed HOT-assignment is to create a new feast day within the theme 'Celebrations'. Students were asked to analyze and evaluate existing feast days to

ultimately create a new feast day. A complete description of the assignment can be found in Appendix X. Although students needed encouragement for creative thinking, the assignment was a success.

Data Analysis

The effectiveness of the professional development training on primary school teachers' knowledge, attitude and behavioral attention towards teaching higher order thinking was analyzed using univariate repeated measures ANOVA's for each component with statistical significance at $p < 0.05$. For each repeated measures ANOVA, the between-subject variable was condition and the within-subject variable was time. We investigated the interaction effects between time and condition to determine differences in development within the experimental group compared to the control group, as a result of the training. To further investigate the effects of the training, additional post-hoc paired *t*-test were used to explore differences between pre- and post-measurement for both the experimental and control group separately.

Results

Preliminary analysis

Results from preliminary analysis showed that the assumption of homogeneity of variance was satisfied on each component of knowledge, attitude and behavioral intention. Homogeneity of variance was tested using independent-sample t-tests in pretest measurement, including assessment of Levene's tests effect at a significance level of $p = 0.05$.

Results from tests on normality showed non-normal distributions for some components of knowledge, attitude and behavioral intention. As the sample was small, we accepted the limitation of the non-normality in this study. Since the assumption of homogeneity was satisfied, we assume that data from the experimental and control group showed large similarities and were valuable for further data analysis.

Results of the multiple ANOVA's are presented in Table 3 (descriptive statistics) and Table 4 (interaction effects). Analyses of the univariate analyses for each component is described in more detail, reporting on the interaction effects between condition (experimental and control) and time (pre- and posttest) to show the effect of the professional development training for each component. Post-hoc paired *t*-test were reported to indicate differences between pre- and posttest within each group (experimental and control).

Table 3

Descriptive statistics pre- and post-measurement organized by component

		Experimental group (N = 13)				Control group (N = 14)			
		Pre		Post		Pre		Post	
		M	SD	M	SD	M	SD	M	SD
Knowledge	Factual	2.92	2.33	5.23	2.68	2.21	2.58	3.57	3.63
	Conceptual	5.23	1.24	5.69	1.03	5.07	1.00	4.86	1.03
	Procedural	3.38	1.98	4.92	1.44	2.50	2.10	2.57	1.40
Attitude	Perceived Relevance	4.54	0.50	4.73	0.35	4.20	0.78	4.18	0.63
	Low achieving students	2.63	0.50	2.36	0.53	2.65	0.92	2.67	0.76
	Self-efficacy	2.73	0.62	3.38	0.60	2.86	0.73	3.02	0.63
	Context- dependency	2.91	0.54	2.79	0.51	2.82	0.59	3.00	0.63
Behavioral intention		4.30	0.56	4.46	0.47	3.90	0.66	3.90	0.75

* Mean score range for each knowledge dimension: factual 0 – 9; conceptual 0 – 8; and procedural 0 – 8.
** Mean scores range for attitude components: 1 (totally disagree) to 5 (totally agree).

Table 4

*Interaction effects (time of measures * condition) organized by component*

		F	*p*	Partial η^2
Knowledge	Factual	1.04	.32	.040
	Conceptual	**4.38**	**.047**	**.15**
	Procedural	3.29	.082	.12
Attitude	Perceived Relevance	1.09	.31	.040
	Low achieving students	0.82	.37	.032
	Self – efficacy	**5.23**	**.031**	**0.17**
	Context - Dependency	1.42	.25	.054
Behavioral Intention			.22	.060

* bold values show significant difference in scores between control and experimental group
** significance level at p = 0.05

Knowledge

The result of the study on the component of knowledge are presented in Table 3 and corresponding Figure 4. Table 3 shows descriptive statistics on each knowledge dimension (factual, conceptual and procedural) for both experimental and control condition. Figure 4 shows the graphical presentation of the mean pre- and posttest score of the experimental condition (Fig. 4a) and the control condition (Fig. 4b). The effects of the training are investigated using univariate repeated measurement ANOVA for each knowledge dimension, reporting the interaction effect (see Table 4) between time (pre- and posttest) and condition (experimental and control).

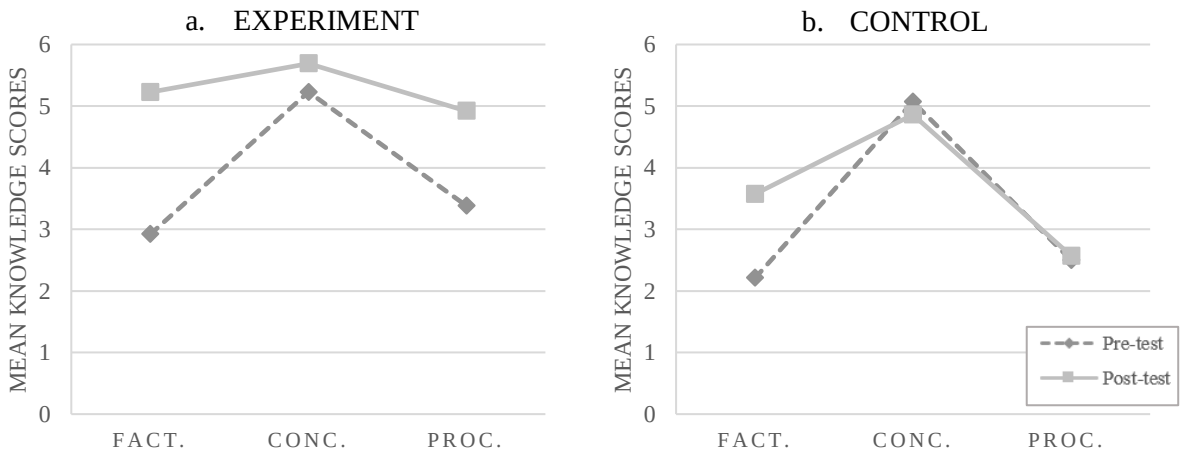

Figure 4. Mean scores pre- and posttest measurement on each knowledge dimension: factual (fact.), conceptual (conc.) and procedural (proc.).

The univariate analyses did not show a significant interaction effect of time and condition for factual knowledge dimension, $F(1, 25) = 1.04$, $p = 0.32$. When exploring data extensively by using paired *t*-tests, both experimental, $t(12) = -2.62$, $p = 0.022$ and control group, $t(13) = -3.66$, $p = 0.003$, showed

significant increase in factual knowledge. This means that both groups developed their factual knowledge over time.

The univariate analysis for the component of conceptual knowledge showed a statistically significant interaction effect of time and condition, $F(1, 25) = 4.38$, $p = 0.047$, $\eta^2 = .15$. The effect size is high (Cohen, 1988) with partial η^2 of .15, meaning that 15% of the variance in score for conceptual knowledge was accounted for by the training. However, consulted paired *t*-tests did not show significant change within pre- and posttest score for experimental group $t(12) = -1.59$, $p = 0.14$, nor for the control group $t(13) = 1.39$, $p = 0.19$ on conceptual knowledge. This means that there was no effect of the professional training on conceptual knowledge as both experimental and control group did not develop conceptual knowledge over time.

There was no statistically significant interaction effect between time and condition on the procedural knowledge dimension, $F(1, 25) = 3.29$, $p = 0.082$. Additional paired *t*-tests showed a significant increase in procedural knowledge for respondents in the experimental group from pre- to posttest, $t(12) = -2.49$, $p = 0.028$, while the change for the control group was not significant $t(13) = -0.14$, $p = 0.90$. In other words, a trend was found for development of procedural knowledge for teachers participating in the experimental group.

Metacognitive knowledge was measured using a self-reporting measurement tool in which teachers of the experimental group reflect individually on the development of metacognitive knowledge. Results of the self-reflection are presented in Figure 5 and indicated positive development of metacognitive knowledge categorized by metacognitive strategies:(1) evaluation, (2) monitoring, and (3) planning for a majority of the teachers.

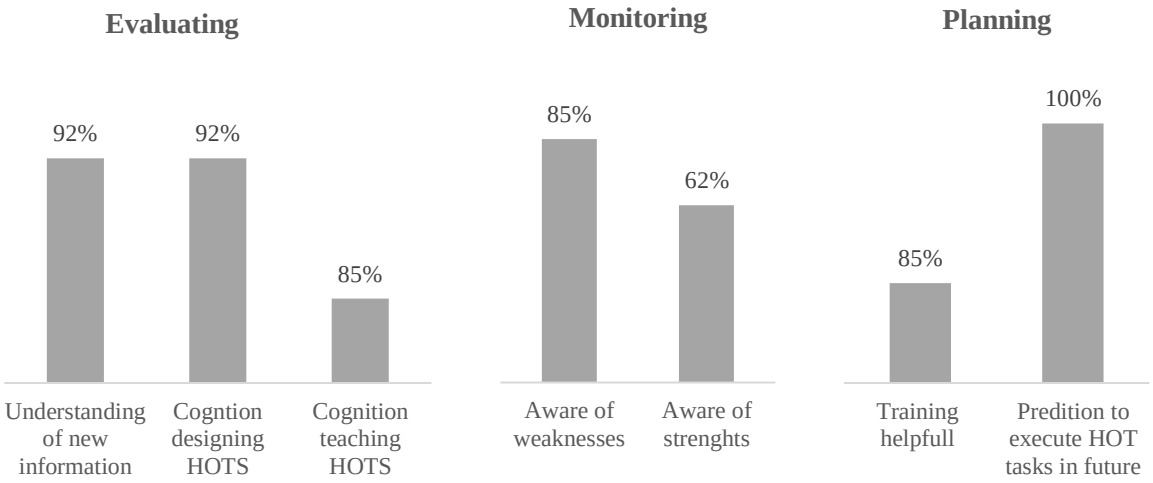

Figure 5. Percentages of teachers in the experimental group reporting positive development of metacognitive knowledge dimension categorized by evaluating, monitoring and planning components (N = 13).

As evaluation indicated the transfer of the training, 92% percent of teachers reported positive development of cognition on designing and understanding HOTS, supported by examples of comments of teachers as "*Bloom's Taxonomy Scheme helped me designing tasks*" and "*Practical tips and examples helped me understand teaching HOTS".* Additionally, 85% of the teachers self-reported positive development of cognition on teaching HOTS in practice.

At monitoring-level, teachers reported on control of own's cognitive systems. 85% of the teachers reported positively on the discovery of weakness with examples as "*difficulties remembering theories*" and "*requiring more practice*". Strengths on metacognitive development for teaching HOTS are positively valuated by 62% of the teachers with examples as "*creative thinking*" and "*curiosity*".

The metacognitive strategy planning is valued to indicate teachers' cognitive awareness for adaptation of behavior. As 85% of the teachers acknowledged the training to be helpful for future classroom practice, each teacher that engaged in the professional development training plans to teach HOTS in future classroom practice (100%). Comments on planned adaptation of behavior were:

"*being aware of importance teaching HOTS*", "*acknowledging the value of exchanging experience with colleagues*" and "*important to teach HOTS for students' future private and professional life*".

Thus, based on self-reported measurement, teachers engaging in the professional development training valued the development of their metacognitive knowledge positively.

To summarize, teachers who engaged in the professional development training did not develop more factual, conceptual and procedural knowledge, compared to teachers from the control group. Although procedural knowledge dimension did show a trend for improvement for the experimental group, the training had no significant effect. Nonetheless, the majority of the teachers in the experimental group self-reported positive development of metacognition as result of the professional development training.

Attitude

Regarding attitude toward teaching HOTS, we measured teachers' cognitive beliefs and perceptions of behavioral control. The results of the study on the component of attitude are presented in Table 3 and corresponding Figure 6. Table 3 shows descriptive statistics on each attitude component (i.e., perceived relevance, beliefs about low achieving students, self-efficacy and context-dependency) for both the experimental and control condition. Figure 6 shows the graphical presentation of the mean pre- and posttest score of the experimental condition (Fig. 6a) and the control condition (Fig. 6b). The effects of the training were investigated using univariate repeated measurement ANOVA for each attitude component, reporting the interaction effect (see Table 4) between time (pre- and posttest) and condition (experimental and control).

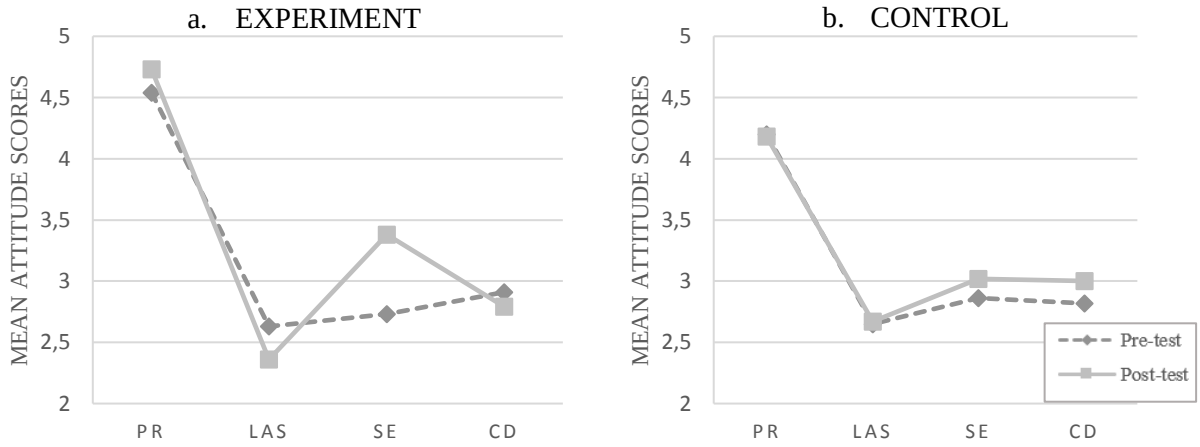

Figure 6. Mean scores pre- and posttest measurement on each attitude component: perceived relevance (PR), beliefs about low-achieving students (LAS), self -efficacy (SE) and context-dependency (CD).

The univariate analysis for the component perceived relevance did not show a statistically significant interaction effect between time and condition, $F(1, 25) = 1.09$, $p = 0.31$. By exploring data using paired *t*-tests, a trend for development of perceived relevance is found for the experimental group, $t(12) = -2.54$, $p = 0.026$. This trend was absent in the control group for pre- and posttest, $t(13) = 0.099$, $p = 0.92$. This means that, as a result of the training, teacher's believes towards perceived relevance for teaching HOTS positively changed for experimental group.

There was no statistically interaction effect of time and condition for the beliefs about low achieving students, $F(1,25) = 0.82$, $p = 0.37$. Additional paired *t*-tests showed no significant difference in attitude towards low achieving students from pre- and posttest for both experimental group, $t(12) = 1.40$, $p = 0.19$, and control group $t(13) = -0.05$, $p = 0.96$. Meaning that teachers from both groups did not change their belief towards student-ability of low-achieving students.

The univariate analysis showed a statistically significant interaction effect of the training on self-efficacy, $F(1, 25) = 5.23$, $p = 0.031$, $\eta^2 = .17$ for the experimental group. The effect size is large

(Cohen, 1988) as 17% of the variance was accounted for by the professional development training. The effect of the training was supported by paired *t*-tests showing a significant change in self-efficacy for the experimental group, $t(12) = -3.13$, $p = 0.009$, while the statistically significant effect was absent for the control group, $t(13) = -1.53$, $p = 0.15$. This means that only the teachers from the experimental group showed increased self-efficacy as a result of the training.

The univariate analysis for the component context-dependency did not show a statistically significant interaction effect, $F(1, 25) = 1.42$, $p = 0.25$. Although a trend, i.e., a decrease within valued context-dependency for the experimental group was found, the change showed no significant difference, $t(12) = 0.92$, $p = 0.38$. Teachers' context- dependency in the control group increased, though non-significant $t(13) = -0.86$, $p = 0.40$. Meaning that the professional development training did not affect teachers' context-dependency towards teaching HOTS.

To sum up, the professional development training positively affects teachers' self-efficacy. Compared to teachers from the control group, teachers who engaged in the training increased their self-efficacy regarding teaching HOTS. The attitude components perceived relevance, beliefs about low-achieving students and context-dependency did not significantly change after participation in the training

Behavioral Intention

The result of the study on behavioral intention are presented in Table 3 and corresponding Figure 7. Table 3 shows descriptive statistics on behavioral intention for both experimental and control condition. Figure 7 shows the graphical presentation of the mean pre- and posttest score of the experimental condition and the control condition. The effects of the training are investigated using univariate repeated measurement ANOVA, reporting the interaction effect (see Table 4) between time (pre- and posttest) and condition (experimental and control). Results of the interaction effect are presented in Table 4.

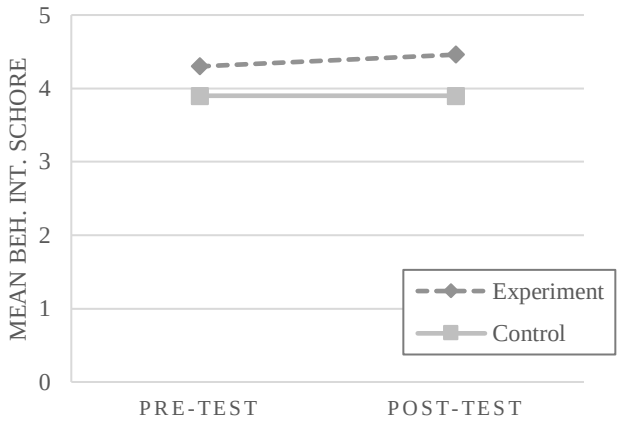

Figure 7. Mean scores pre- and posttest measurement on behavioral intention for experimental and control group.

The univariate analysis of the interaction between time and condition for the component behavioral intention did not show a significant effect, $F(1, 25) = 1.61$, $p = 0.22$, $\eta^2 = .060$. Additional paired *t*-tests showed no significant difference in behavioral intention from pre- and posttest for both experimental group, $t(12) = -1.57$, $p = 0.14$, and control group $t(13) < 0.00$, $p = 1.00$. Meaning that,

conflicting with the hypothesis, the professional development training had no effect on teacher's behavioral intention to teach higher-order thinking.

In conclusion, we found no effect of the professional development training on primary school teachers' factual, conceptual and procedural knowledge. Although the interaction effect for conceptual knowledge is significant, additional post-hoc tests showed that this interaction effect is neglected as both groups did not significantly change their conceptual knowledge over time. The seeming interaction effect for conceptual knowledge can be explained by the opposite effect for both groups over time as score for experimental group increased while score for control group decreased. This conflicts with our hypotheses since the experimental group was expected to increase knowledge compared to unvaried control group.

Nevertheless, we did find an effect for teachers' self-efficacy as a result of the training. Meaning that teachers in the experimental group felt more confidence and able to teach higher-order thinking skills after participation in the professional development training. Evaluating teachers' metacognitive knowledge, teaches reported to be more capable of teaching HOTS once provided with examples and materials. This explains the small, though non-significant, increase for primary school teachers' behavioral intention to teach higher-order thinking as teachers felt more capable to teach higher-order thinking.

To summarize the results, we found no significant effect for development of teachers' factual, conceptual and procedural knowledge and behavioral intention to teach higher-order thinking skills. Nevertheless, teachers' participating in the experimental group self-reported positively on development of metacognitive knowledge. Moreover, though beliefs about perceived relevance, low-achieving students and context-dependency did not change, teachers' self-efficacy beliefs regarding teaching HOTS is positively influenced by the professional development training.

Discussion

In this study, we evaluated the impact of a newly-developed two-day professional development training designed to improve primary school teachers' knowledge, attitude and behavioral intention towards teaching HOTS. As we did not include Bonferroni correction, we must be careful when interpreting results. Nevertheless, the results of the study partially support our hypotheses, indicating that the training has a positive effect on teachers' metacognitive knowledge and attitude toward self-efficacy for teaching higher-order thinking in primary schools.

The results of the post-hoc paired-*t*-tests showed significant changes for the factual knowledge dimension, the attitude toward perceived-relevance, and the attitude toward self-efficacy for the experimental group. However, most of the univariate ANOVA tests showed no interaction effect between time and condition. The small sample in both experimental ($N = 13$) and control ($N = 14$) condition is assumed to be causing the lack of interaction effect for the components. Nonetheless, we did find a significant interaction effect for self-efficacy as a result of the training.

Knowledge

We hypothesized increased knowledge at all knowledge-dimensions (Bloom, 1965) as a result of the training. Although factual, conceptual and procedural knowledge increased in experimental group, the results of the univariate analyses did not show statistically significant interaction effect for those knowledge dimension, combining effect of time and condition.

Worth noting is the relatively low score on pre-test measurement for each knowledge dimension for both conditions. This supports findings in literature, demonstrating that teachers' knowledge in the context of higher-order thinking is generally low (Zohar, 1999; Retnawati et al., 2018). During the first training session, only few poor descriptions of HOTS were found. Results

support previous findings of Retnawati et al. (2018) showing that teachers find it difficult to give a clear definition of the term higher-order thinking. As the low score on pre-test left room for improvement, an increased score for each knowledge dimension was expected and accordingly found for respondents from the experimental group.

Voluntary participation in the intervention seems to have effect on the development of knowledge dimensions. Previous studies on teacher professional development indicated that teachers who do not voluntarily participate in interventions tend to lack content knowledge (Desimone, Smith, & Ueno, 2006) as they do not connect with the subject-matter. It is expected that teachers in the experimental group signed up for the intervention because they already connect with the subject-matter and possess basic knowledge of HOT. This is supported by higher mean score on pre-test for all knowledge dimensions of experimental group. Moreover, teachers participating in the intervention are expected to be motivated learners (Borko, 2004) as the majority is eager to explore new ideas when volunteering for professional development (Fishman, Marx, Best & Tal, 2003). Accordingly, results show indeed a greater (non-significant) improvement for experimental group on knowledge.

On the contrary, respondents of the control group also increased their score, though minimally, on post-test (M = 3.57) compared to pre-test (M = 2.21) for the factual knowledge dimension. This effect can be explained by raised awareness in the control group, commonly referred to as the Hawthorne-effect (Mayo, 1933), suggesting modified behavior as a result of the awareness of being studied. Nevertheless, in the current study we agree with previous studies, assuming that the impact of social desirability is minimal when questionnaires are anonymous (Armitage & Conner, 1999).

An explanation for the results for development of knowledge can be found in the timespan of the study. Although we deliberately designed the training to be short, it takes time for teachers to learn and change (Desimone, 2002). The relatively short time between the sessions can be explanatory for

the lack of transferred of knowledge as time for practice and implementation are important for effective professional development (Timperley, 2008). Nevertheless, the few take-home assignments that were completed individually were of high quality (see Appendix X). Furthermore, some of the teachers were able to teach the HOTS-assignments in classroom environments with their students. Those teachers noted that the assignments were successful in classroom practice as students became more critical and creative during these assignments. These findings support statements from introduction, concluding that teacher professional develop has a large effect on the quality of education and learners' achievement (Whitworth & Chiu, 2015). Hence, the effect of the assignments is considered to stimulate teachers' continuous future development of knowledge in teaching HOTS.

Another important discussion point is the instrument used for measuring knowledge. As the questionnaires entail self-reported measurement, we do not measure actual classroom practices. Although group discussion attributes to the skill of self-reflection (Civitillo, Juang, Badra, & Schachner, 2019), results from self-reporting measurements could differ from actual implications. Due to limited assessment time in this study, the practical implementations were not studied.

To conclude, although, except for metacognitive knowledge, the results did not support our hypotheses on increased knowledge, based on teachers' statements in the evaluative session of the training, we value the results as promising. Future research should extend training duration and include measurement of actual behavior as a result of the TPD-program to investigate effectiveness.

Attitude

In the current study, we hypothesized a change in attitude as a result of the professional development training. We expected increased values for attitude components perceived relevance and self-efficacy. We believe teachers will acknowledge the importance of teaching HOTS when informing them on

developments in future labor market. As we provide respondents with practical information and opportunities to share professional development in a learning community, we expect teachers to increase self-efficacy as a result of the training. Accordingly, we hypothesized decreased values for attitude components beliefs about low-achieving student ability and context-dependency. Teachers in the professional development training are provided with examples on HOTS-assignments focusing on all students, hence decreased attitude towards ability from low-achieving students towards higher-order thinking is expected. Finally, we believed teachers' context-dependence decreases as a result of the training since the training focusses on teacher's ability to design HOTS-assignments individually by providing teachers with theoretical and practical information.

Since teachers acquire beliefs through professional development experiences (Gaines et al., 2019), the findings on attitude are promising. Respondents of the experimental group valued the effects of the training based on their experience. Though not show significant, teachers in the experimental group did decrease their value toward the attitude components: beliefs about low-achieving students (M = - 0.27), context-dependence (M = - 0.12), and increased the value towards the attitude component: perceived relevance (M = + 0.12) and self-efficacy (M =+0.65).

The latest was found significant, meaning that teachers' self-efficacy (i.e. perceived control and self-confidence) in teaching HOTS increased as a result of the training. As previous studies indicated that most teachers' feel insufficiently competent to teach HOTS (Ivie, 1998; Zohar & Schwartzer, 2005; Thijs et al., 2014) and self-efficacy is one of the major antecedents of behavioral intention and actual behavior (Fishbein & Ajzen, 1975), we consider the significant effect on teachers' self-efficacy as a result of the professional development training valuable. Though mean scores on self-efficacy in this study remained relatively low, evaluative session of the training acknowledged the appreciation for increased self-efficacy by teachers. Most of the statements concerned increased self-

efficacy due to practical tips and materials. These results support previous studies suggesting that provided teaching materials and strategies support teaching HOTS (Collins, 2004).

Previous studies on the attitude component perceived relevance indicated that primary school teacher's believes on perceived relevance towards teaching HOTS is improvable (Zohar et al., 2001; Ivie, 1998). Nevertheless, in this study, respondents' attitude towards perceived relevance was already valued relatively high at pre-test for both experimental and control group. Moreover, respondents in the experimental group increased their value toward perceived-relevance to $M = 4.73$ at post-test measurement. Statements from teachers in the experimental group as "*These skills are necessary in the 21st century*" support teachers' positive attitude towards perceived relevance. Based on these findings, conflicting with previous studies on perceived-relevance for teaching HOTS, we assume that teachers' attitude towards perceived-relevance is generally high.

Furthermore, we found relatively high score on beliefs about low-achieving students for both experimental and control group. Meaning that, conflicting with Zohar et al. (2001), primary school teachers in this study believe that teaching HOTS is also appropriate for low-achieving students and primary school teachers do not only value high-achieving students as capable independent thinkers.

A possible explanation for the non-significant interaction effect between time and condition for attitude components can be found in teachers' perceptions of TPD. Not all teachers change as a result of professional development in the same intensity (Fennema et al., 1996), since learning in studied to be an uncertain process (Borko, 2004). During the professional development training, teachers are confronted with required change in their teaching practices (Darby, 2008). Resultingly, teacher development is often limited by emotions as anxiety or fear (Gaines et al., 2019) Also, teachers could associate professional development trainings with unpleasant feelings towards development based on previous experiences (Gaines et al., 2019).

On the contrary, we considered well-being of respondents when designing the professional development training as we established a culture of trust to increase effectiveness of the training (Van Geel, Keuning, Visscher, Fox, 2016). In this study, teachers formed a learning community while trained in stimulating higher-order thinking at their own school locations with colleagues, thus in a familiar environment. Teachers from the experimental group acknowledge the value of collaborative interactions when examining and improving their practice (Borko, 2004). We believe we established a positive social learning community in a familiar environment since teachers commented on the community with statements such as "*I appreciate the brainstorming on assignments with colleagues"* and "*Sharing thoughts helps me designing tasks"* during the evaluative session.

To conclude, as the training was developed to train teachers on designing and executing HOT-assignments, we are pleased by the statistically significant effect of the training on teachers' self-efficacy. The development of a more positive attitude towards self-efficacy is supported by teachers in the evaluative session of the training with statements as "*The practical examples helped me teaching HOTS in my class*". Though non-significant, results on perceived-relevance, beliefs about low-achieving students and context-dependency are promising as trends in development are found and should be studied in future research.

Behavioral Intention

At the beginning of this study, both experimental (M = 4.30) and control (M = 3.90) conditions scored high on pre-test measurement (on a scale from 1 to 5) of behavioral intention. High score on pre-test measurement restrains room for improvement on post-test measurement. Though, results showed a relatively small trend for development of behavioral intention in post-tests for experimental group.

However, despite room for improvement, the trend in developing behavioral intention was absent in the control group. In other words, respondents in the experimental group increased their behavioral intention while behavioral intention from respondents in the control group remained the same.

The relatively high score on behavioral intention can be explained by supporting literature on behavioral intention. Namely, behavioral intention is studied as the motivation required to behave particularly (Armitage & Christian, 2003). Results from pre-tests show that teachers already were motivated to teach HOTS. Motivation for particular subject could explain voluntary participation in the current study (Van Aalderen-Smeets & Walma van der Molen, 2015). During the evaluative session, teachers support this finding as they wanted to stimulate HOTS but experienced practical limitations as lack of time or lack of perceived control before attending the training. So, behavioral intention does not always lead to actual behavior (Fishbein & Ajzen, 1975). As the current study did not include measurements on actual behavior, future research should investigate effects of professional development programs on actual behavior.

Thus, although the improvement on behavioral intention is minimal we do assume that teachers from experimental group are likely to transform behavioral intention into behavior as some of the teachers already did. During the evaluative session, this transfer is supported by teachers' statements such as "*I acknowledge the importance of teaching HOTS*" and "*These assignments stimulate students' enthusiasm and involvement*". Based on these finding, we expect that behavioral intention is predicative for behavior, as we eliminate limitations such as lack of knowledge.

To summarize, in line with findings from previous studies, results from this study demonstrate that behavioral intentions are determined by attitudes (Armitage & Cristian, 2003) and knowledge (Zohar & Schwartzer, 2005). As the increase of values on knowledge dimensions and the change on attitude

components for the control group was absent, teachers' behavioral intention did not change. Likewise, though non-significant, the positive development of knowledge and change of attitude in the experimental group synchronizes with the positive development of behavioral intention. In other words, results suggest that development of knowledge as a result from professional development trainings, synchronize with an effect in attitude and an effect in behavioral intention can be expected.

Conclusion

The aim of this study was to evaluate the effects of a newly developed two-day professional development training on primary school teachers' knowledge, attitude and behavioral intention toward teaching higher-order thinking skills to contribute to scientific research base on professional development trainings. As we conclude, a few limitations for this study must considered accordingly.

One of the limitations is having a small sample size at $N = 27$, representing six primary schools in the Netherlands. Due to small sample size, the result limit the transferability to other teacher populations. We must be careful when generalizing the effects of professional development training on teaching HOTS, as effects are less likely to transfer to larger populations. Due to limited time span and relatively low application of voluntary participation, we were unable to include more respondents.

The disappointing registration for free professional development training in primary schools support the findings in literature, suggesting that participation depends on contextual factors (Nordlöf et al., 2017) as time (Thijs et al, 2014). When consulting over twenty-five primary schools and pre-service teacher-training courses, unfortunately, the most common used reason for refusal was lack of time. Due to limited number of respondents, we were unable to randomly assigning participating schools to experimental and control group in this study.

Therefore, voluntary participation in the experimental group is considered to be a limitation of this study as teachers participating in such experiments, are likely to be motivated learners (Borko, 2004). Although other studies argued respondents in control group behaving socially desirable in research correspondingly (Mayo, 1933), in this study, we agree with Armitage and Conner (1999) acknowledging that the impact of social desirability in anonymous questionnaires on models as planned behavior is minimal.

Lastly, the timespan of the study tends to have a negative effect on the results. Although the trainings were deliberately designed to be short to overcome practical limitations as lack of time (Thijs et al., 2014), we experienced that it takes time for teachers to learn and change (Desimone, 2002). These findings are in line with previous studies on TPD, stressing the importance of transfer time in professional development (Borko, 2004; Timperley, 2008). Both limited time and practical implications as holidays reduced transfer of knowledge, as the timespan was only two weeks.

Nonetheless, this study provide evidence on teachers' intention to teach higher-order thinking in primary schools as scores on behavioral intention are relatively high. Similar to literature on teachers' willingness to teach HOTS (Thijs et al, 2014; Ivie, 1998; Zohar & Schwartzer, 2005), findings of this study showed positive development of attitudes as predictor for increased behavioral intention (Ajzen & Fishbein, 2000). In fact, answering the research question, we can conclude that teachers' self-efficacy on teaching HOTS are positively developed as a result of the newly developed short TPD-program.

Despite potential limitations, we value the present study as contributive to the limited research base on professional development of teaching higher-order thinking skills in primary education. We gained more in-depth understanding of teachers' knowledge, attitude and behavioral intention toward teaching higher-order thinking. The results of the study are promising as we found significant effect

for self-efficacy development within a relatively short time span. Future research is necessary to further investigate actual practical implications and student achievements as a result of professional development programs on higher-order thinking skills.

In practice, teachers in primary education benefit from practical tips and tricks provided in the intervention such as overviews of useful questions and assignments on stimulating higher-order thinking in classroom practice. The main practical contribution of this study is the videotaped training, as a useful tool in creating awareness and understanding for the importance of teaching higher-order thinking skills in primary schools. This tool stimulates acknowledgement on including higher-order thinking skills in primary school curricula, which is needed to prepare young individuals for challenging daily and future lives.

Acknowledgements

We express our gratitude and appreciation to all schools voluntary participating in this study and contributing to the research base on teachers' professional development. The enthusiasm and eagerness during training-sessions were both motivating and pleasing in researching the effectiveness of the newly developed short professional development training.

I like to thank Prof. dr. Juliette Walma van der Molen and Frances Wijnen, MSc for support and cooperation in this research, which truly contributed to the development of own learning in Educational Science.

At last, we want to end wishing for further implementation of higher-order thinking skills in primary schools' curricula as we believe education is not the learning of facts but training the mind to think (Albert Einstein).

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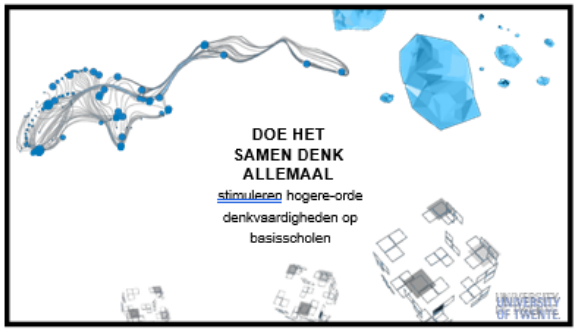
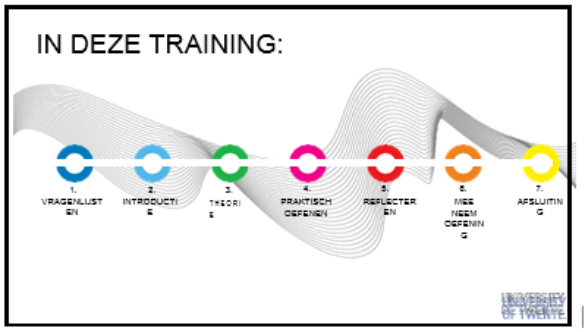
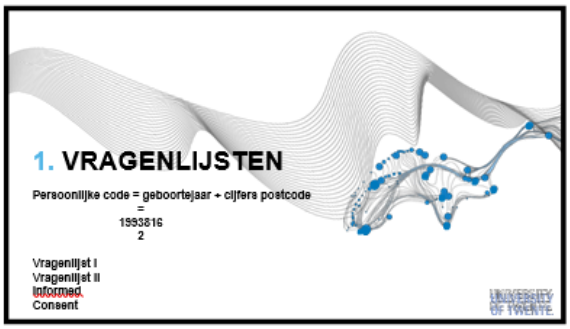
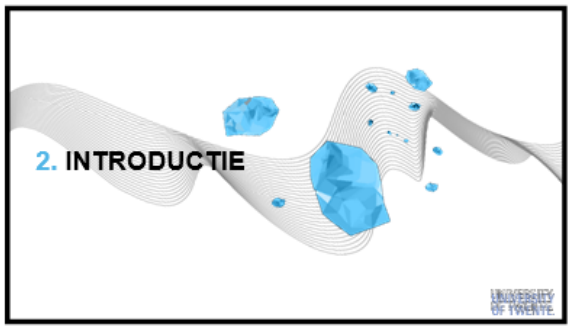
Appendix I

Handouts Meeting One









3. THEORIE

. HOGERE-ORDE DENKEN

- Definitie
- De complexe cognitieve vaardigheden: **analyseren, evalueren en creëren**, om te komen tot een oplossing, beslissing, voorspelling, oordeel of product.
- Kritisch denken
- Creatief denken
- Probleem oplossen

. LAGERE VS HOGERE ORDE

ONTHOUDEN	BEGRIJPEN	TOEPASSEN
VRAGEN	VRAGEN	VRAGEN

. LAGERE VS HOGERE ORDE

ANALYSEREN	EVALUEREN	CREËREN
VRAGEN	VRAGEN	VRAGEN

. TOEPASSING

- Alle leerlingen
- Alle leeftijden
- Alle vakken
- Ontwikkeling complexe cognitieve vaardigheden

. ONDERWIJS

LESOMSCHRIJVING	Insecten - Biologie
ANALYSEREN	Kies insecten uit die je het best vindt passen bij onderstaande vergelijkingen: Zoliefalseen… Zosnelalseen … Zoslimalseen …
EVALUEREN	Als jij een insect zou zijn, welk insect zou je zijn en waarom? Geef tenminste vijf redenen
CREËEREN	Combineer delen van verschillende insecten met elkaar en creëer zo een nieuw insect. Maar een tekening van het nieuwe insect en beschrijf de

Bron: Ongepubliceerd

. ONDERWIJS

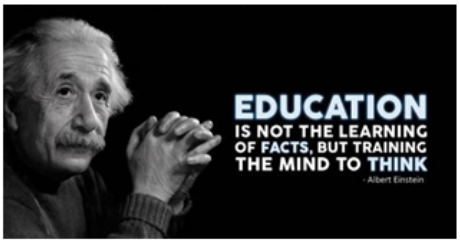
LESOMSCHRIJVING	Oceanen - Aardrijkskunde
ANALYSEREN	Vergelijk een oceaan met een: .. maar .. zoals .. zoals Wat zijn de overeenkomsten en verschillen?
EVALUEREN	Je gaat een lange bootreis maken op een kleine boot. Je kunt maar vijf van de volgende items meenemen. Wat kies je en waarom? - Roeispaan - Reddingvest - Anker - Deken - Kompas - Voedsel - Verbanddoos - Zakmes - Boek

Bron: Ongepubliceerd

. ONDERWIJS

LESOMSCHRIJVING	Sommen ontdekken – Rekenen
ANALYSEREN	Houd een onderzoek in je klas om te weten welke rekensommen moeilijk gevonden worden in je klas. Maak een grafiek van de resultaten.
EVALUEREN	Kies uit de grafiek de rekensommen die jij het moeilijkst vind.
CREËEREN	Maak een spel (bijv. quiz / raadsel) over de moeilijkste sommen. Maak hier een spelbeschrijving van en presenteer deze aan de rest van je klas.

Bron: Bloomblocks



4. PRAKTISCH OEFENEN

. WERK SAMEN. DENK ALLEMAAL

Alternatieve Sporten
Hoger-orde denken vraagstuk

- 5 alternatieve sporten
- 1 sportzaal

Individueel- en groepsonderdeel

. WERK SAMEN. DENK ALLEMAAL

- Analyseren
  Wat is er nodig voor___?
- Evalueren
  Zou het beter zijn om…?
- Creëren
  Zie je een oplossing voor …?

Presentaties ONTWERP en DENKPROCES

PRESENTATIES ONTWERPEN & DENKPROCESS

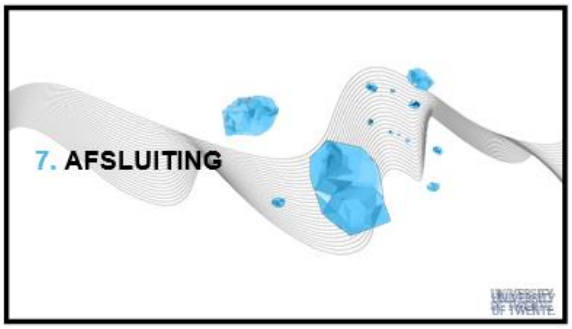
5. REFLECTEREN

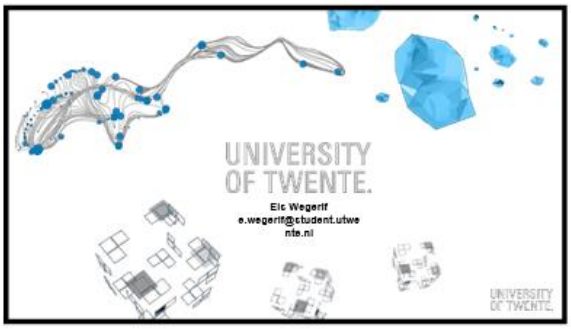
. Aan het denken gezet?

- Verschillen
- Overeenkomsten
- Hoe zou je het een volgende keer doen?


6. OEFENING NA TRAINING


. EIGEN ONTWERP
Hoger-orde denken basisonderwijs
Eigen onderwerp in klas
Duo's
Kies jullie uitdaging
Presentatie in volgende training sessie


7. AFSLUITING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Appendix II
Meeting One Assignment

HOGERE-ORDE DENKVRAAGSTUK
MULTIFUNCTIONELE SPORTZAAL

Probleem

Er wordt verwacht dat basisscholen voldoende tijd vrij maken om leerlingen te laten bewegen. Op de meeste scholen is een (kleine) sportzaal aanwezig. Deze zaal biedt voldoende ruimte voor eenvoudige sporten en spellen als trefbal of tikkertje. Maar zou het niet leuk zijn om leerlingen in contact te brengen met meer nieuwe sporten, om ze te laten ontdekken welke sport bij hen past?! Helaas is er bij de meeste basisscholen hier geen ruimte voor beschikbaar.

Opdracht

Ontwerp samen met groepsleden een multifunctionele sportzaal waarin verschillende nieuwe sporten beoefend kunnen worden. Daarnaast moet de sportzaal ook functioneel zijn voor toneelstukken, opvoeringen en uitreiking evenementen.

De volgende sporten moeten uitgeoefend kunnen worden in de sportzaal:

- Bootcamp
- Quidditch
- 360-ball
- Onderwaterhockey
- Bosaball

Voorwaarden

In de sportzaal moeten minstens 5 verschillende sporten beoefend worden.

De sportzaal bestaat enkel uit één ruimte.

Materiaal moet ergens opgeslagen worden.

De veiligheid van leerlingen en leerkrachten moet gewaarborgd worden.

Het design moet uitvoerbaar zijn.

Werk samen. Denk alleen.

Analyseer – Wat heb ik nodig voor …?

Evalueer – Zou het beter zijn om …?

Creëer – Zie je een oplossing voor …?

Appendix III
Meeting One – take home assignment

HOGERE-ORDE DENKVRAAGSTUK
EIGEN ONTWERP

Tijdens de korte training over het stimuleren van hogere-orde denkvaardigheden, heeft u kennis opgedaan over het concept hogere-orde denken en de mogelijke toepassingen hiervan.

Tijdens de eerste sessie hebben wij een voorbeeld van een hoger-orde denkvraagstuk behandeld. Graag wil ik u vragen na de training sessie zelf en hogere-orde denkvraagstuk te ontwerpen. Lukt het om de levels van het hogere-orde denken te verwerken in een eigen ontwerp?

Opdracht opties

De opdrachten dienen in **duo's** uitgevoerd te worden. Kies één van de onderstaande opties of, voor extra uitdaging, voer ze beide uit.

1. Herontwerp bestaand lesmateriaal door hogere-orde denkopdrachten toe te voegen
2. Ontwerp een eigen thematische hogere-orde denk opdracht

(Her)ontwerp zoveel mogelijk opdrachten en presenteer het **ONTWERP** en het **DENKPROCES** tijdens de intervisie bijeenkomst.

Denk aan:
- Het activeren van kennis
- Analyseren
- Evalueren
- Creëren

Werk samen. Denk allemaal.

Appendix IV
Detailed description of characteristics respondents

Personal characteristics	***n***	**Percent**
Gender:		
Female	27	100
Male		
Educational Degree:		
Teacher training Applied Science (PABO)	16	59.3
Teacher Training Academic University (academische PABO)	1	3.7
Applied Science Master	8	29.6
Academic University Master	1	3.7
Shorten teacher training	0	0
Other	1	3.7
Category of job:		
Teacher	27	100
Teaching class:		
Class 1	7	13.7
Class 2	7	13.7
Class 3	2	3.9
Class 4	6	11.8

Teaching class:		
Class 5	4	7.8
Class 6	7	13.7
Class 7	5	9.8
Class 8	6	11.8
Pluss - Class	1	2.0
Student	0	0
Condition		
Experiment	13	48.1
Control	14	51.9

Appendix V
Questionnaire knowledge

VRAGENLIJST I

STIMULEREN HOGERE-ORDE DENKVAARDIGHEDEN

Persoonscode*:

**maak uw eigen code door uw geboortejaar te combineren met de cijfers van uw postcode.*

Deze code wordt gebruikt om data anoniem te verwerken.

Voorbeeld: 1986 1034AB = 19861034

Leeftijd:

Geslacht:

Wat is uw hoogst genoten vooropleiding?

☐ PABO

☐ Academische PABO

☐ HBO Master

☐ Academische Master

☐ Verkorte lerarenopleiding/zij-instromer

☐ Anders

U bent:

☐ Leerkracht op een basisschool

Aan welke groep(en) geeft u dit jaar les? (meerdere antwoorden mogelijk)

☐ Groep 1 ☐ Groep 5 ☐ Plusgroep

☐ Groep 2 ☐ Groep 6 ☐ Anders

☐ Groep 3 ☐ Groep 7

☐ Groep 4 ☐ Groep 8

Naam van de school waar u werkzaam bent:

☐ PABO student

In welk leerjaar zit u nu?

☐ Jaar 1 ☐ Jaar 2 ☐ Jaar 3 ☐ Jaar 4

Naam van de school waar u de opleiding volgt:

De volgende vragenlijst bevat vragen die uw huidige kennis test over HET STIMULEREN VAN HOGERE-ORDE DENKEN**.**
Resultaten van de vragenlijst worden enkel gebruikt om begin- en eindpunt van onderwerp-kennis te meten.
Vul deze vragenlijst volledig in, onvolledige vragenlijsten zullen niet gebruikt kunnen worden voor het onderzoek.

Vraag 1.

Geef in uw eigen woorden de best passende definitie voor de term ‘hogere-orde denken’.

Vraag 2.

De taxonomie van Bloom is één van de modellen die denkvaardigheden onderverdeeld in hoge en lage ordes. Wat zijn de zes levels van deze taxonomie?

Vraag 3.

Omschrijf in uw eigen woorden waarom het van belang is hogere-orde denken te onderwijzen?

Vraag 4.

Welke vakken zouden geschikt zijn voor het stimuleren van hogere-orde denkvaardigheden?

Vraag 5.

Classificeer de volgende vragen als hogere- of lagere-orde denkvragen over het onderwerp seizoenen Kruis het juiste antwoord aan.

1.	Wanneer begint de herfst?	□ hogere-orde	□ lagere-orde
2.	Wat is de relatie tussen de seizoenen en de nat	□ hogere-orde	□ lagere-orde
3.	Wat weet je al over de over de winter?	□ hogere-orde	□ lagere-orde
4.	Wat zijn de voordelen van vakantie in de zomer?	□ hogere-orde	□ lagere-orde
5.	Stel je voor: het wordt in Nederland twee graden warmer. Welk effect zou dit hebben op de seizoenen en de natuur	□ hogere-orde	□ lagere-orde

Vraag 6.

Hieronder volgen twee voorbeelden van traditionele lesopdrachten.

Herschrijf deze opdrachten op een dergelijke wijze dat het hogere-orde denken van studenten gestimuleerd wordt.

1. Geschiedenis.

*Opdracht zoals gepresenteerd aan leerling: "*De Gouden Eeuw, de 17^{e} eeuw, was voor Nederland een periode van welvaart. Wat kun je vertellen over deze periode."

Herziene versie van opdracht voor stimuleren hogere-ore denken:

2. Biologie

*Opdracht zoals gepresenteerd aan leerling: "*Maak een lijst van alle dieren die je in het park kan tegenkomen. Beschrijf van elk dier één uiterlijk kenmerk."

Herziene versie van opdracht voor stimuleren hogere-orde denken:

Appendix VI

Rubric Scoring Questionnaire Knowledge

SCORING RUBRIC

ONDERWIJZEN HOGERE-ORDE DENKVAARDIGHEDEN

Vraag		Maximale Score	Score per omschrijving	Antwoord omschrijvingen
1.	Geef in uw eigen woorden de best passende definitie voor de term hogere-orde denken	3	1 ½ ½	Kritisch denken Creatief denken Probleemoplossend Analyseren Evalueren Creëren Cognitief proces 21ste -eeuwse vaardigheid
2.	De taxonomie van Bloom is één van de modellen die denkvaardigheden onderverdeeld in hoge en lage ordes. Wat zijn de zes levels van deze taxonomie?	6	1	Onthouden Begrijpen Toepassen Analyseren Evalueren Creëren
3.	Omschrijf in uw eigen woorden waarom het van belang is hogere-orde denken te onderwijzen?	3	1	Verandering arbeidsmarkt/ samenleving 21e -eeuwse vaardigheden Technologische ontwikkeling Probleemoplossing
4.	Welke vakken zouden geschikt zijn voor het stimuleren van hogere-orde denkvaardigheden?	2	2	Alle vakken
5.	Classificeer de volgende vragen als hogere- of lagere-orde denkvragen over het onderwerp seizoenen.	5	1	Hogere-orde Lagere-orde
6.1	Herschrijf lesvoorbeeld: Geschiedenis	3	1	Herschreven op niveau: - Analyseren - Evalueren - Creëren
6.2	Herschrijf lesvoorbeeld: Biologie	3	1	Herschreven op niveau: - Analyseren - Evalueren - Creëren
	Totaal te behalen score	25		

Appendix VII
Questionnaire Metacognitive Knowledge

VRAGENLIJST EVALUATIE
STIMULEREN HOGERE-ORDE DENKVAARDIGHEDEN

Persoonscode*:

**maak uw eigen code door uw geboortejaar te combineren met de cijfers van uw postcode.*
Deze code wordt gebruikt om data anoniem te verwerken.

Voorbeeld: 1986 1034AB = 19861034

De volgende vragenlijst bevat vragen over uw professionele ontwikkeling ten opzichte van het stimuleren van hogere-orde denkvaardigheden in het basisonderwijs. In deze vragenlijst worden stellingen en vragen omtrent uw ervaring met de training voorgelegd.
Vul deze vragenlijst volledig in, onvolledige vragenlijsten zullen niet gebruikt kunnen worden voor het onderzoek.

Omcirkel uw keuze

Vraag 1.

Ik heb het gevoel dat ik tijdens de training nieuwe dingen geleerd heb over het concept hogere-orde denken. Ja/ Nee

---

Vraag 2.

Tijdens de training heb ik mijn *zwakke punten* ontdekt ten aanzien van het onderwijzen van hogere-orde denken. Ja/Nee

Namelijk: (ik ben minder goed in…)

Vraag 3.

Tijdens de training heb ik mijn *sterke punten* ontdekt ten aanzien van het onderwijzen van hogere-orde denken. Ja/Nee

Namelijk: (ik ben goed in…)

Vraag 4.

Na het volgen van de training ben ik beter in staat zelf hogere-orde denkvraagstukken te *ontwerpen.* Ja/Nee

---

Vraag 5.

Na het volgen van de training ben ik beter in staat zelf hogere-orde denkvraagstukken te *onderwijzen*. Ja / Nee

---

Vraag 6.

De training heeft voldaan aan mijn verwachting. Ja / Nee

Waarom wel of niet?

Vraag 7.

Ik verwacht in de toekomst meer hogere-orde denkvraagstukken toe te passen in mijn lessen? Ja / Nee

Waarom wel of niet?

Appendix VIII
Questionnaire Attitude and Behavioral Intention

VRAGENLIJST II

STIMULEREN HOGERE-ORDE DENKVAARDIGHEDEN

Persoonscode*:

**maak uw eigen code door uw geboortejaar te combineren met de cijfers van uw postcode.*

Deze code wordt gebruikt om data anoniem te verwerken. Voorbeeld: 1986 1034AB = 19861034

BELANGRIJK: De onderstaande vragen gaan over HET STIMULEREN VAN HOGERE-ORDE DENKEN
Met het stimuleren van hogere-orde denken bij leerlingen bedoelen we het aanbieden van opdrachten, vragen, problemen of dilemma's waarbij kinderen complexe cognitieve denkvaardigheden moeten gebruiken (zoals analyseren, evalueren en creatief denken) om te komen tot een oplossing, beslissing, voorspelling, oordeel of product. Voorbeelden hiervan zijn (1) leerlingen zoveel mogelijk oplossingen laten bedenken voor een gegeven probleem, (2) leerlingen een ontwerp laten maken voor een nieuw nog niet bestaand product (zoals een huis dat geen rechte lijnen heeft), (3) leerlingen voor- en tegenargumenten laten bedenken rondom een stelling om zo een eigen mening te vormen over een bepaald onderwerp.

In deze vragenlijst zijn er geen goede of foute antwoorden, het gaat om uw persoonlijke mening.
Vul deze vragenlijst volledig in, onvolledige vragenlijsten zullen niet gebruikt kunnen worden voor het onderzoek.
Geef aan in hoeverre u het eens bent met de onderstaande stellingen
door op dezelfde regel het nummer te omcirkelen dat het meest met uw mening overeenkomt.

Vraag		Helemaal niet mee eens				Helemaal mee eens
1.	Ik denk dat het cruciaal is voor het leren van leerlingen dat zij worden aangezet tot hogere-orde denken	1	2	3	4	5
2.	Ik ben goed in staat om vragen te stellen aan mijn leerlingen waarmee hogere-orde denken wordt gestimuleerd	1	2	3	4	5
3.	Ik denk dat 'slimme' leerlingen veel beter zijn in hogere-orde denken dan 'zwakke' leerlingen	1	2	3	4	5
4.	Voor mij is extra tijd doorslaggevend of ik wel of geen hogere-orde denken stimuleer bij mijn leerlingen	1	2	3	4	5
5.	Ik beschik over genoeg vaardigheden om mijn lessen te verrijken met hogere-orde denkopdrachten	1	2	3	4	5
6.	Om de ontwikkeling van leerlingen te stimuleren, vind ik dat je niet vroeg genoeg kunt beginnen met het aanbieden van opdrachten waarin hogere-orde denken aan bod komt	1	2	3	4	5
7.	Voor mij is het maken van hogere-orde denkopdrachten voor mijn lessen alleen mogelijk als ik een methode heb waarin beschreven staat wat ik moet doen	1	2	3	4	5
8.	Ik denk dat 'zwakke' leerlingen opdrachten die hogere-orde denken vereisen niet aan kunnen	1	2	3	4	5
9.	Ik ben goed in staat om leerlingen te begeleiden bij het maken van opdrachten waarbij zij aangezet worden tot hogere-orde denken	1	2	3	4	5
10.	Voor mij is de beschikbaarheid van een scholingsprogramma een voorwaarde om hogere-orde denken te stimuleren bij mijn leerlingen	1	2	3	4	5

Geef aan in hoeverre u het eens bent met de onderstaande stellingen
door op dezelfde regel het nummer te omcirkelen dat het meest met uw mening overeenkomt.

Vraag		Helemaal niet mee eens				Helemaal mee eens
11.	Ik denk dat de meeste opdrachten die hogere-orde denken vereisen te moeilijk zijn voor 'zwakke' leerlingen	1	2	3	4	5
12.	Ik denk dat het voor de ontwikkeling van het denken van leerlingen essentieel is om hogere-orde denken te stimuleren	1	2	3	4	5
13.	Voor mij is een pasklaar pakket met voorbeeldmaterialen (bijv. Denksleutels) een voorwaarde om hogere-orde denken aan te moedigen bij mijn leerlingen	1	2	3	4	5
14.	Voor mij is de grootte van de groep bepalend of ik wel of geen hogere-orde denken stimuleer bij mijn leerlingen	1	2	3	4	5
15.	Ik denk dat de meeste opdrachten die hogere-orde denken vereisen frustrerend zijn voor 'zwakke' leerlingen	1	2	3	4	5
16.	Ik ben goed in staat om zelf opdrachten te maken die mijn leerlingen aanzetten tot hogere-orde denken	1	2	3	4	5
17.	Ik denk dat opdrachten die hogere-orde denken vereisen geschikter zijn voor 'slimme' leerlingen dan voor 'zwakke' leerlingen	1	2	3	4	5
18.	Ik denk dat het stimuleren van hogere-orde denken zo belangrijk is, dat alle leerkrachten dit regelmatig moeten doen in hun lessen	1	2	3	4	5
19.	Voor mij is de samenwerking met collega's een voorwaarde om hogere-orde denken te stimuleren bij mijn leerlingen	1	2	3	4	5
20.	Ik denk dat we van 'zwakke' leerlingen weinig hogere-orde denken moeten verwachten	1	2	3	4	5

Geef aan in welke mate de onderstaande stellingen voor u van toepassing zijn
door op dezelfde regel het nummer te omcirkelen dat het meest met uw onderwijspraktijk overeenkomt.

Vraag		**Helemaal niet mee eens**				**Helemaal mee eens**
Ik heb de intentie om…						
21.	… zelf lessen te ontwerpen waarin het hogere-orde denken van leerlingen expliciet wordt gestimuleerd.	1	2	3	4	5
22.	… lessen te geven (zelf ontworpen of uit een lesmethode) waarin het hogere-orde denken van leerlingen expliciet wordt gestimuleerd.	1	2	3	4	5
23.	… leerlingen opdrachten te geven waarbij hogere-orde denken nodig is.	1	2	3	4	5
24.	… vragen te stellen aan mijn leerlingen om hogere-orde denken te stimuleren.	1	2	3	4	5
25.	… mijn leerlingen aan te moedigen in de les om meer dan één oplossing te vinden voor een probleem.	1	2	3	4	5
26.	… mijn leerlingen aan te sporen om een onderwerp vanuit verschillende perspectieven te benaderen (zoals voor- én tegenargumenten laten bedenken).	1	2	3	4	5
27.	… mijn leerlingen creatief te laten denken (zoals het ontwerpen van een nog niet bestaand product).	1	2	3	4	5
28.	… mijn leerlingen te motiveren mijn leerlingen om een fenomeen (zoals hoe kan een vliegtuig vliegen) te onderzoeken.	1	2	3	4	5

Appendix IX
Questionnaire statements categorized by factor

Attitude

Cognitive – perceived relevance

1.	Ik denk dat het cruciaal is voor het leren van leerlingen dat zij worden aangezet tot hogere-orde denken
2.	Om de ontwikkeling van leerlingen te stimuleren, vind ik dat je niet vroeg genoeg kunt beginnen met het aanbieden van opdrachten waarin hogere-orde denken aan bod komt
3.	Ik denk dat het voor de ontwikkeling van het denken van leerlingen essentieel is om hogere-orde denken te stimuleren
4.	Ik denk dat het stimuleren van hogere-orde denken zo belangrijk is, dat alle leerkrachten dit regelmatig moeten doen in hun lessen

Cognitive – beliefs about low achieving students

5.	Ik denk dat 'slimme' leerlingen veel beter zijn in hogere-orde denken dan 'zwakke' leerlin
6.	Ik denk dat 'zwakke' leerlingen opdrachten die hogere-orde denken vereisen niet aan kun
7.	Ik denk dat de meeste opdrachten die hogere-orde denken vereisen te moeilijk zijn v 'zwakke' leerlingen
8.	Ik denk dat de meeste opdrachten die hogere-orde denken vereisen frustrerend zijn v 'zwakke' leerlingen
9.	Ik denk dat opdrachten die hogere-orde denken vereisen geschikter zijn voor 'slim leerlingen dan voor 'zwakke' leerlingen
10.	Ik denk dat we van 'zwakke' leerlingen weinig hogere-orde denken moeten verwachten

Perceived relevance – self-efficacy

11.	Ik ben goed in staat om vragen te stellen aan mijn leerlingen waarmee hogere-orde denken wordt gestimuleerd
12.	Ik beschik over genoeg vaardigheden om mijn lessen te verrijken met hogere-orde denkopdrachten
13.	Ik ben goed in staat om leerlingen te begeleiden bij het maken van opdrachten waarbij zij aangezet worden tot hogere-orde denken
14.	Ik ben goed in staat om zelf opdrachten te maken die mijn leerlingen aanzetten tot hogere-orde denken

Perceived relevance – context dependency

15.	Voor mij is extra tijd doorslaggevend of ik wel of geen hogere-orde denke stimuleer bij mijn leerlingen
16.	Voor mij is het maken van hogere-orde denkopdrachten voor mijn lessen allee mogelijk als ik een methode heb waarin beschreven staat wat ik moet doen
17.	Voor mij is de beschikbaarheid van een scholingsprogramma een voorwaarde on hogere-orde denken te stimuleren bij mijn leerlingen
18.	Voor mij is een pasklaar pakket met voorbeeldmaterialen (bijv. Denksleutels) ee voorwaarde om hogere-orde denken aan te moedigen bij mijn leerlingen
19.	Voor mij is de grootte van de groep bepalend of ik wel of geen hogere-orde denke stimuleer bij mijn leerlingen
20.	Voor mij is de samenwerking met collega's een voorwaarde om hogere-orde denken t stimuleren bij mijn leerlingen

Behavioral intention

21.	Intentie zelf lessen te ontwerpen waarin het hogere-orde denken van leerlinge expliciet wordt gestimuleerd.
22.	Intentie lessen te geven (zelf ontworpen of uit een lesmethode) waarin het hogere-ord denken van leerlingen expliciet wordt gestimuleerd.
23.	Intentie leerlingen opdrachten te geven waarbij hogere-orde denken nodig is.
24.	Intentie vragen te stellen aan mijn leerlingen om hogere-orde denken te stimuleren.
25.	Intentie mijn leerlingen aan te moedigen in de les om meer dan één oplossing te vinde voor een probleem.
26.	Intentie mijn leerlingen aan te sporen om een onderwerp vanuit verschillend perspectieven te benaderen (zoals voor- én tegenargumenten laten bedenken).
27.	Intentie mijn leerlingen creatief te laten denken (zoals het ontwerpen van een nog nie bestaand product).
28.	Intentie mijn leerlingen te motiveren mijn leerlingen om een fenomeen (zoals hoe ka een vliegtuig vliegen) te onderzoeken.

Appendix X
Take-Home Assignments

Aardrijkskunde blok 3: opstarten

Het bevorderen van hoge orde denkvragen

De kinderen gaan een eigen boerenbedrijf ontwerpen in groepjes van 4 (dmv namenstokjes)

Nodig: Grote vellen papier (2x a3)
Stiften

Eerst uitleggen wat een boerenbedrijf is.
Welke soorten heb je? Akkerbouw, landbouw, kippen, koeien, varkens, schapen
Hoe ging het vroeger? Alles met de hand, knechten (geen machines, geen computers)
Hoe gaat het nu? Machines, computers, robots
Wat is duurzaamheid? Milieuvriendelijk, het gaat lang mee, meerdere functies

Opdracht:
Ontwerp een modern boerenbedrijf dat duurzaam, winstgevend en diervriendelijk is.

Bedenk eerst wat voor een bedrijf je wilt ontwerpen:
Akkerbouw, landbouw, kippen, koeien, varkens, schapen

Filmpjes:
Koeientuinen, boerderij van de toekomst
Klokhuis: boerderij toekomst
De circulaire boerderij
Regiotour flevoland boerderij van de toekomst
Wanneer gaan we kweekvlees eten?

Thema "Vieren" groep 4

Maak met je groepje een woordweb van het feest:_____ .

Schrijf zoveel mogelijk woorden op waar je aan denkt bij dat feest.

Kies de 3 belangrijkste kenmerken van dat feest en onderstreep ze.

Bedenk met je groepje een **nieuw** feest. Gebruik hierbij van 3 verschillende feesten 3 verschillende dingen. Bedenk ook 1 nieuw voorwerp of kenmerk bij het nieuwe feest.

Hoe heet jullie zelfbedachte feest?

Welke kleren heb je aan?

Wanneer vier je het feest?

Hoe lang duurt het feest?

Wat eet je?

Waar vier je het feest?

Met wie vier je het feest?

Wat doe je tijdens het feest?

Laat zien hoe het feest gevierd wordt, door het te tekenen en / of er woorden bij te schrijven. Overleg wie het presenteert aan de groep.