Primary school teachers' development of differentiation skills: Comparing skills, teachers' mastery of skills, and factors influencing the development of skills

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Master Thesis

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Abstract

Differentiation is an approach that requires teachers to adjust their teaching to students' needs. In previous research (Van Geel et al., 2018) it was identified which differentiation skills teachers need to master. However, many teachers still cannot adjust their teaching to students' needs, even though education requires teachers to differentiate (Inspectie van het Onderwijs, 2014). To help teachers adapt their teaching to students, insights into the development of teachers' differentiation skills were needed. Therefore, to gain more insight into how teachers develop differentiation skills and which factors promote and this development, this research was conducted. To examine what teachers do to differentiate per phase of a lesson and lesson period, which skills they think are easy and hard to master, and what they think supported and obstructed them in developing the differentiation skills, seven teachers were interviewed. The results led to an extension of the second instrument. To investigate how teachers develop the differentiation skills, the Differentiation Self-Assessment Questionnaire (DSAQ) was used and new items and questions related to influencing factors were added. A total of 288 Dutch primary school teachers filled out the online survey.

To determine the reliability of the DSAQ including the new items, Cronbach's alpha was calculated and the reliability turned out good. It is concluded that, on average, teachers think they master the required differentiation skills well. The skills to conduct diagnostic conversations, set goals with students, and support high-achieving students are mastered to a lower extent by teachers and considered as more difficult skills to master. To examine differences in the mastery of differentiation skills between the beginning and more experienced teachers, between teachers teaching different grades, and between part-time and full-time teachers, analyses were done. Teachers with less than three years of teaching experience think they master differentiation skills to a lower extent than teachers with more than three years of teaching experience. Upper grade teachers think they master differentiation skills to a higher extent compared to other teachers. There is no difference between the mastery of differentiation skills by full-time and part-time teachers. Factors influencing teachers' development of differentiation skills were also described. The most promoting factors are teachers' experiences, their positive attitude and beliefs, and support from Teacher Education. Hindering factors are the lack of time to differentiate, lack of information from Teacher Education, and teachers' lack of knowledge and experience. The insights are valuable for the specification of previous findings on teachers' development and can be used to improve activities for teachers' development of differentiation skills and to increase the effectiveness of differentiation.

Keywords: primary school teachers, differentiation skills, promoting and hindering factors, mathematics

Problem statement

Teachers are alleged to provide all students opportunities to grow in their learning (Smets, 2017). Moreover, the focus in education lies on meeting the different educational needs of all students (Deunk, Doolaard, Smale-Jacobse, & Bosker, 2015) to provide all students opportunities to develop their individual talents (Eysink, Hulsbeek, & Gijler, 2017). Differentiation is described as a method to improve students' learning by providing them activities that are differentiated in content, process, and product and based on the learners' background, environment, interests, intelligence, readiness, pace, and more (Heacox, 2014). Differentiation is a bigger priority than ever due to an increasing degree of students' diversity in many European countries (Gaitas & Martins, 2017; Tomlinson et al., 2003). Nevertheless, many teachers do not know how to adapt their teaching to students (Smets, 2017). In addition, the skills to differentiate are considered as complex skills (Gaitas & Martins, 2017; Smets, 2017; Van Geel et al., 2018). Also in studies in other European countries such as Lower Saxony (Van de Grift, 2013) and Portugal (Gaitas & Martins, 2017), results indicated that many teachers consider the skills to differentiate as difficult skills.

Every year, the Dutch Inspectorate of Education reports which and how many Dutch teachers differentiate in their lessons, how many times teachers differentiate, and when they differentiate during lessons. In half of the lessons observed by the Dutch Inspectorate of Education, primary school teachers did not differentiate sufficiently. Beginning teachers experience challenges in their first teaching years on a daily basis regarding the transfer of differentiation theory into practice. A reason is that they lacked information about differentiation during Teacher Education, as Teacher Education focusses more on knowledge about subjects. Consequently, beginning teachers master the differentiation skills less than more experienced teachers. Nonetheless, even teachers with ten years of teaching experience still struggle with differentiating and do not master all differentiation skills. (Inspectie van het Onderwijs, 2014; Inspectie van het Onderwijs, 2015) Striking is that teachers with approximately three years of teaching experience do not show a huge difference compared to the more experienced teachers regarding mastering differentiation skills. It was also concluded that part-time teachers master differentiation skills less than full-time teachers. Moreover, teachers teaching in lower and upper grades master the differentiation skills less than teachers teaching in the middle grade of primary school. (Inspectie van het onderwijs, 2014)

It is assumed that teachers' development of differentiation skills is a process (Heacox, 2014). Thus, starting teachers will develop differentiation skills over years of experience (Van Casteren, Bendig-Jacobs, Wartenbergh-Cras, Van Essen, & Kurver, 2017) and their confidence in the ability to differentiate will grow over time (Heacox, 2014). However, if teachers are obligated to master general teaching skills before teaching, why would they not be able to master differentiation skills as

soon as they get a job? Additionally, not enough teachers differentiate in their classrooms, even after teaching for several years. So, what do teachers do to gain experience in differentiating in the classroom and become more confident in their ability to differentiate? In order to know what teachers do to develop differentiation skills, it is important that teachers share which differentiation skills they master and what helped them to master these skills, and which skills they are struggling with and which challenges they experience in their process of developing these skills. Identifying this information on teachers' development could lead to the specificity of existing knowledge. In previous research skills necessary to differentiate were described (e.g., Van Geel et al., 2018), the current state of teachers mastering certain differentiation skills was described (e.g., Inspectie van het Onderwijs, 2014), and factors influencing teachers' development of differentiation skills were discussed (e.g., Desimone, 2009). However, the information was incomplete and not specific enough to determine which activities and parts of activities are effective or ineffective for teachers to develop differentiation skills. Thus, to determine how teachers develop the required differentiation skills, research was conducted. The focus of this study lied on gaining insight into how primary school teachers develop differentiation skills and which factors promote and hinder the development of mastering differentiation skills.

Theoretical framework

Differentiation refers to teachers reacting to students' specific needs, readiness to learn, interests, language, prior knowledge, and learning preferences by changing, for instance, the instruction, pace, goals, level, and tasks (e.g., Heacox, 2014; Hall, Strangman, & Meyer, 2003). Dutch primary school teachers differentiate more than in previous years, but they still struggle with providing feedback to their students and adapting lessons to students' differences (Inspectie van het Onderwijs, 2014). So, do teachers really master the skills to differentiate? Which skills are actually required to differentiate effectively? What or who do teachers consult when they want to learn how to differentiate or improve their differentiation skills? Moreover, what challenges could teachers face when developing the required differentiation skills? Researchers such as Keuning et al. (2017), Prast, Van de Weijer-Bergsma, Kroesbergen, and Van Luit (2015), and Van Geel et al. (2018) developed or used instruments to categorise and present important skills to differentiate effectively in a model, and to measure the teachers' levels of mastering differentiation skills. In the literature, also promoting and hindering factors for the development of differentiation skills are listed. Theory on differentiation is mainly focused on mathematics and language lessons.

Required differentiation skills

A cognitive task analysis was performed by Van Geel et al. (2018) to examine the required skills to differentiate. The required skills were categorised into four phases, which are shown in Figure 1. Differentiation starts with the teachers' planning for the upcoming period. Long-term planning includes short-term plans. Short-term plans include deciding for each week or day, depending on the curriculum material the teachers use, what to do in the lessons. Then, it is a matter of carrying the lessons out. After lessons and a period of lessons, evaluations should be done to make new plans for the next lessons and period. (Van Geel et al., 2018)

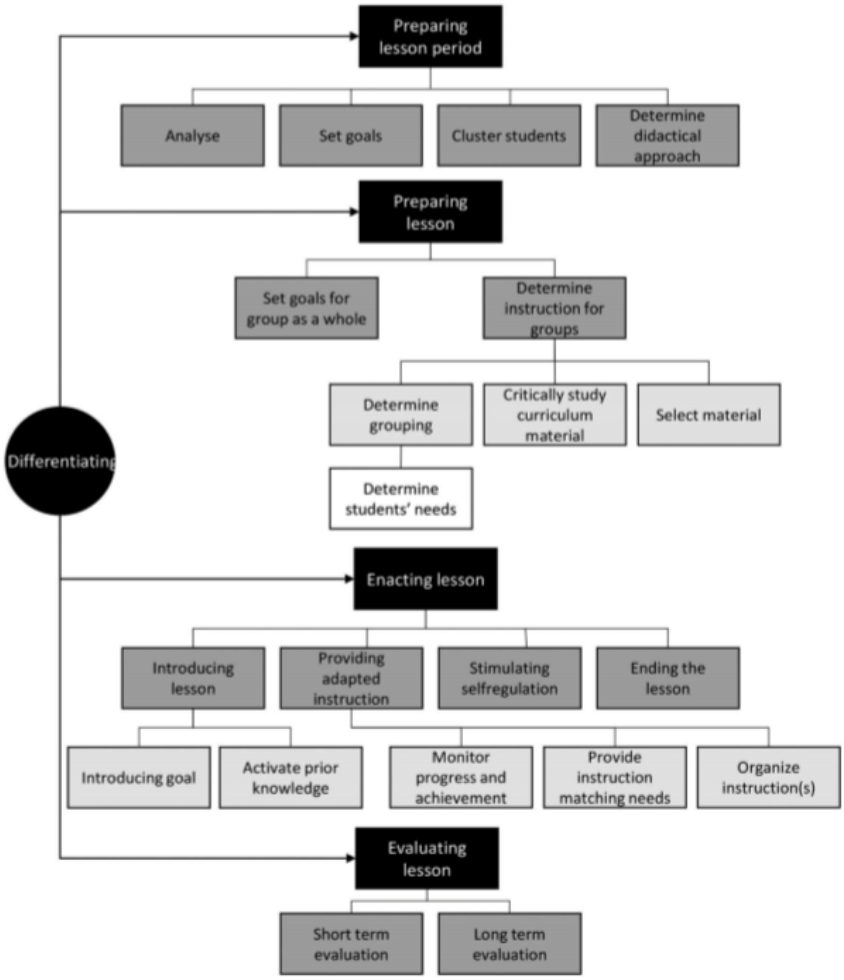

Figure 1. Differentiation skill hierarchy. Adapted from ''Capturing the complexity of differentiated instruction,'' by M. van Geel, T. Keuning, J. Frèrejean, D. Dolmans, J. van Merriënboer, and A. J. Visscher, 2018, School Effectiveness and School Improvement, p. 10. Copyright 2018 by Informa UK Limited, trading as Taylor & Francis Group.

While Van Geel et al. (2018) made an overview of required differentiation skills, Prast et al. (2015) developed a Differentiation Self-Assessment Questionnaire (DSAQ) with strategies to differentiate that are divided over five phases instead of four. The reason for having five phases is that Prast et al. (2015) divided the phase of enacting a lesson into two phases, namely differentiating in instruction and differentiating in practice. The phases are presented and placed as a cycle, as seen in Figure 2, because the steps can be repeated throughout a school year. The term organisation is placed in the middle, as structure and good classroom management are requirements for a successful implementation of differentiation (Prast et al., 2015). Even though the four phases of Van Geel et al. (2018) are not presented as a cycle, they could also be considered as a continuous process. Moreover, the differentiation skills and strategies of both models overlap. Therefore, the four steps with differentiation skills of Van Geel et al. (2018) are discussed and compared with the strategies mentioned by Prast et al. (2018) and other resources (e.g., Keuning et al., 2017).

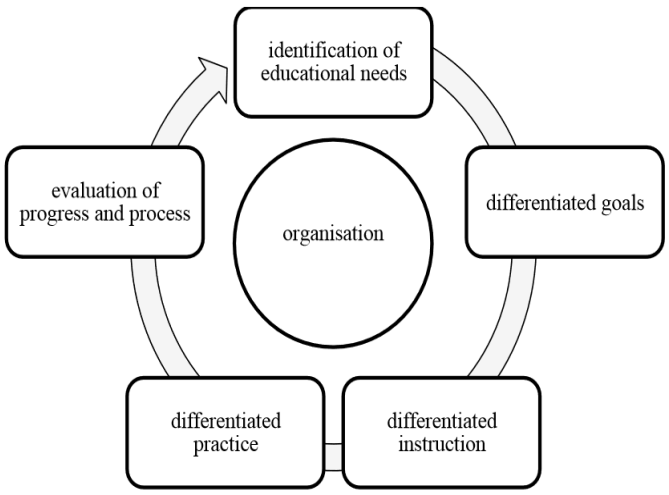

Figure 2. Cycle of differentiation. Adapted from ''Readiness-based differentiation in primary school mathematics: expert recommendations and teacher self-assessment,'' by E. J., Prast, E. van de Weijer-Bergsma, E. H. Kroesbergen, and J. E. H. van Luit, 2015, Frontline Learning Research, p. 98. Copyright 2015 by Emilie Johanna Prast.

Preparing a lesson period

Differentiation requires teachers to analyse students' data and accordingly set flexible, specific, challenging, and realistic goals (Anthonissen et al., 2015; Eysink et al., 2017; Hall et al., 2003; Keuning et al., 2017; Prast et al., 2015; Smit & Humpert, 2012; Van Geel et al., 2018). Analysing students' data will help teachers to identify students' need to make goals more personal. Data of tests, observation of students, students' work, and diagnostic conversations can be used to identify students' educational needs (Prast et al., 2015). Teachers could thereby not only take data concerning students' cognitive background and learning needs into account, but could also focus on other data to respond to students' interests, cultural background, readiness to learn, learning preferences, and motivation (Dixon, Yssel, McConnell, & Hardin, 2014; Rock, Gregg, Ellis, & Gable, 2008; Tomlinson et al., 2003; Van Geel et al., 2018). Additionally, differentiation requires teachers to set various goals, such as long-term goals for a period or year, short-term goals for lessons, goals aimed at the majority of the group, and goals suited for individual students with specific needs (Prast et al., 2015). Knowing and using the opportunities for differentiation, which are stated in curriculum materials, would help teachers set minimum and challenging goals for low- and high-achieving students (Prast et al., 2015).

Teachers can cluster students based on the analyses of test results, goals, and students' learning needs, subsequently to decide which approach is appropriate to use to reach the goals (Heacox, 2014; Keuning et al., 2017; Prast et al., 2015). Flexibility when clustering students for differentiation is important, meaning it should be possible for students to switch groups based on their changing needs (Prast et al., 2015). Teachers could make small groups in different ways. For

instance, using alternately homogeneous and heterogeneous groups is an effective solution (Heylen, 2009). The groups could also each time be based on different characteristics of students (Tomlinson et al., 2003), such as learning preference and motivation. A well-known form of differentiating is grouping students based on their level (Heylen, 2009). However, it is also recommended that teachers create groups based on, for example, students' interests to avoid low expectations from individual students (Lawrence-Brown, 2004).

Preparing a lesson

Differentiation requires teachers to set lesson goals and thereby look critically at the goals from curriculum materials (Heacox, 2014; Keuning et al., 2017; Van Casteren et al., 2017). Working with curriculum materials does not imply that teachers have to or even can follow the stated suggestions of differentiation, as these suggestions are not always accurate and appropriate for all students (Heylen, 2009). Most teachers complement curriculum materials with materials available in the school and online. Teachers can decide on the instruction for the different groups based on their overview and prediction of students' prior knowledge, misconceptions, capabilities, needs, and direction of learning (Heacox, 2014; Keuning et al., 2017; Van Casteren et al., 2017). Moreover, it is suggested that teachers select meaningful materials and learning tasks, with variation in the level of problems, which suit students' specific capabilities, needs, and backgrounds (Heacox, 2014; Tomlinson et al., 2003; Van Casteren et al., 2017), support them to achieve their goals (Keuning et al., 2017; Van Geel et al., 2018), and push them to their limits (Heylen, 2009; Heacox, 2014; Smit & Humpert, 2012; Tomlinson et al., 2003).

Enacting a lesson

The next step to differentiate is introducing the goals and activating students' prior knowledge (Keuning et al., 2017). It is advised that teachers should continuously monitor students' progress in different ways (e.g., observing cues, asking questions), and organise instructions and practice time in a flexible way (Keuning et al., 2017; Van Casteren et al., 2017; Van Geel et al., 2018). Differentiation requires teachers to provide whole-class instructions that include asking questions of different difficulty levels, changing the pace if necessary, giving students time to think, and presenting the content in different ways (e.g., verbal, visual) to reach all students (Prast et al., 2015). Providing an adapted instruction includes providing students multiple examples during instruction for a better understanding, providing media and formats (e.g., digital resources), providing flexible models of skilled performance (e.g., demonstrate knowledge or skills at different levels), using supported practice (e.g., scaffolding), offering choices of content and tools, and providing adjustable levels of challenges (Hall et al., 2003; Van Casteren et al., 2017; Van de Grift, 2013). The practices after the

instruction can also be adapted to students' needs. It is advised to use achievable tasks for the low-achieving students, compact practices for high-achieving students, and challenge the high-achieving students with enrichment tasks (Prast et al., 2015). Moreover, teachers can use websites and computer programmes to let students practise the skills they did not achieve yet and challenge high-achieving students (Prast et al., 2015).

To enable students to acquire and develop knowledge and skills, differentiation requires teachers to create a rich and safe learning environment to support students' learning, collaboration (Van de Grift, 2013), confidence, and independence (Heylen, 2009; Van Casteren et al., 2017). Stimulating students to take ownership of their learning can be done by giving students opportunities to become responsible (Heacox, 2014; Keuning et al., 2017; Tomlinson et al., 2003). Examples of responsibilities are: 1) deciding if they need instruction and practices, 2) what, how, when, how long, and where to learn, 3) how to present the learning gain, and 4) deciding to work alone or in groups (Heacox, 2014; Smit & Humpert, 2012). Furthermore, teachers could let the students work on their own pace (Heacox, 2014; Joseph, 2013; Tomlinson et al., 2003), but give responsibility for the deadlines they give to students (Joseph, 2013).

Evaluating a lesson

The evaluation of lessons refers to teachers evaluating the process, product, and goals to control students' understanding and the effectiveness of the used approaches in order to make decisions for new lessons (Keuning et al., 2017; Van de Grift, 2013; Prast et al., 2015). Evaluating whether the goals are met by the students can be done by analysing test results, students' work, and observations of students, and conducting diagnostic conversations (Prast et al., 2015). Effective reflection with students and colleagues, and assessment contribute to differentiated instruction in a way that the shared data show the impact of the instruction on students' learning and achievements and give an indication of the quality of teachers' teaching (Rock et al., 2008). Furthermore, differentiating teachers are advised to design and use other assessments such as pre-assessments and formative assessments to monitor the learning progress, to provide their students with effective feedback, and to make instructional adjustments during lessons (Rock et al., 2008; Smit & Humpert, 2012; Van Casteren et al., 2017; Van de Grift, 2013).

Teachers across the world mastering differentiation skills

Besides Dutch teachers, teachers in other countries are also differentiating or trying to implement differentiation in their classroom. Studies regarding the mastery of differentiation skills by Dutch teachers and teachers from several countries are discussed and compared.

Dutch teachers' differentiation skills

Teachers nowadays differentiate more than they did five years ago. Although it will always be a challenge to adapt instructions to students' educational needs, 60% of the Dutch teachers are able to adapt their instructions. Also, 78% of the teachers can adapt the practices to students' educational needs, which is 8% more than a few years ago (70%). In addition, teachers use suggestions from curriculum materials to differentiate, compact, and provide enrichment tasks more often. (Inspectie van het Onderwijs, 2018) Five years ago 50% of the schools in the Netherlands showed that in 75% of the lessons teachers master some differentiation skills. Whereas 38% of the schools showed in 75% or more of the lessons that teachers master all differentiation skills (Inspectie van het Onderwijs, 2014). Nevertheless, only 11% of the schools in the Netherlands are judged by the Dutch Inspectorate of Education as schools in which the general didactical skills and differentiation skills are above average quality. The Dutch Inspectorate of Education noticed that the analysis of the needs of individual students, with different needs than the majority of the group, and their guidance stay limited. Moreover, the guidance students receive is most of the time only an additional instruction. Furthermore, teachers test more often but rarely use the information they get from the results. (Inspectie van het Onderwijs, 2018)

Teachers' differentiation skills in other countries

Studies in other countries were conducted to compare teachers' adaptation of their teaching to students' diverse educational needs. For instance, in the study of Van de Grift (2013), the quality of the learning climate, classroom management, instruction, teaching of learning strategies, and adaptation of teaching in mathematics lessons were examined in various countries. The results showed that the average score on adapting the teaching to students' various needs was significantly higher of Dutch teachers than teachers in Flanders, Lower Saxony, and the Slovak Republic. The average score of Slovakian teachers was higher than the teachers in Flanders and Lower Saxony. Relationships between the adaptation of teaching and the characteristics of the teachers and schools were also examined. Results showed that Flemish teachers especially adapted their teaching when they found that students in a group with many different ages were lagging behind and ''when the Flemish teachers had to work with poor arithmetic curricula'' (Van de Grift, 2013, p. 10). Moreover, a relationship was found between the adaptation of teaching, the quality of the curriculum, and student characteristics, only in Flanders. In Lower Saxony, there was a relationship between teachers adapting their teaching and students with another mother-language and the time teachers weekly spent with the students on arithmetic. (Van de Grift, 2013)

In another study, it was examined which differentiation skills were difficult according to Portuguese primary school teachers (Gaitas & Martins, 2017). The Portuguese primary school

teachers considered activities and materials for differentiation, associated with adapting curricular elements (e.g., changing the content students have to learn) to students' characteristics, such as learning preferences and interests, as the most difficult skills (Gaitas & Martins, 2017). Other difficult skills according to those Portuguese teachers were planning and preparing for differentiation, management, and the evaluation of differentiation processes and outcomes (Gaitas & Martins, 2017). In a country outside Europe, Indonesia, teachers' implementation of differentiation were examined (Suprayogi, Valcke, & Godwin, 2017). Suprayogi et al. (2017) reported a high level of the implementation of differentiated instruction by primary school students.

Comparisons based on teachers' characteristics

The inspectorate of the Netherlands (2014) compared different teachers based on a few characteristics. It was concluded that teachers with less than one year of teaching experience or more than twenty years of teaching experience master the differentiation skills less than teachers with more than one but less than twenty years of teaching experience. Many school leaders claimed that they give combinations of groups to beginning teachers, while such groups require more differentiation skills than beginning teachers master. (Inspectie van het Onderwijs, 2014) Additionally, on the one hand, 91% of the just-graduated teachers claimed they are able to react to students' needs. On the other hand, just-graduated teachers did also admit that they rarely respond to students who are ahead or lagging behind in mathematics and Dutch language (Inspectie van het Onderwijs, 2015a). Teachers with one to three, three to ten, and ten to twenty years of teaching experience did not show a huge difference in mastering differentiation skills. In Indonesia, teachers with less than five years of teaching experience showed less adaption of differentiated instruction than teachers with more than five years of teaching experience (Suprayogi et al., 2017).

The Dutch Inspectorate of Education (2014) also found that part-time teachers master differentiation skills less than full-time teachers. The reason might be that full-time teachers have more time and space to practise for differentiation. Besides, teachers who teach in the third group (middle grade) master the differentiation skills better than teachers from the upper grade and teachers from the lower grade. One of the reasons is that curriculum materials for the third group provide a lot of support for differentiation. Differences between middle and lower grade teachers may be due to the combination of two groups in the lower grade or that mainly teachers who teach more than twenty years teach the youngest students. (Inspectie van het Onderwijs, 2014) Moreover, in a following report of the Dutch Inspectorate of Education (2015b) it was concluded that teachers with a certification of Teacher Education scored higher on the mastery of differentiation skills than teachers without a teacher certification. However, teachers with a teacher certification who did a follow-up study did not score better than teachers who only did the Teacher Education

(Inspectie van het Onderwijs, 2015b). Besides, there was almost no difference in mastering differentiation skills between Dutch teachers with big classes, average classes, and small classes (Inspectie van het Onderwijs, 2014). However, it was more common that on schools with more students the differentiation skills of teachers were marked as sufficient compared to teachers in smaller schools (Inspectie van het Onderwijs, 2014). Furthermore, in Indonesia it was found that the bigger a group is, the more the teachers feel the need to differentiate (Suprayogi et al., 2017).

Factors that promote the development of differentiation skills

The process of developing differentiation skills depends on several factors. The categories of promoting factors which repeatedly appeared in previous studies are: teachers' attitude, the presence of particular formal and informal professional development activities, and support from the teachers' environment. First of all, teachers need to be willing to create a clear understanding of differentiation and its importance (Hall et al., 2003; Van Casteren et al., 2017), believe that differentiation will enhance students' learning (Nicolae, 2014), willing to change, and willing to invest time and effort in differentiation (Van Casteren et al., 2017). Changing the attitude towards differentiation also requires teachers to have a growth mindset so they can change and improve their teaching. It was found that the higher a teacher's self-efficacy was, the more positive beliefs a teacher had to implement differentiation (Suprayogi et al., 2017). In addition, teachers need to accept that every student is different (Stavrou & Koutselini, 2016), be convinced that every student has a growth mindset, and that (s)he can learn anything if (s)he is willing to work hard and if (s)he gets support in the learning process on his or her own level (Tomlinson & Imbeau, 2010).

Secondly, professional development activities with certain features can have a positive effect on the development of differentiation. According to Little (1987), teachers' professional development is ''any activity that is intended partly or primarily to prepare paid staff members for improved performance in present or future roles in the school districts'' (p. 491). Professional development can occur in a formal and informal way. The formal way of professional development includes activities that are mainly intentional and arranged, while the informal way refers to less structured development activities, which are most of the time intentional or involving an external person (OECD, 2009).

Formal activities could include training or courses provided by an expert or visitations of other classrooms, schools, or countries. Visiting different spaces helps teachers to discover and try new teaching strategies and to evaluate their own practice (Sprott, 2019). There are five important features of professional development training that influence teachers' beliefs, attitudes, knowledge, and skills (Desimone, 2009). Firstly, content focus of teacher learning refers to activities during training focused on certain content (e.g., subject matter content, how students learn). Secondly,

active learning refers to providing teachers opportunities to be active during professional development training (Desimone, Porter, Garet, Yoon, & Birman, 2002). Thirdly, coherence refers to how much teacher training is in line with teachers' beliefs and attitudes (Desimone, 2009), and how it is integrated into their daily school life (Garet, Porter, Desimone, Birman, & Yoon, 2001). Fourthly, duration refers to activities during the training that are spread over a long time, enough for teachers to acquire knowledge and practise skills. Dixon et al. (2014) concluded that the more hours during professional development training is invested in the differentiation of instruction, knowledge, and practicing skills, the more self-efficacy teachers create to differentiate in their classrooms. Lastly, it is crucial for teachers to collaborate with their colleagues during professional development training to improve teacher learning (Desimone, 2009).

Informal professional development activities refer to activities such as teachers individually reading literature about differentiation, engaging in an informal conversation with other teachers to improve teaching, or incidental observing a colleague when walking by the classroom (Jones & Dexter, 2014; OECD, 2009). One of the findings of Sprott (2019) was that teachers appreciated reflecting with colleagues and professionals by building a relationship, and sharing ideas, familiar difficulties, and questions in a structured conversation to solve certain problems. In addition, having informal and formal conversations with students seemed to help teachers build a relationship with students. This resulted in responding more effectively to students' educational and social needs (Sprott, 2019). Informal activities are not measurable in days (OECD, 2009), mostly because such activities occur incidentally.

Finally, school team support focused on differentiation skills is a promoting factor for the practice of differentiated instruction, teachers' professional development, and student achievement (Desimone, 2009; Smit & Humpert, 2012). According to Stavrou and Koutselini (2016), cooperation with leaders and colleagues plays a major role in teachers' conceptual change and their effort to adjust their lessons to students' needs. School leaders and colleagues should be dedicated to help teachers change their perceptions on how students learn, on what and how they should be taught, and on the teacher's role during differentiation (Tomlinson et al., 2003). In addition, the implementation of differentiation is supported when principals and administrators give teachers educative resources focused on differentiation, such as digital tools (Van Casteren et al., 2017; Van Geel et al., 2018). Even parents can contribute to differentiation in the classroom, for instance by volunteering to lead a small group or by providing hands-on materials (Hall et al., 2003).

Factors that hinder the development of differentiation skills

There are three frequently mentioned difficulties in the literature that teachers experience while developing differentiation skills. Firstly, understanding and accepting that learning in the

classroom occurs in different ways is already a complex process (Dixon et al., 2014). Unfortunately, many teachers' beliefs lead to teachers being resistant to adjust their teaching (Aldossari, 2018; Heacox, 2014; Joseph, 2013; Nicolae, 2014) and way of thinking regarding students' learning (Hall et al., 2003). Differentiated instruction is in contrast with most traditional educational perspectives and practices, which requires teachers to change their way of teaching, materials, approaches, and ways of thinking regarding students' learning (Hall et al., 2003). Not all teachers think differentiation is needed. They think it is only necessary to differentiate if they have students with different ethnic and cultural backgrounds. Another teachers' misconception is that differentiation is only based on the level of students' disabilities (e.g., dyslexia), which leads to wrong learning expectations regarding low- and high-achieving students. A third misconception is that teachers think differentiating is time consuming, because they think students need to receive extra exercises. (Anthonissen et al., 2015) Many teachers also complained that they already have an overload of other responsibilities and therefore do not have enough time to put more effort into the preparation of differentiated lesson instead of a 'regular lesson' (Nicolae, 2014; Van Casteren et al., 2017).

A second hindering factor is that some teachers have a low self-efficacy regarding their capabilities to differentiate, mostly due to a lack of experience with differentiated instruction (Aldossari, 2018; Dixon et al., 2014). ''This lack of teacher efficacy may be a reason that some teachers attend professional development focused on differentiation of instruction and then return to business as usual without implementing what they have learned to address student variability in the classroom'' (Dixon et al., 2014, p. 116). A cause of the lack of experience may be due to a lack of explanation during Teacher Education on how to transfer the theory on differentiation to actual practice (Dixon et al., 2014; Inspectie van het Onderwijs, 2015a). This resulted in teachers' lack of ability to analyse data using assessments and to respond to students' interests, readiness, and learning preferences (Dixon et al., 2014; Nicolae, 2014). Teachers who do not recognise ways to differentiate or feel incapable of instructing different groups at the same time will struggle with providing differentiated instruction (Dixon et al., 2014).

Lastly, teachers state they lack support (Hall et al., 2003). The support refers to collaboration with colleagues and school leaders, the accessibility to resources and materials (e.g., suggestions for remediation, digital tools), and partly the availability and quality of students' data (Van Geel et al., 2018). Digital tools can support the implementation of differentiated instruction, but getting access to and working with technology can be a challenging and time-consuming process (Hall et al., 2003). Moreover, teachers stated that materials are not always supportive, because curriculum materials do not always provide teachers with explanations and examples on how to use differentiated instruction skills (Keuning et al., 2017). On top of that, a school curriculum can be very restricted, demanding,

and in conflict with the beliefs of teachers (Sprott, 2019). A certain way of working in a school can demotivate teachers to embed differentiation in their lessons.

Research question

The goal of this study is to gain more insight into the development of primary school teachers' differentiation skills. Previous studies (Keuning et al., 2017; Prast et al., 2015; Van Geel et al., 2018) were focused on differentiation for the subject mathematics, because the skills to differentiate can vary across subject areas, and focussing on one subject is more specific and gives teachers more guidance (Prast et al., 2015). Therefore, this study is focused on the subject mathematics. New insights will lead to rich knowledge to help teachers improve their development and mastery of differentiation skills. This leads to the following research question: ***How do primary school teachers develop the required differentiation skills?***

In previous research (e.g., Inspectie van het Onderwijs, 2014), teachers' mastery of differentiation skills were examined, but not all differentiation skills were observed. Also the perception of teachers regarding differentiation skills was barely examined. There were found differences between teachers, such as that teachers with more than one year of teaching experience master differentiation skills more than beginning teachers. In addition, it was reported that teachers teaching in the third group master differentiation skills better than teachers who only teach in a lower and/or upper grade group. Moreover, full-time teachers master the differentiation skills to a higher extent than part-time teachers (Inspectie van het Onderwijs, 2014). Furthermore, in previous studies factors which promote and factors which hinder the development of the differentiation skills were frequently mentioned, such as teachers' attitude and beliefs, active training, support from the team (e.g., Desimone, 2009; Van Casteren et al., 2017), lack of information from Teacher Education, lack of support, lack of materials, and lack of time (e.g., Aldossari, 2018). However, the descriptions of the factors were not detailed enough. Therefore, the following sub-questions are formulated:

1. To what extent do primary school teachers think they master the required differentiation skills?

2a. Which differentiation skills do teachers consider as easy skills to develop and master?

2b. Which differentiation skills do teachers consider as difficult skills to develop and master?

3. Is there a difference in mastering differentiation skills between teachers with various years of teaching experience?

4. Is there a difference in mastering differentiation skills between teachers teaching different grades?

5. Is there a difference in mastering differentiation skills between part-time and full-time teachers?

6. Which factors promote the development of the required differentiation skills?

7. Which factors hinder the development of the required differentiation skills?

Method

In this chapter, the method, participants of the study, the process of data collection, and the data analysis are described.

Research design

The current study consisted of two main goals. The first goal was to gain a broader and deeper insight into the details of the development of the required differentiation skills of primary school teachers. This insight included discovering more about the content of the differentiation skills, about the promoting factors, and about the hindering factors teachers face when developing the required differentiation skills. Secondly, it was aimed to discover to what extent the primary school teachers think they master the differentiation skills and which promoting and hindering factors (and their features) are most important and effective according to the teachers.

A mixed-method study was done to reach the two goals. To reach the first goal and thus complement already existing theory, teachers were interviewed. In order to reach the second goal, a survey was conducted. It was a cross-sectional study, as the survey was conducted at a specific, single point in time to compare teachers with different years of work experience.

Instrumentation

Interview. The interview was semi-structured. The interview started with questions about teachers' demographic characteristics. The interview was divided into five parts with questions regarding differentiation: 1) identification of educational needs, 2) differentiation in goals, 3) differentiation in instruction, 4) differentiation in practice, and 5) evaluation of progress and learning process. Each part of the survey consisted of two subparts. The first subpart consisted of the statements on the differentiation skills teachers had to score. These statements were derived from the Differentiation self-assessment questionnaire of Prast et al. (2015). This questionnaire that functions as a teacher self-assessment was used, as it suited the goal of investigating to what extent the teachers think they master the differentiation skills defined by Keuning et al. (2017) and Van Geel et al. (2018). The other subpart consisted of questions regarding the time to master differentiation skills, factors which positively influence(d) the development of the required differentiation skills, and challenges that teachers experience(d) during that development. These questions were based on the literature. All questions are presented in Appendix A.

Survey. The survey had the same structure as the interview. The results of the interview were used to supplement questions for the survey. Firstly, three items which almost all teachers mentioned in the interviews as differentiation skills, were added to the questionnaire of Prast et al.

(2015) to cover more elements of the differentiation skill hierarchy. The added items are discussed in the results section of the interviews. For each item, respondents rated to what extent an item applies to them, ranging from does not apply at all to me (1) to fully applies to me (5). From the interviews it became clear that not all teachers use curriculum materials, while some items in the survey refer to the use of curriculum materials. Therefore, the option was added to check a box if a teacher does not use curriculum materials. As it appeared from interviews that it was too hard for teachers to tell how long it took to master the skills, this question was not included in the survey. However, teachers were able to indicate which skills were easy and difficult to master. Therefore, in the survey teachers were asked to decide for each part which skills were easy to master and which skills were more difficult and took more time to develop and master. Half of the survey was also focused on which factors positively and negatively influence(d) the development of the differentiation skills. The promoting and hindering factors mentioned in previous research were put as answer possibilities and complemented with factors mentioned by the interviewed teachers. An example of the first part of the survey is presented in Appendix B to give an impression of how the questions for each part were presented to the teachers.

Participants

For the interviews, several primary schools in the region Hengelo were approached. The researcher selected the teachers who were interviewed. The aim was to interview ten teachers. As contacting schools in one region did not lead to ten participants, other ways were used to obtain participants. The snowball effect method was used by asking the teachers if they knew other teachers who were willing to participate. Teachers from other regions were also approached. Eventually, seven teachers were willing to participate in the first part of the study. The characteristics of the participants who were interviewed are shown in Table 1.

Participants of the survey were selected and approached by the researcher and supervisors through social media, e-mail, and face-to-face contact. A total of 1156 teachers started with the survey and 288 (25%) out of the 1156 teachers completed the survey. The other 868 teachers did not complete the survey and 37% of these teachers had withdrawn from the participation after rating the items stated in the first part. This may be due to the length of the survey and lack of time to fill the survey completely out at the moment teachers were participating. The characteristics of the participants who filled out the survey are shown in Table 2 in the results section.

Table 1

Characteristics of the Teachers

Teacher*	Gender	Age	Current grade	Years of teaching experience	Full-time or part-time	Highest level of education
Anne	Female	34	Upper grade	12	Part-time	Higher Education
Elsa	Female	35	Middle grade	13	Full-time	Higher Education
Julia	Female	31	Middle grade	8	Full-time	Higher Education
Intisar	Female	26	Middle grade	3	Full-time	Higher Education
Karen	Female	23	Lower grade	3	Full-time	Higher Education
Sabine	Female	29	Middle grade	3	Part-time	University
Mylie	Female	29	Upper grade	9	Full-time	University

Note. *The teachers have fictional names to ensure anonymisation.

Procedure

Before the data was collected, permission was received from the BMS Ethics Committee of the University of Twente to conduct the study. The participants who were approached for an interview were informed about the objectives and consequences of the study by e-mail and verbal. For the interviews, the researcher made appointments with the teachers to visit and interview them. Permission was asked through e-mail and verbally to record audio for the interview. In the e-mail and during the visit, the researcher informed the teachers about the possibility to withdraw from the interview. Each interview took approximately thirty minutes. The interviews took place in April 2019.

The survey was shared in May and June 2019 on social media. The platforms which were used were as followed: Facebook, teacher forums, WhatsApp, Instagram, and LinkedIn. Other ways that were used to reach teachers were e-mailing educational institutions, using the snowball effect, and asking personal contacts and contacts of the supervisors. The survey could be completed from May the 1st till June the 20th. In the online messages and e-mails, the teachers were informed about the goal of the survey and received the link to the survey. In the description of the survey, the teachers were informed about the goals of the survey. Moreover, the participants were informed about the anonymisation of the data and were informed that their participation was voluntary. At the beginning of each interview the participants were asked to confirm they belonged to the target group and to confirm they agreed to participate.

Results

In this chapter, the results of the interviews and survey are presented.

Results of the interviews

Five phases of differentiation

Interviews were held with seven primary school teachers to gain insight into the development of the differentiation skills. The interviews were also held to examine factors that promote and hinder the development of differentiation skills in order to design a survey. The data that led to additional information for the completion of the survey are discussed per phase, followed by the results of important factors that promote and hinder the teachers' development of differentiation skills.

Identification of educational needs. Most teachers indicated they identify students' needs based on observations, tasks, and tests, and thereby mainly pay attention to scores that are lower or higher than expected. Not all teachers conduct diagnostic conversations to identify students' needs, as conducting diagnostic conversations sometimes is the task of a remedial teacher. The teachers indicated that most skills are easy for them to master. The teachers also indicated that conducting diagnostic conversations is the most difficult skill to develop and master.

Differentiation in goals. Teachers claim they set minimum goals for low-achieving students but barely set challenging goals for high-achieving students. Some teachers work with differentiated goals as an approach. Other teachers use and adjust the goals stated in curriculum materials. In addition, some teachers set personal goals together with students to fit their level of understanding. Most teachers find it easier to set goals for low-achieving students than for high-achieving students, especially in their first years of teaching. Teachers experienced that following curriculum materials is easy, but does not always fit the goals and way of teaching.

Differentiation in instruction. Teachers indicated they adjust the levels, modality, and pace of instructions based on students' needs. They also use hands-on materials and digital tools for instructions. The teachers ask open-ended questions and questions of different difficulty levels during instructions if the questions contribute to the goals. Half of the teachers do not give extended instruction or instruction to high-achieving students, as an assistant sometimes gives such instructions. Other teachers give extended instruction if some students do not understand the instruction. The teachers said they do not find it difficult to differentiate in instruction.

Differentiation in practice. Teachers support students' learning with hands-on materials, computer programs (e.g., for students with dyslexia), materials from colleagues and materials from the Internet. Some teachers use curriculum compacting programs for high-achieving students, while other teachers use worksheets and projects as enrichment activities. Digital, adaptive programs are

used for low-achieving students to practise the goals they did not achieve yet. Nevertheless, teachers barely use computers to challenge high-achieving students. Teachers experienced that it is harder to find materials for high-achieving students than for low-achieving students. Teacher Intisar indicated that most curriculum materials only provide materials for practice for low-achieving students.

Evaluation of progress and process. Finally, teachers evaluate goals by observing students, checking their tasks, looking at test scores, and analysing answers. Most teachers evaluate the effectiveness of instructions and practices by asking students what they have learned, which struggles they had, and what was (in)effective about the lesson. A few teachers briefly discuss lessons with colleagues. Teachers Sabine mainly evaluates students' products. Contrariwise, teacher Karen focusses on the learning process, because she experienced that the way students solve problems reveals the reason behind their results.

Based on the information received from the teachers, it was decided to add three items to the survey. The first addition was the question whether teachers dare to deviate from curriculum materials, as teachers experienced that curriculum materials do not always correspond with the goals or with their way of teaching. The second question relates to setting goals together with students, as teachers said they also set personal goals with students to adapt to students' needs. Thirdly, teachers do not only focus on products, but also on students' learning processes. Therefore, it was added whether teachers evaluate students' learning processes. Moreover, support from a remedial teacher was added as an answer possibility for the questions about influencing factors.

Promoting factors

Various factors promote teachers' development of differentiation skills. Factors that are not frequently mentioned in the literature or only briefly explained, are discussed and added as answer possibilities for questions in the survey. Teachers mainly had to experiment. Teaching groups for a long time helped teachers to deepen their knowledge. Teacher Education provided a theoretical base, while an additional study (e.g., master Educational Needs) also helped teachers deepen their knowledge. Curriculum materials provide suggestions for differentiation. However, some teachers find working with mathematic themes more helpful than having different goals every week. Certain digital tools support teachers in developing differentiation skills. For identifying educational needs and evaluating goals, teachers use digital systems to analyse tests. For differentiating in goals, three teachers consult goals stated in TULE from SLO. For differentiation in instruction and practice, teachers use digital, adaptive programs, such as Rekentuin, and online materials (e.g., worksheets, ideas on Pinterest). Most adaptive programs show how far students are and which tasks they had right and wrong. Teacher Intisar uses the digital program Gynzy as lesson preparation. Each teacher chooses a goal, creates an online lesson, and shares the lesson in Gynzy to save time and inspire.

Besides, support from an academic coach plays a big role in developing all differentiation skills. The academic coach makes together with teachers a plan with goals for individual students with special needs, observes the teachers and students during instructions and individual working time, and evaluates periods to decide on the next steps and goals for teachers and students. In addition, teachers receive workshops from the academic coach. The workshops are mainly focused on the skills to identify students' needs, differentiate in goals, and evaluate the progress and process. The workshops have four characteristics: 1) theory about differentiation, 2) practices with hands-on tasks, 3) time to practise in the group, and 4) reflections with colleagues. For instance, teacher Mylie and her colleagues of the same grade received four workshops, divided over a year. In one of the workshops, they received theory about differentiation, looked at students' results, and estimated students' levels and needs. After practising, they received additional information. The teachers made a plan based on the analyses. The teachers received time to carry out and adjust their plans. During the following workshops, teachers shared their experiences and gave feedback to each other. Another example was from teacher Karen. The teachers received three workshops with instruction about analysing mathematics goals, achieving goals, and analysing students' results. They carried out their tasks, while the academic coach visited the teachers a few times to observe and give feedback.

Moreover, training from other experts were mentioned by teachers as promoting factors. However, a training covers certain differentiation skills and not all skills. For instance, the teachers Anne and Elsa followed a course of a year about setting goals and how to reach the goals, which was most effective to improve the differentiation in goals. Four teachers were enthusiastic about the course Sprongen Vooruit, offered by an institute. The course lasted for six months and teachers had to show up six times in total. Teachers received information about the goals of mathematics, underlying ideas, and strategies. The focus lied more on the practical part of the course, consisting of trying out meaningful tasks and games to imagine how students can achieve the goals. Teachers tried out the activities in their groups. Afterwards, they shared their experiences and received feedback.

Furthermore, teachers experienced team meetings as promoting factors. During most meetings, teachers discuss a struggle regarding a specific differentiation skill or phase. Teachers Anne and Elsa sometimes have meetings with colleagues from the same grade to analyse curriculum materials, compare goals of curriculum materials with the goals of SLO, and decide which goals they will work on, in which order, and how.

Hindering factors

Teachers experience(d) difficulties during the development of differentiation skills. The hindering factors that are not frequently mentioned or only briefly mentioned in previous research are described. Teachers indicated they lack time to identify needs, differentiate in goals and instruction,

search for or design materials for a differentiated practice, and evaluate students' learning continuously. Teachers are afraid they cannot give every student enough guidance on their level. Another struggle is a lack of suggestions for differentiation from curriculum materials and lack of materials in the school (e.g., hands-on materials) or ineffective materials (e.g., digital programs). For example, teachers experienced they sometimes lack suggestions from curriculum materials that fit their way of teaching. An example of less effective materials is that teacher Mylie does not use the adaptive program Snappet anymore, because Snappet also judges students' answers based on their grammar and spelling, which are not the initial goals when solving mathematical problems.

Teachers said they lack support from colleagues and are insecure about their position in the team. However, this struggle was not mentioned as a struggle during the development in every phase of differentiation. Some teachers sometimes feel insecure asking colleagues for help when identifying educational needs or evaluating due to a lack of trust and because it takes time. An example was from teacher Julia, who is struggling with the standards she has when evaluating the goals of the lessons, as the standards are not the same throughout the school.

Moreover, the teachers consider self-confidence as a prerequisite to identify educational needs, to differentiate during instruction, and to select effective materials. Some teachers said it will take more time to increase the self-efficacy as a substitute teacher, because substitute teachers do not know the students well and work on various schools with different visions and curriculum materials, which might slow down the process of creating a preference. In addition, they do not have to analyse test results, set differentiated goals or decide on the practice. They also think the flexibility to adjust lessons as a substitute teacher depends on the availability of time, space, and materials.

Finally, less mentioned difficulties are a lack of knowledge and experience and ineffective training. Teacher Sabine indicated she lacks knowledge and experience to use compact programs and analyse tests, due to being a substitute teacher and not having many years of teaching experience. Teachers Anne and Elsa said they did not receive moments to practise for differentiation during Teacher Education, which caused a lack of experience. Furthermore, they experienced that not all training courses about differentiation are effective. For instance, during one training, the information was not transferred effectively. Teachers had almost no interaction with the expert, could not be active, were not observed, and did not receive examples, materials, feedback, and practice time. Nevertheless, teachers do not necessary feel they lack or need training for differentiation. The results per phase and influencing factors with their effective and ineffective features were used to add questions to the survey and specify questions and answer possibilities.

Results of the survey

Reliability of the items, scales, and DSAQ instrument

A survey was designed to determine how primary school teachers develop the required differentiation skills. The survey was active from the 1st of May till the 20th of June. The survey consisted of five parts with questions about teachers' development of differentiation skills. In order to examine how well teachers think they master the required differentiation skills, scales with items were included in the survey. The scales were used from the DSAQ instrument of Prast et al. (2015). Two items were added to the scale Differentiated Goals (Goals+) and one item was added to the scale Evaluation of Progress and Process (Evaluation+) based on the interviews with teachers. To check whether the new items contributed to the scales, Cronbach's alpha was calculated. As shown in Table 3, the Cronbach's alphas of the new scales Goals+ (α = .75) and Evaluation+ (α = .80) were larger than .70 and even slightly larger than the Cronbach's alphas of the scales Differentiated goals (α = .73) and Evaluation of progress and process (α = .77) of Prast et al. (2015). This meant that the reliability of the new scales Goals+ and Evaluation+ were acceptable and good (Taber, 2017). The reliability of the new instrument (DSAQ+) was found to be high (α = .92). The results indicated that the added items are a strong addition, fit the instrument well, and can be included in the analyses.

Table 2

Descriptive Statistics of the Scales

Scales DSAQ[a]	Number of items	*n*[b]	Total scores	α	*M (SD)*
Identification of educational needs	5	284	5504	.63	3.94 (0.62)
Differentiated goals	6	283	6671	.73	4.03 (0.67)
Goals+	8	284	8609	.75	3.89 (0.65)
Differentiated instruction	7	288	8302	.77	4.12 (0.60)
Differentiated practice	8	288	8778	.80	3.81 (0.75)
Evaluation of progress and process	7	282	7464	.77	3.81 (0.64)
Evaluation+	8	282	8519	.80	3.80 (0.63)
Total DSAQ including original items	33	288	36719	.91	3.93 (0.52)
Total DSAQ including added items	36	288	39712	.92	3.90 (0.52)

Note. [a]Each item of the scales had a scale from 1 to 5 with 1 = does not apply to me at all, and 5 = fully applies to me

[b] Not all respondents gave scores for all items, because some teachers do not use curriculum materials.

Characteristics of the respondents

In total, 1156 Dutch primary school teachers started with the survey and 25% of the teachers (288) completed the survey. Only fully completed questionnaires were used for analyses. In Table 3, characteristics of the respondents are presented. As seen in Table 3, the average age of the respondents are 39 years, varying from 21 years to 65 years. In the current study, 12,5% of the teachers are 55 years and older and 10% are younger than 25 years. According to Traag (2018), teachers who are 55 years or older together form 20% of the Dutch primary school teachers, while teachers between 15 and 25 years old form approximately 5% of the teachers. Data in this study are different compared to the data of Traag (2018). Nevertheless, the oldest teachers still form a bigger group than the youngest teacher. Teachers between 25 and 55 years old form the biggest group.

Table 3

Characteristics of the Respondents

	M (SD)	Frequency	Percent	*M (SD)* total score DSAQ
Age[a]	39.24 (11.72)			
Gender				
Female		272	94,4	3.90 (0.53)
Male		16	5,6	3.96 (0.49)
Years of teaching experience	14.44 (9.99)			
0-3 years of teaching experience		49	17	3.61 (0.45)
3-10 years of teaching experience		69	24	3.95 (0.46)
10-20 years of teaching experience		94	32,6	3.96 (0.51)
>20 years of teaching experience		76	26,4	3.98 (0.59)
Educational background				
Teacher Education		285	89,6	3.92 (0.50)
Academic Teacher Education		16	5,6	3.86 (0.58)
Pre-school Teacher Education		7	2,4	3.87 (0.94)
Other		7	2,4	3.52 (0.61)
Grade[b]				
Lower grade teacher		30	10,4	3.81 (0.65)
Middle grade teacher		157	54,5	3.87 (0.50)
Upper grade teacher		143	49,7	3.99 (0.50)
Substitute teacher		11	3,8	3.63 (0.61)
Employment				
Full-time teacher		118	41,0	3.95 (0.50)
Part-time teacher		170	59,0	3.87 (0.54)

Note. [a]Six birthdates were missing due to incomplete dates.

[b]The total number of grade selection can exceed the total number of respondents, as some teachers teach in more grades or teach combinations of two or more groups from different grades.

The majority of the respondents are female (94,4%). This is in line with statistics showing the majority of Dutch teachers are female (Traag, 2018). The majority of the respondents have finished Teacher Education (89,6%). On average, the respondents have 14 years of teaching experience, varying from 0 to 43 years of teaching experience. The smallest group has teachers with zero to three years of experience (17%) and the largest group consists of teachers with ten to twenty years of teaching experience. 10,4% of the respondents teach at least in the lower grade, which refers to the first and second year of primary school in the Netherlands. Slightly more than half of the respondents (54,5%) teach at least in a middle grade group (group 3, 4, and/or 5). The other half of the respondents (49,7%) teach in the upper grade (group 6, 7, and/or 8). In the current study, 3,8% of the respondents are substitute teachers. Lastly, 41% of the teachers work full-time, while the other 59% of teachers work part-time. In the past 15 years, there was a huge decrease of Dutch teachers working full-time, due to an increase of Dutch female teachers with part-time contracts (Traag, 2018). In the current study, also 61% out of the 272 female teachers work part-time, while 39% of the female teachers work full-time. Thus, more female teachers have a part-time contract.

Scores and categorisation of each differentiation skill per scale

This study aimed to investigate to what extent teachers think they master the required differentiation skills and which skills they consider as easy skills to master and which skills they consider as difficult skills to master. The scales in Table 2 consisted of items, differentiation skills, for which teachers could give points on a scale from 1 to 5 to tell how much each skill applies to them. Per scale, it is reported to what extent teachers thought they master each skill and which skills they think are easy or difficult to develop and master.

Identification of educational needs. In Table 4, an overview of the scores per item for the scale Identification of Educational Needs is presented. The items had an average score between 3.46 and 4.14. Teachers scored high on the skills to analyse curriculum-based tests (*M* = 4.13) and to identify specific students' educational needs based on observations during maths lessons (*M* = 4.14). These skills were also indicated by the teachers as easy skills that were or could be mastered quickly. Although the skill to identify specific students' educational needs based on their maths work did not have one of the highest average scores, almost all teachers (91,3%) consider it as an easy skill to master. Conducting diagnostic conversations has the lowest average score (*M* = 3.46). Most of the teachers (84,7%) indicated that it is a skill that is more difficult to develop and will take a longer time to master.

Table 4

Descriptive Statistics of the items in the Scale Identification of Educational Needs (range 1 – 5)

Items *subscale 1: Identification of educational needs*		*n*[a]	*M* (*SD*)	Difficulty and duration (*n* = 288)	
				Easy/quick	Hard/slow
1.1	I analyse the answers on curriculum-based tests to assess a student's educational needs	273	4.13 (0.93)	236 (81.9%)	52 (18.1%)
1.2	I analyse the answers on standardised tests to assess a student's educational needs	277	4.01 (0.99)	143 (49.7%)	145 (50.3%)
1.3	I assess specific students' educational needs based on daily maths work	281	3.96 (0.94)	263 (91.3%)	25 (8.7%)
1.4	I assess specific students' educational needs based on (informal) observations during the maths lesson	283	4.14 (0.88)	231 (80.2%)	57 (19.8%)
1.5	If necessary, I conduct diagnostic conversations to analyse the educational needs of specific students	284	3.46 (1.12)	44 (15.3%)	244 (84.7%)

Note. [a]Some respondents had not given a score on each item, because they do not use curriculum materials.

Differentiation in goals. In Table 5, an overview of the skills of the scale Differentiated Goals is shown. Teachers scored high on the skills of knowing and using the opportunities curriculum materials offer for low- and high-achieving students. More than 200 teachers indicated that these skills are easy and quick to master. However, teachers are not afraid to deviate from curriculum materials if necessary (*M* = 4.41). More than half of the teachers (60,1%) think it is easy to deviate from curriculum materials. The average score on the skill to set challenging goals for high-achieving students (*M* = 4.19) was higher than the score on the skill to set minimum goals for low-achieving students (*M* = 3.87), even though slightly more teachers (51,7%) experienced it is easier to set goals for low-achieving students. Teachers had the lowest average score on the skill to set learning goals together with students (*M* = 2.61) and 83,3% of the teachers indicated it is a difficult skill to develop and master and also takes more time to master. The skill to set different goals based on achievement levels also did not receive a high score.

Table 5

Descriptive Statistics of the items in the Scale Differentiated Goals (range 1 – 5)

Items subscale 2: Differentiated goals		*n*[a]	*M* (*SD*)	Difficulty and duration (*n* = 288)	
				Easy/quick	Hard/slow
2.1	I set different goals for the students, dependent on their achievement level	281	3.78 (1.04)	137 (47.6%)	151 (52.4%)
2.2	I set extra challenging goals for high-achieving students	281	4.19 (0.91)	139 (48.3%)	149 (51.7%)
2.3	I set well-considered minimum goals for very low-achieving students	282	3.87 (1.06)	149 (51.7%)	139 (48.3%)
2.4	I know the opportunities for differentiation offered by the curriculum	270	4.26 (0.98)	224 (77.8%)	64 (22.2%)
2.5	I use the opportunities the curriculum offers for differentiation for high-achieving students	272	4.12 (1.01)	222 (77.1%)	66 (22.9%)
2.6	I use the opportunities the curriculum offers for differentiation for low-achieving students	271	3.94 (1.06)	231 (80.2%)	57 (19.8%)
2.7	I dare to deviate from the opportunities the curriculum offers for differentiation[b]	272	4.41 (0.94)	173 (60.1%)	115 (39.9%)
2.8	I set learning goals together with the students[b]	283	2.61 (1.29)	48 (16.7%)	240 (83.3%)

Note. [a]Some respondents had not given a score on each item, because they do not use curriculum materials.
[b]The item was added in the current study by the researcher.

Differentiation in instruction. An overview of the skills of the scale Differentiated Instruction is presented in Table 6. The teachers had the highest average score for the skill to give low-achieving students additional instruction (*M* = 4.44), and most teachers (80,9%) said it is an easy skill to master. The teachers also scored high on the skills to adapt the level of abstraction and pace of instruction students' needs. These skills are considered as easy skills to master. The teachers also adapt the modality of the instruction, ask open-ended questions, and ask questions of various difficulty levels during whole-class instructions. However, the opinions are more divided whether these skills are easy or hard skills to master, because only somewhat over 50% of the teachers indicated that these skills are easy skills to master. The skill to regularly provide additional instruction or guidance to high-achieving students at their level got the lowest score (*M* = 3.57). Moreover, 61,1% of the teachers

indicated that the skill to provide instruction to high-achieving students is a difficult skill that will take more time to master.

Table 6

Descriptive Statistics of the items in the Scale Differentiated Instruction (range 1 – 5)

Items subscale 3: Differentiated instruction		*n*	*M* (*SD*)	Difficulty and duration (*n* = 288)	
				Easy/quick	Hard/slow
3.1	I adapt the level of abstraction of instruction to the needs of the students	288	4.26 (0.77)	201 (69.8%)	87 (30.2%)
3.2	I adapt the modality of instruction (visual, verbal, manipulative) to the needs of the students	288	4.15 (0.86)	178 (61.8%)	110 (38.2%)
3.3	I adapt the pace of instruction to the needs of the students	288	4.27 (0.82)	242 (84.0%)	46 (16.0%)
3.4	I deliberately ask open-ended questions during whole-class instruction	288	4.08 (1.02)	197 (68.4%)	91 (31.6%)
3.5	I deliberately ask questions at various difficulty levels during whole-class instruction	288	4.06 (0.98)	172 (59.7%)	116 (40.3%)
3.6	I regularly provide low-achieving students with additional instruction (extended instruction, pre-teaching)	288	4.44 (0.82)	233 (80.9%)	55 (19.1%)
3.7	I regularly provide high-achieving students with additional instruction or guidance at their level, in a group or individually	288	3.57 (1.15)	112 (38.9%)	176 (61.1%)

Differentiating in practice. In Table 7, an overview is shown of the scores on the skills of the scale Differentiated Practice. The teachers had an average score of 3.77 on the skill to vary in the types of practice and approximately half of the teachers (56,3%) think it is an easy skill to master. They also adjust different types of practice to students' needs (*M* = 3.49), but the teachers think this skill is neither easy nor hard to master. The teachers had the highest total average score for the skill to provide high-achieving students with enrichment tasks (*M* = 4.33). However, only somewhat over half of the teachers (58,7%) indicated that it is an easy skill to master. The skill to use curriculum compacting received a lower score (*M* = 3.93). The teachers also select the most important tasks for low-achieving students, and the majority of the teachers finds it an easy skill to master (71,2%). Teachers use computer programs or maths websites for their maths lessons, and most teachers think it is an easy skill to master (72,2%). The difference is that teachers use computer programs and

maths websites more often for students to practise skills they do not master yet (*M* = 3.59) than for specific students to challenge them (*M* = 3.42). Additionally, somewhat more than half of the teachers indicated that it is easier to master the skill to use computer programs and websites for extra practice (69,8%) than to use computer programs and websites to challenge students (60,1%).

Table 7

Descriptive Statistics of the items in the Scale Differentiated Practice (range 1 – 5)

Items subscale 4: Differentiated practice		*n*	*M* (*SD*)	Difficulty and duration (*n* = 288)	
				Easy/quick	Hard/slow
4.1	I vary different types of practice during the maths lesson (e.g. individual or group work, solution spoken, written or drawn)	288	3.77 (1.03)	162 (56.3%)	126 (43.8%)
4.2	I adjust different types of practice to the needs of the students in the classroom (e.g. having a specific child complete exercises on the computer because this child learns more in this way)	288	3.49 (1.13)	144 (50.0%)	144 (50.0%)
4.3	I select the most important tasks for very low-achieving students	288	3.99 (1.03)	205 (71.2%)	83 (28.8%)
4.4	I use curriculum compacting for high-achieving students	288	3.93 (1.22)	183 (63.5%)	105 (36.5%)
4.5	I provide high-achieving students with enrichment tasks	288	4.33 (0.98)	169 (58.7%)	119 (41.3%)
4.6	I also use computer programmes or maths websites in my maths lessons	288	3.95 (1.18)	208 (72.2%)	80 (27.8%)
4.7	I use computer programmes and/or maths websites to offer students focused practice in a skill that they do not sufficiently master	288	3.59 (1.31)	201 (69.8%)	87 (30.2%)
4.8	I use computer programmes and/or maths websites to offer specific students additional challenge in the maths lesson	288	3.42 (1.36)	173 (60.1%)	115 (39.9%)

Evaluation of progress and process. Table 8 consists of an overview of the scores on the skills of the scale Evaluation of Progress and Process. The teachers had a high average score on the skills to evaluate whether the students have met the learning goals based on observations during lessons and based on scores on tests. More than half of the teachers (69,4%) do not think it is hard to master the skill to evaluate based on observations and 62,8% of the teachers thinks it is also easy to evaluate

based on test scores. Moreover, the majority of the teachers (79,9%) finds it easy to master the skill to analyse test answers. According to most teachers (88,5%), a skill that is easy to master is the skill to evaluate whether the students have achieved the learning goals based on their maths work. The skill to evaluate whether students have met the lesson goals by conducting diagnostic conversations had the lowest average score (*M* = 2.92) and was considered by the majority of the teachers (81,6%) as a difficult skill to master. Moreover, two-thirds of the teachers (65,3%) indicated it is hard and it takes time to master the skill to evaluate whether a specific type of instruction was effective for specific students.

Table 8

Descriptive Statistics of the items in the Scale Evaluation of Progress and Process (range 1 – 5)

Items subscale 5: Evaluation of progress and process		*n*[a]	*M*	Difficulty and duration (*n* = 288)	
				Easy/quick	Hard/slow
5.1	I use scores on standardised and curriculum-based tests to evaluate whether the learning goals have been met	279	4.26 (0.92)	181 (62.8%)	107 (37.2%)
5.2	I analyse the answers on curriculum-based tests to evaluate whether the learning goals of that unit have been met	272	3.94 (0.91)	230 (79.9%)	58 (20.1%)
5.3	I regularly evaluate whether all students have met the learning goals based on their daily maths work	280	3.99 (0.92)	255 (88.5%)	33 (11.5%)
5.4	I evaluate whether all students have met the lesson goals based on (informal) observations during the maths lesson	282	4.31 (0.94)	200 (69.4%)	88 (30.6%)
5.5	I conduct diagnostic conversations to evaluate whether specific students have met the lesson goals	282	2.93 (1.11)	53 (18.4%)	235 (81.6%)
5.6	I evaluate whether the type of instruction and practice chosen by me were effective for the majority of the students in the class	282	3.73 (0.98)	164 (56.9%)	124 (43.1%)
5.7	I evaluate whether a specific type of instruction was effective for specific students	282	3.53 (1.02)	100 (34.7%)	188 (65.3%)
5.8	I regularly evaluate the learning process of the students*	282	3.74 (0.93)	151 (52.4%)	137 (47.6%)

Note. [a]Some respondents had not given a score on each item. because they do not use curriculum materials.

[b]The item was added in the current study by the researcher.

Examining differences between groups of teachers

In order to determine whether there was a significant difference between teachers with various years of teaching experience, a one-way ANOVA was conducted. The total scores on the DSAQ+ of teachers with '0 to 3', '3 to 10', '10 to 20', and 'more than 20' years of teaching experience were compared. There was a significant difference between the groups ($F(3,284) = 6.54$, $p = 0.000$). A Tukey post hoc test revealed that the total score on the DSAQ+ of teachers with 0 to 3 years of teaching experience was significantly lower (3.61 ± 0.45 points) compared to the total scores of teachers with 3 to 10 years of teaching experience (3.95 ± 0.46 points, $p = 0.002$), teachers with 10 to 20 years of teaching experience (3.96 ± 0.51 points, $p = 0.001$), and teachers with more than 20 years of teaching experience (3.98 ± 0.59 points, $p = 0.001$). In Figure 3 is shown that the average score ($M = 3.61$) on the DSAQ+ of teachers with 0 to 3 years of teaching experience was lower than other teachers. In Figure 4 the mean scores are presented per scale and the results indicate that teachers with 0 to 3 years of teaching experience scored lower on all scales compared to other teachers. There were no significant differences between teachers with '3 to 10' and '10 to 20' years of teaching experience ($p = 0.999$), between teachers with '3 to 10' and 'more than 20' years of teaching experience ($p = 0.988$), and between teachers with '10 to 20' and 'more than 20' years of teaching experience ($p = .997$). However, in Figure 3 is shown that the scores on the DSAQ+ of teachers with 10 to 20 years of teaching experience individually were more spread out in the group, varying from an average score of 2.60 to 5. In Figure 4 is shown that the mean score of teachers with 3 to 10 years of teaching experience was slightly higher regarding skills to differentiate in practice. Moreover, all teachers seemed to think they master the skills to differentiate in instruction better than other skills.

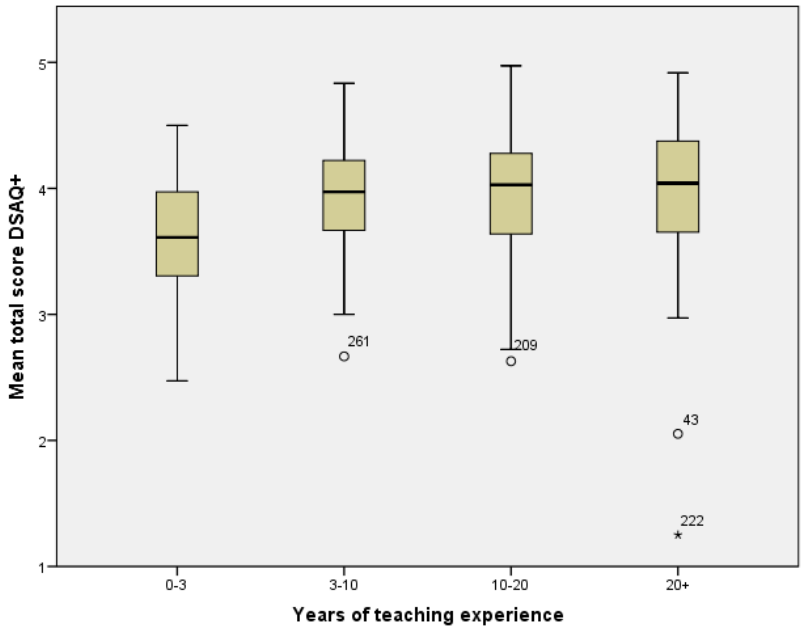

Figure 3. Mean total score DSAQ+ of teachers with various years of teaching experience

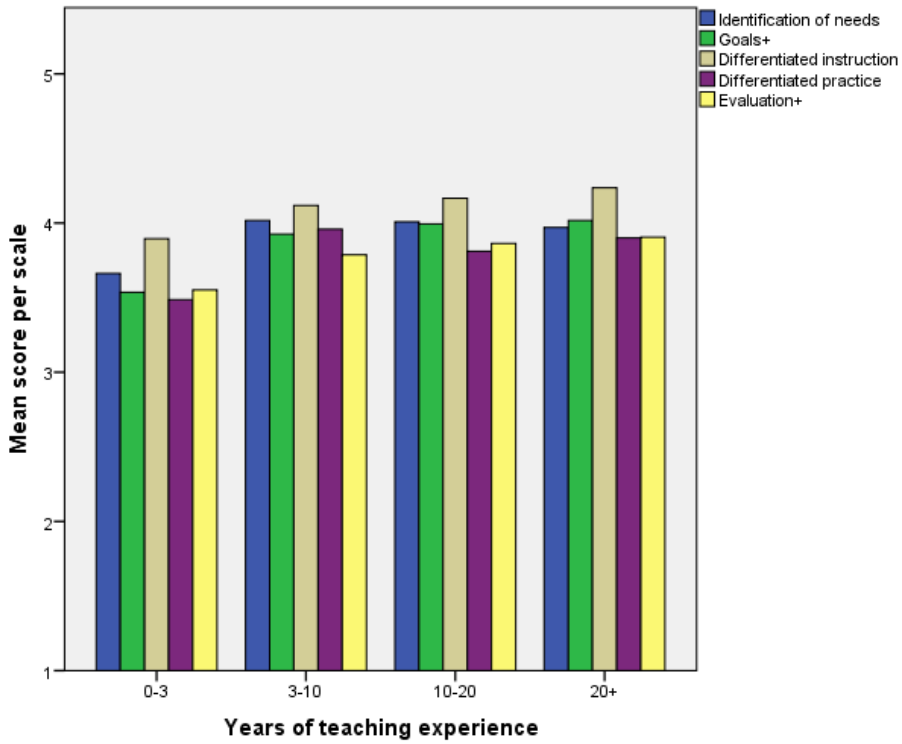

Figure 4. Mean scores of teachers with various years of teaching experience per scale.

Besides determining differences between teachers with various years of experience, the current study focused on whether there were significant differences in the total score on the DSAQ+ between teachers in different grades, namely the lower, middle, and upper grade. Normally a one-way ANOVA would be conducted to compare three groups. However, some teachers teach in more than one grade. Therefore, the decision was made to compare two groups per grade, for instance, the group of teachers who teaches in the lower grade versus the group of teachers who do not teach in the lower grade. This comparison resulted in three independent sample t-tests.

There was no significant difference in the total score of lower grade teachers versus other grade teachers; t (275) = 1.17, p = 0.243. The lower grade teachers (M = 3.81) did not have a higher mean score on the DSAQ+ and therefore do not think they master the differentiation skills better than teachers who do not teach in the lower grade. No significant difference was found in the total score of the middle grade teachers versus other grade teachers; t (243,197) = 1.41, p = 0.161. This means that also middle grade teachers did not have a higher mean score (M = 3.87) than teachers who do not teach in the middle grade.

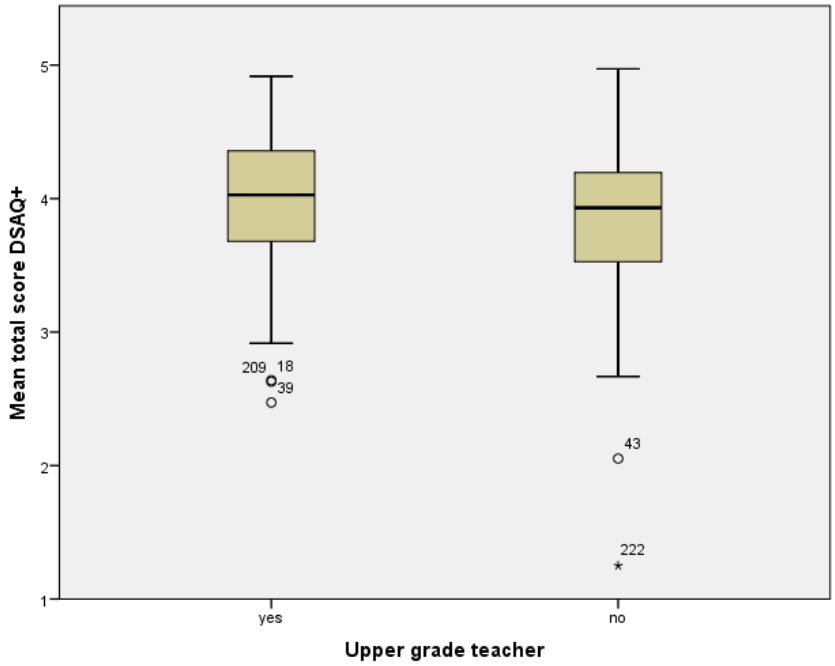

Figure 5. Mean total score DSAQ+ of upper grade teachers.

However, there was a significant difference in the total score on the DSAQ+ of upper grade teachers versus teachers who do not teach in the upper grade; t (275) = 2.49, p = 0.013. Thus, upper grade teachers had together a higher mean score on the DSAQ+ (M = 3.99) compared to the teachers who do not teach in the upper grade as seen in Figure 5. On average, upper grade teachers think they master differentiation skills better than other teachers. As seen in Figure 6, upper grade teachers overall scored better on all differentiation skills compared to teachers who do not teach in an upper grade. The differences between the upper grade teachers versus other teachers regarding scores for the skills to identify students' educational needs and the skills to differentiate in instruction seemed smaller than differences in scores for the skills to differentiate in goals, to differentiate in practice, and to evaluate the learning progress and process.

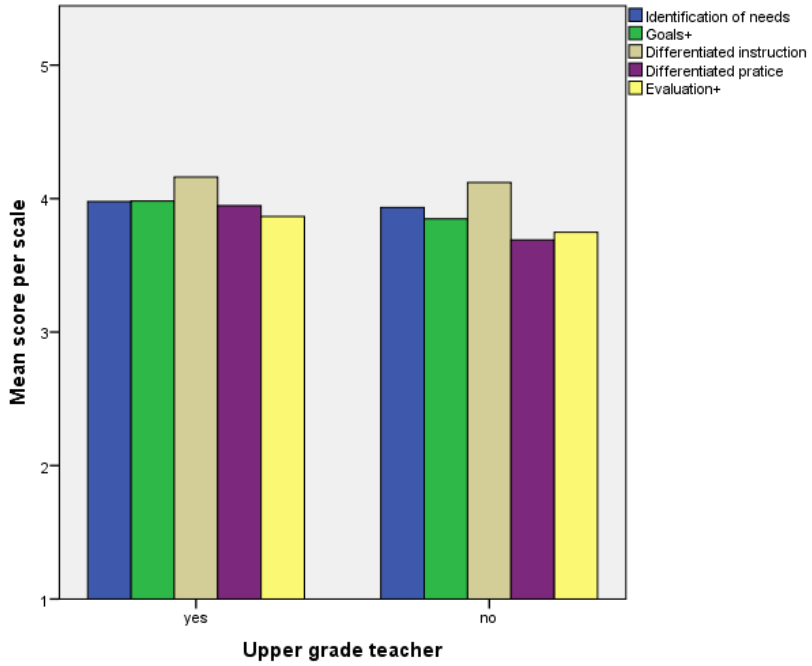

Figure 6. Mean scores of upper grade teachers versus other grade teachers per scale.

Another aim of the study was to examine possible differences between teachers with different employment contract types. Therefore, another independent samples t-test was conducted to compare the scores in full-time and part-time conditions. There was no significant difference in the total score of teachers who work full-time and teachers who work part-time; t (286) = 1.31, p = 0.191. Also in Figure 7 is shown that there were no significant differences in the mean scores of the full-time and part-time teachers per scale and for the whole DSAQ+.

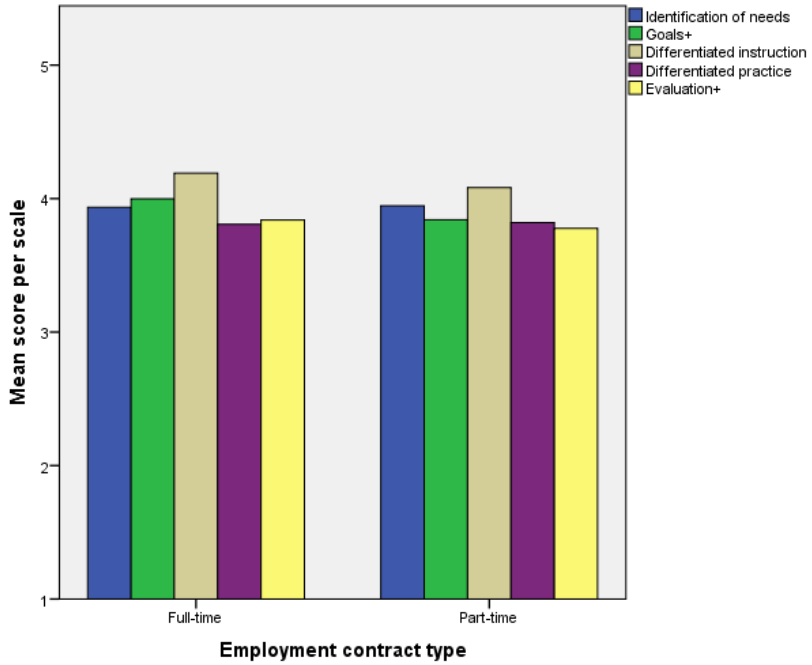

Figure 7. Mean scores of full-time and part-time teachers for DSAQ+ and per scale.

Defining promoting factors according to teachers

In the survey, two questions per scale were related to letting teachers make a 'Top 3' of factors which promote the development of differentiation skills and make a list of factors which are also helpful, if applicable. The teachers received an open-ended question for further explanation of the chosen factors, if they could formulate what and why a chosen factor is effective according to them. In Tables 9, 10, 11, 12, and 13 in Appendix C overviews are presented of the promoting factors for each scale. In Figure 8, an overview is shown of remarkable results in percentages regarding promoting factors selected by the teachers per scale.

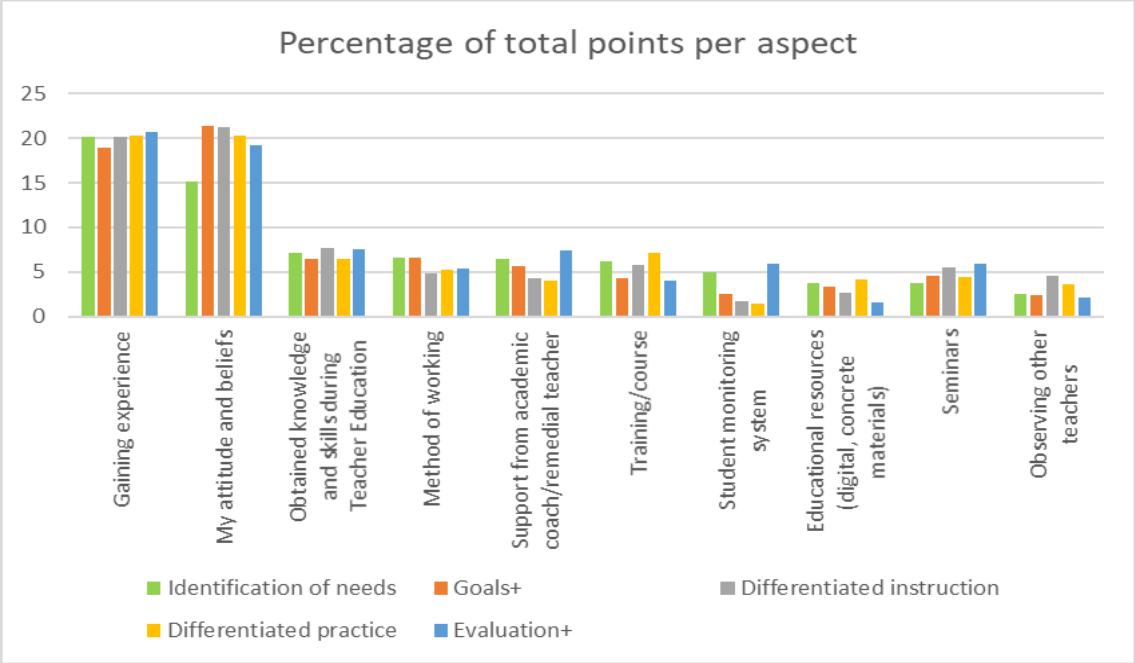

Figure 8. Percentage of total points of a selection of promoting factors.

Most promoting factors

The following factors were selected by more than 5% of the teachers (see Figure 8) per factor as the most important factors for all scales: 'gaining experience', 'attitude and beliefs', and 'obtained knowledge and skills during Teacher Education'. Teachers stated that the combination of these factors makes these factors effective. Firstly, teachers indicated that based on their experiences, they decided which ways of differentiation suited their way of teaching. Gaining experience over the years helped them to gain insights into the diversity in students' educational needs, how to estimate students' educational needs faster, and how to adapt to certain needs. By gaining experience, teachers became able to select important goals, formulate goals more specifically, and adjust goals. Teachers indicated that more experience and stable classroom management led to being able to let go of the curriculum material and formulating more personal goals. Practicing in different groups

with different maths curriculum materials helped teachers to experience different opportunities for differentiation. To differentiate in instruction, teachers think it is especially important to try out what works and what does not work for specific students. Due to gaining positive and negative experiences, teachers get a clearer idea of what the students need for practice. Gaining experience also helps teachers to recognise patterns and problems during evaluation quickly.

Another important promoting factor according to teachers is their attitude. Some teachers indicated that their intrinsic motivation, willingness to change, their self-efficacy, the belief that all students are different, and the belief that the skills help to better adapt to students' learning and lead to better outcomes are very important for the development of all differentiation skills. Teachers also stated they want an overview of their students' progress, but at the same time think students have the right to have ownership of their own learning process. Therefore, teachers have a critical attitude towards differentiation and make an effort to identify students' educational needs, set personal goals, give differentiated instruction and practice, and evaluate the lessons. However, it is remarkable that the attitude and beliefs of a teacher seem less important for the skills to identify educational needs than for other scales, as seen in Figure 8. Some teachers indicated that also the attitude and beliefs of the whole team influence their decisions to differentiate.

Moreover, the knowledge and skills teachers received during Teacher Education and additional studies are considered as important promoting factors for the development of differentiation skills. Teacher Education provides a solid base for differentiation, mainly regarding theory (e.g., learning line mathematics). Internships helped teachers in transferring the theory into practice. Teachers experienced that other studies, such as the master Educational Needs and Montessori education supported them in deepening their knowledge (e.g., how to structure observations) per scale of differentiation skills, by reading books and articles and doing research about a certain scale (e.g., identifying students' educational needs).

Also important promoting factors

Other factors were also chosen by teachers as important promoting factors, but for certain scales. For instance, the way of working on a school seemed more important for the development of the skills to identify educational needs and skills to differentiate in goals (see Figure 8). Teachers indicated that a way of working referred to shared responsibility, analysing test results with a form designed by the team, using another approach for differentiation (e.g., working in goals, learning by moving, working with a Direct Instruction Model), and working in special needs education. Training and courses are also helpful according to teachers, especially for the skills to identify students' needs, differentiate in instruction, and differentiate in practice. Teachers explained that the course Sprongen Vooruit was practical with hands-on activities to try out games teachers can use in lessons.

Teachers also mentioned they prefer training with the team with a balance between theory and practice (with feasible examples) from an external or internal expert with coaching (e.g., receiving feedback). By internal expert teachers meant the academic coach, who gives training and makes appointments with teachers to discuss plans, answer questions, and to observe teachers to provide them feedback on their professional development. As seen in Figure 8, the support from an academic coach or remedial teachers mainly concerns the skills to identify students' needs and to evaluate the learning progress and process. Moreover, teachers selected the support from their colleagues (and colleagues specialised in mathematics) as a promoting factor for the development of most differentiation skills. Teachers explained that their colleagues can share their knowledge, experiences, and ideas, provide materials for practice, and sometimes make appointments to observe lessons and mainly differentiated instructions (as seen in Figure 8). Teachers also indicated they decide with colleagues on the educational needs and goals of a period by evaluating a period.

Less important promoting factors

Remaining factors were mainly chosen as factors that are also helpful instead of selected as one of the three most important factors. Reading books or articles is sometimes done by teachers for a follow-up study. As shown in Figure 8, teachers make more often use of a student monitoring system for the identification of educational needs and evaluation of progress and process than for other differentiation skills. Teachers said that student monitoring systems give clear overviews of results and directions on the next steps to help students in their learning. Besides that, maths curriculum materials were helpful according to teachers, as curriculum materials are goal-oriented and consist of guidelines. Additionally, (digital) educational resources are helpful. Teachers indicated that digital resources summarise the goals students have to achieve and show the progress of students. Teachers said digital resources make it easier to differentiate in practice, such as Ambrasoft, Snappet, and Rekentuin. Teachers indicated they use Gynzy to differentiate in instruction. Hands-on materials help teachers with explanations during instructions and practice time to make sums visual. Some teachers said seminars are effective, as they can interact with each other about new knowledge. Teachers evaluate periods for a large part during seminars, which also can be seen in Figure 8.

Although few teachers said that being a long-term substitute teacher or having a permanent contract is a promoting factor, teachers explained that teaching groups for a longer time helped them to know students better, follow their progress, and deepen their knowledge in maths curriculum materials. Remaining factors, such as having conversations during breaks with colleagues, support from the school management, visiting other schools, and meetings were barely or not chosen as promoting factors by the teachers for the development of differentiation skills.

Defining hindering factors according to teachers

Per scale, also two questions were related to letting the teachers make a top three factors which hinder the development of differentiation skills and making a list of factors which were also hindering, if applicable. The teachers received an open-ended question to further explain the chosen factors if the teachers could formulate what and why a chosen factor is ineffective according to them. In Tables 14, 15, 16, 17, and 18 in Appendix D, overviews are shown of the hindering factors per scale. In Figure 9, an overview is shown of remarkable results in percentages regarding hindering factors selected by the teachers per scale.

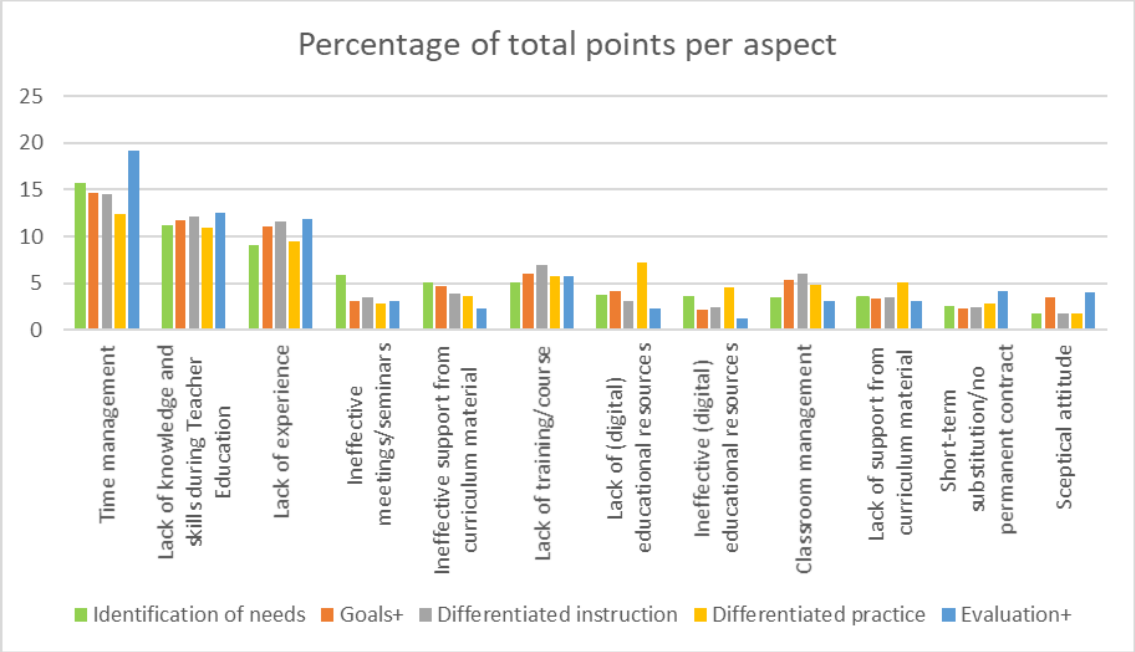

Figure 9. Percentage of total points of a selection of hindering factors.

Most important hindering factors

Four factors were selected as the most hindering factors by teachers when developing all differentiation skills, namely: 'time management', 'lack of knowledge and skills during Teacher Education', 'lack of experience', and 'lack of knowledge'. In Figure 9 is shown that teachers mainly lack time to identify students' needs and evaluate. Teachers explained it takes time to observe students during lessons, conduct diagnostic conversations with students, report information, evaluate lessons, and analyse test results. Also trying new approaches, adapting goals for low-achieving and high-achieving students, providing additional instruction, and searching materials for high-achieving students take more time according to teachers. Teachers indicated that the reasons for the lack of time are: 1) a large group of students, 2) many students with too specific needs, 3) a combination of two or more groups, and 4) other tasks which are priorities for the school.

The second most selected hindering factor is the lack of knowledge and skills from Teacher Education regarding differentiation. Teachers stated that Teacher Education is focused on general theory and the didactical part of differentiation, rather than on the transfer from theory into practice and the pedagogical part of differentiation. An example from a teacher was that Teacher Education provides help on how to deal with a low-achieving student, but does not help on how to apply the knowledge on thirty students with nine different levels and specific needs. In addition, a few teachers were disappointed that Teacher Education did not prepare them for specific needs education.

Other most selected hindering factors were the teachers' lack of experience and knowledge. Teachers struggle with offering mathematics in an effective and efficient way. Some teachers indicated they do not know enough ways to differentiate in instruction and practice. They stated that the lack of knowledge and skills is because of a lack of focus on differentiation during Teacher Education. This resulted in teachers starting late with differentiation in their classrooms. Teachers experienced that the lack of experience resulted in being less good at differentiation in the first years of their teaching career. Other teachers were concerned if they are able to differentiate in other grades, as they only have experience in one grade. Some teachers stated they would like to receive training about differentiation, because they lack knowledge and skills about the required differentiation skills. As seen in Figure 9, the lack of knowledge and skills from Teacher Education and general lack of experience and knowledge were mostly selected as hindering factors for the skills to differentiate in goals and instruction, and the skills to evaluate progress and process.

Also important hindering factors

Hindering factors which were mainly selected as important factors for certain differentiation scales were: ineffective meetings or seminars, ineffective and lack of support from curriculum materials, the ineffectiveness and lack of educational resources, classroom management, and ineffective support from the academic coach or remedial teacher. For instance, ineffective meetings and seminars were selected more often as hindering factors for the scale to identify educational needs. Teachers indicated that meetings and seminars are not productive, not always well-prepared, not constructive enough, weak content-wise, and time-consuming. Moreover, the content is not always in line with the vision of the school or teachers' personal way of teaching.

Teachers stated that the support of curriculum material often is ineffective, especially regarding skills to identify needs, and to differentiate in goals and instruction as seen in Figure 9. The information from curriculum materials does not fit certain groups with students with very specific needs. Additionally, lessons of most curriculum materials are not divided into themes. Therefore, teachers feel they do not get the chance to repeat or practise difficult mathematics subjects if the following lessons are completely different. Curriculum materials also lack more suggestions on how

to differentiate, as most of the time only one way of differentiation is provided. Besides, teachers experience that certain curriculum materials do not offer challenging tasks for high-achieving students. This results in teachers spending a lot of time searching for materials for those students.

Another hindering factor regarding school materials is the ineffectiveness and lack of (digital) educational resources, especially for differentiating in practice and identifying students' needs (see Figure 9). Sometimes teachers lack hands-on materials, materials for high-achieving students, digital resources for differentiation in instruction and practice, more options in digital educative programs, and better wi-fi and charging possibilities. An example of the ineffectiveness of materials is that digital materials of curriculum materials give information on students' educational needs too late. The information from analyses is not even detailed enough, because it shows which sum the student had wrong but does not show where the student made a fault in the calculations.

As shown in Figure 9, teachers mainly selected classroom management as a hindering factor for the differentiation in goals, instruction, and practice. On the one hand, teachers indicated that classroom management took a lot of time in their first years of teaching. On the other hand, teachers meant it is difficult for them to plan for a big group in which every group of students receives enough guidance. Moreover, hindering factors mainly selected as number 2 or 3 for a 'Top 3' were the ineffectiveness and lack of support from an academic coach or remedial teacher. Teachers experienced they cannot ask questions to the academic coach or receive feasible suggestions for the improvement of differentiation, sometimes due to the lack of knowledge of academic coaches.

Less important hindering factors

Other, less selected factors are ineffective courses, being a substitute teacher, ineffective support from the school management, and the method of working. Teachers indicated that courses were too theoretical and not innovative. Substitute teachers experienced they do not have time to talk to students, deepen their knowledge about curriculum materials, deviate from curriculum materials, and evaluate lessons as seen in Figure 9. Some teachers feel they do not receive effective support from the school management due to a lack of knowledge or disagreement regarding certain decisions for differentiation. Schools not wanting to change directions or visions in the school is not helpful. Remaining factors were hardly selected by teachers: ineffective and lack of support from colleagues, negative experiences regarding differentiation, lack of meetings or seminars, lack of support from the school management, and having a sceptical attitude regarding differentiation. However, in Figure 9 is shown that almost 5% of the teachers have sceptical attitudes that hinder the development of skills to identify students' needs and evaluate. Finally, some teachers were satisfied with their development of differentiation skills and do not experience challenges.

Conclusion and Discussion

Conclusions and discussions

The aim of the study was to discover how teachers develop the required skills to differentiate. In order to answer the research question, it was investigated to what extent primary school teachers' master the required differentiation skills, mainly defined by Prast et al. (2015) and Van Geel et al. (2018) and which differentiation skill are easy and hard in teachers' perceptions. In addition, the scores of teachers with various years of teaching experience, teachers teaching different grades, and part-time and full-time teachers were compared to determine whether these characteristics influence the development of differentiation skills. Lastly, teachers were asked which factors and their main features promote and hinder their development differentiation skills.

Primary school teachers' differentiation skills

It can be concluded that primary school teachers think they master most differentiation skills. Teachers think they are especially good at differentiating in instruction, while evaluating the progress and process is a more difficult task. The results are in line with previous studies in which was stated that evaluation was considered as a difficult task by other European teachers, such as Portuguese teachers (Gaitas & Martins, 2017). Differentiation skills whereof teachers think they master to a high extent and which are considered as easy skills to master are the skills to identify students' needs and evaluate if students achieved the goals based on observations, the skill to use and deviate from the curriculum if needed, and the skills to provide low-achieving students with additional instruction and enrichment tasks. It was also reported by the Dutch Inspectorate of Education that teachers are nowadays better able to differentiate in practice (Inspectie van het Onderwijs, 2014; Inspectie van het Onderwijs, 2018). The skills to conduct diagnostic conversations for the identification of needs and evaluation, to set learning goals based on achievement levels, to set learning goals together with students, to provide high-achieving students with additional instruction or guidance on their level, and to use computers programs and websites to challenge high-achieving students are less applicable to teachers and stated as difficult skills to master.

Differences between teachers

Differences between groups of teachers were examined, as in previous research differences were found between teachers with certain characteristics. The current study included the examination of those differences to confirm or question previous results. From the current study, it can be concluded that beginning teachers master the required differentiation skills less than teachers with more than three years of teaching experience. The Dutch Inspectorate of Education (2014) also

found differences between teachers with various years of teaching experience, namely that teachers with less than one year of experience and teachers with more than twenty years of teaching experience master the differentiation skills less than teachers with years of teaching experience between one and twenty years. In Indonesia, teachers with less than five years of experience showed they master skills for differentiated instruction less (Suprayogi et al., 2017). A possible reason behind the result is that teachers did not receive enough guidance during Teacher Education, which resulted in teachers having to experience themselves how to differentiate in their first teaching years. Some beginning teachers also focus more on classroom management.

Secondly, in this study there was a difference between upper grade teachers and other teachers, concluding that upper grade teachers, on average, think they master differentiation skills better than lower grade and middle grade teachers. On the contrary, the Dutch Inspectorate of Education (2014) concluded that teachers teaching a middle grade group master differentiation skills better than other grade teachers. In the current study, a self-assessment instrument for teachers was applied, while the Dutch Inspectorate of Education observed teachers to measure the extent of teachers mastering differentiation skills. Differences in interpretations of mastering differentiation skills between teachers and inspectors may explain the differences in results. However, in the research of the Dutch Inspectorate of Education (2014) teachers in group 3 mastered the differentiation skills better than other teachers. In this study, no similar conclusions can be drawn.

Thirdly, differences regarding differentiation skills between teachers with different employment contract types were examined. In this study, it is concluded that there is no difference in mastering the required differentiation skills between full-time teachers and part-time teachers. This is not in line with previous results, as it was reported by the Dutch Inspectorate of Education (2014) that teachers who work part-time master the differentiation skills less than teachers who work full-time. Differences in results may be explained by the teachers' own view on the mastery of differentiation skills varying from the view of the Dutch Inspectorate of Education on teachers' mastery of differentiation skills.

Promoting and hindering factors

Based on the data of the interviews and survey, in which teachers selected which factors were important, conclusions are drawn about factors promoting and hindering teachers' development of differentiation skills. In the results section, all factors and features are widely discussed. It can be concluded that teachers' experience, attitude, beliefs, and Teacher Education have the most positive influence on the development of differentiation skills. Implementing and developing differentiation skills start with the willingness to change the way of teaching and realising that differentiating will lead to positive outcomes. This is in line with statements made by Nicolae (2014) and Van Casteren

et al. (2017) about teachers' beliefs being a starting point for differentiation. Teachers also develop differentiation skills by trying things out. The obtained knowledge and skills from Teacher Education form a solid base for teachers to further develop differentiation skills.

Other promoting factors are the way of working on a school and training from an academic coach or external expert, if it includes theory about mathematics, differentiation, students' learning, examples of differentiation, time to practise with hands-on activities, materials which directly can be used in maths lessons, and feedback moments. Features of training mentioned by teachers are in line with features discussed by Desimone (2009), namely that professional development activities should be active, focus on content for teacher learning, and provide opportunities to collaborate. The results are not in line with the findings of Siam and Al-Natour (2016), as they found that teachers lack special training programs and workshops that are focused on teachers' practice and see it as a hindering factor. The contradicting results may be explained by the fact that the participants of Siam and Al-Natour were teachers in Jordan teaching students with learning disabilities. Additionally, teachers find appointments with and observations by the academic coach effective. Moreover, support from colleagues by feeling able to ask them to share ideas, experiences, and materials for practice (e.g., worksheets), and by evaluating lessons together are considered as effective. Similar results were stated by Sprott (2019). Materials are not only helpful for practice (e.g., digital adaptive programs), but also helpful for instruction (e.g., digital tools), identifying needs, and evaluating goals (e.g., using student monitoring systems). Support from the school management, reading books, and visiting schools are less important promoting factors, while these activities were frequently mentioned as important factors in previous studies (e.g., Stavrou & Koutselini, 2016).

The most hindering factors are time management, lack of experience, and lack of knowledge and skills from Teacher Education. It especially takes time to identify students' needs and evaluate the progress and process. Besides, trying out new approaches takes time, while teachers should receive and spend enough time to practise new things from training (Desimone, 2009) to increase their self-efficacy in differentiation (Dixon et al., 2014). Striking is that the knowledge and skills received from Teacher Education is considered as a promoting as well as a hindering factor. Teachers lack experience and knowledge to differentiate more effectively, which might be the cause of the lack of information during Teacher Education according to Dixon et al. (2014). Teachers especially lack information on evaluation by analysing results. The results are in agreement with other findings (e.g., Dixon et al., 2014). However, in the current study, it is found that teachers also lack information and experience to differentiate in goals and instruction. This might explain the low score on the skills to set and adjust goals based on students' achievement levels.

Factors which also hinder teachers' development of differentiation skills are ineffective meetings and seminars, classroom management, and ineffective or lack of support from curriculum

materials, educational resources, and academic coaches. Meetings and seminars are not always productive, innovative, and appropriate. However, one of the features of activities is providing opportunities for active learning (Desimone et al., 2002). Curriculum materials and (digital) resources lack more specific suggestions, examples, and effective practices. This result confirms that school materials are not always helpful (Keuning et al., 2017) and that teachers do not have sufficient resources (Siam and Al-Natour, 2016). Teachers find it hard to organise differentiated lessons with enough guidance for all students. As stated by Prast et al. (2015), organisation is a requirement for a successful implementation of differentiation. Surprisingly, in the literature (e.g., Aldossari, 2018; Van Geel et al., 2018) the emphasis regarding hindering factors seemed to lie on teachers' attitude, beliefs, and low self-efficacy, and ineffective support from colleagues and school management. In this study, those factors are barely considered as very hindering factors by teachers.

To conclude, findings in the current study regarding teachers' mastery of differentiation skills and influencing factors correspond to earlier findings from previous studies. However, there are some differences. In the current study, it was found that upper grade teachers think they master the differentiation skills better than lower and middle grade teachers. Besides, no differences were found between full-time and part-time teachers regarding mastering differentiation skills, while in previous research (Inspectie van het Onderwijs, 2014) there was found a difference. In addition, differences in the importance of promoting and hindering factors between the previous and current research were found. Many aspects of the factors correspond to the factors described in the literature, but are more specified in this study and the list of influencing factors is supplemented because of this study. The study could use some improvements to discover more rich information on teachers' development of differentiation skills. However, the findings are valuable for scientific research and practice to help researchers, schools, and teachers with further exploration of teachers' development of differentiation skills. Therefore, the limitations of the study and suggestions for future research are described, followed by the scientific and practical relevance of the study.

Limitations and future research

Although insights and rich information is provided, the study has some limitations. First of all, the interviews were held by one researcher, which could have influenced the interpretation of the data. The teachers also reflected on their own teaching during the interviews and survey, leading to different interpretations of the 5-point scale, depending on how critical a teacher looks at his or her own actions and when a teacher considers something as sufficient.

Secondly, there are limitations regarding the survey. The length of the survey withheld many teachers from filling the survey (completely) out. Open questions in the survey were not obligated to

increase the accessibility of the survey. However, this choice influenced the behaviour of teachers to not share details about factors, which may have resulted in less specific conclusions. Also, the mobile version of the survey was less functional, making it more difficult and less attractive to fill the survey completely or successfully out. Therefore, some data of the drag-and-drop questions could be slightly deviated due to accidentally dragging the items to the wrong blocks. Additionally, not all teachers understood how many items they could drag and drop and therefore it was slightly difficult to conclude what the three most important promoting and most hindering factors are according to teachers. In future research, the survey can be adjusted by adding a clear sentence or example on how many items the teachers are allowed to drag and drop in certain questions. Moreover, only a few lower grade teachers had filled out the survey. Some lower grade teachers communicated to the researcher that it was almost impossible for them to fill out the survey, because they do not use curriculum materials and do not or barely differentiate when teaching mathematics. This problem may be solved by making a second survey specifically for lower grade teachers with similar questions but suited for their way of teaching youngest students.

Additionally, it is hard to say whether conclusions can be generalised. Teachers do not stand for the same group every day or year, do not teach in the same grade every year, and do not always work full-time or part-time, which makes it hard to generalise results. In this study, teachers answered the questions based on their current group, while they may not master all skills if they would teach in another group or grade. Therefore, it would be valuable for future research to follow a group of beginning teachers for a few years with the same conditions. In this study, it was not feasible to follow teachers for a long period. Moreover, it is a question whether the conclusions can be generalised to other school subjects and teachers from other educational stages, such as secondary schools. Furthermore, the current study was focused on the development of differentiation skills of primary school teachers for mathematics. It is not sure whether teachers master and develop the differentiation skills to the same extent and in the same way for other school subjects such as writing or history. Future research should be focused on other schools and school subjects to provide more insight into the overall development of differentiation skills. Finally, it cannot be said whether the results can be generalised to other countries. This requires further investigation of the development of differentiation skills in other (European) countries.

Scientific and practical relevance

Despite the limitations, the study contributes to scientific research and practice. In previous research, it was investigated which skills are required to differentiate (Van Geel et al., 2018; Keuning et al., 2017) and to what extent teachers master certain differentiation skills based on observations of the Dutch Inspectorate of Education (Inspectie van het Onderwijs, 2014). However, no information was

provided on which of the required differentiation skills exactly do teachers master well or not enough. Therefore, this study provides rich insights into teachers' perceptions of their mastery of each differentiation skill. In studies it was also described which factors influence the development of differentiation skills. However, the list of factors was incomplete, and earlier research lacked information about specific features of factors that are important to differentiate effectively. This study helps research in further defining promoting and hindering factors. Thus, this study contributes to scientific research by providing further insight into the development of differentiation skills.

This study is also valuable for practice, because the gained insights can lead to positive changes in the implementation of differentiation by beginning and experienced teachers, schools, and experts. Firstly, this study provides an overview of which required differentiation skills are and are not mastered well according to teachers, and which skills are considered as easy and hard skills to master. This was not known before but is important for teachers in order to know which skills they will master quickly and which skills will take more time when they want to implement differentiation. In other words, the information prepares teachers and may give them a reassuring feeling that not all teachers already master all differentiation skills to a high extent at the beginning of their teaching career. Moreover, the knowledge is valuable for Teacher Education, as with the provided information Teacher Education can focus in their curriculum on differentiation skills that are easy to master according to teachers, so students may be able to master these skills before graduating. Then, just graduated teachers have more time in the first years of their teaching career to develop the differentiation skills that are considered as difficult skills to master. On the other hand, Teacher Education can choose to focus more on skills that are considered as difficult, to make the development of these skills less hard and time consuming for future teachers. For the more experienced teachers, it is valuable to know which required differentiation skills are still not mastered well enough, to pay more attention to the development of these specific skills.

Furthermore, the insights concerning the promoting factors provide a clear understanding of the criteria for effective activities to develop and master the differentiation skills. This information will hopefully result in schools and experts improving professional development activities for teachers to differentiate more effectively. The results even show which activities are the most effective per scale. This information enables schools and experts to apply certain activities focused on specific differentiation skills instead of applying activities which seem less important for certain differentiation skills. Finally, the overview of and details on the hindering factors will most probably give the teachers an indication of the problems they should avoid. This way, teachers, schools, and experts, can prevent or solve ineffective features of activities and try to solve the lack of materials or activities to increase the effectiveness of differentiation in the classrooms.

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Appendices

Appendix A: Questions interview

Vooraf

1. Bedanken voor de aanwezigheid + introduceren
2. Doel + opbouw van het interview bespreken

Demografische data

1. Wat is uw geslacht?
2. Wat is uw geboortedatum?
3. Wat is u hoogst behaalde diploma?
4. Hoeveel jaar werkervaring heeft u in het onderwijs?
5. In welke groep/bouw geeft u les en heeft u het meest lesgegeven?
6. Werkt u fulltime of parttime?

Beheersing differentiatievaardigheden

- DSAQ instrument van Prast et al. (2015) bij de hand houden
- Differentiatie hiërarchie bij de hand houden
- Vertellen over de fasen van differentiatie
- Per onderdeel de stellingen laten bekijken

1. Hoe bereidt u een les(periode) van rekenen voor?

1.1. Welke differentiatievaardigheden beheerst u wel en niet?

1.2. In hoeverre past u vaardigheden toe? Hoe vaak? Op welke manier?

1.3. Zijn er nog andere vaardigheden die u toepast die van belang zijn? Zo ja, welke?

1.4. Ga door naar vraag 4

1.5. Ga door naar vraag 5

1.6. Ga door naar vraag 6

2. Hoe voert u een rekenles uit? Hoe ziet de uitvoering van een gedifferentieerde rekenles eruit?

2.1. Welke differentiatievaardigheden beheerst u wel en niet?

2.2. In hoeverre past u vaardigheden toe? Hoe vaak? Op welke manier?

2.3. Zijn er nog andere vaardigheden die u toepast die van belang zijn? Zo ja, welke?

*Ook vragen naar de mate van de stimulering van zelfregulatie en op welke manier dat gebeurt.

2.4. Ga door naar vraag 4

2.5. Ga door naar vraag 5

2.6. Ga door naar vraag 6

3. Hoe evalueert u een rekenles en lesperiode?

3.1. Welke differentiatievaardigheden beheerst u wel en niet?

3.2. In hoeverre past u vaardigheden toe? Hoe vaak? Op welke manier?

3.3. Zijn er nog andere vaardigheden die u toepast die van belang zijn? Zo ja, welke?

3.4. Ga door naar vraag 4

3.5. Ga door naar vraag 5

3.6. Ga door naar vraag 6

<u>Duur beheersing differentiatievaardigheden</u>

4. Hoe lang heeft het ongeveer geduurd voordat u het idee kreeg dat u de differentiatievaardigheden voldoende heeft ontwikkeld?

4.1. Welke differentiatievaardigheden heeft u snel beheerst? Kunt u het uitdrukken in tijd?

4.2. Welke differentiatievaardigheden zijn volgens u eenvoudig om te ontwikkelen en beheersen? Wat is eenvoudig volgens u? Waarom?

4.3. Voor welke vaardigheden heeft u meer tijd genomen? Kunt u het uitdrukken in tijd?

4.4. Welke vaardigheden bent u nog aan het ontwikkelen?

4.5. Welke vaardigheden zijn wat lastiger om (snel) te ontwikkelen en beheersen? Waarom?

Factoren ontwikkeling differentiatievaardigheden

5. Wat heeft de ontwikkeling van die differentiatievaardigheden gestimuleerd bij u (indien u stimulansen om u heen had en/of heeft)?

5.1. Wat is uw houding (overtuigingen en ervaringen) ten opzichte van differentiatie?
5.2. Heeft u informele en formele professionele ontwikkelingsactiviteiten ondernomen om differentiatievaardigheden te ontwikkelen? Voorbeelden: training, cursus, zelfstudie, gesprekken op de gang en in de pauze, en andere scholen bezoeken. Zo ja, kunt u er wat meer over vertellen?
5.3. Wat heeft u ondernomen na een activiteit?
5.4. Heeft u ondersteuning gehad van de schoolleider, collega's en/of ouders? Zo ja, kunt u daar wat meer over vertellen?
5.5. Heeft u hulpmiddelen (bijvoorbeeld methode, digitale leermiddelen, of concrete materialen) ter beschikking om te kunnen differentiëren ? Zo ja, kunt u daar wat meer over vertellen?
5.6. Zijn er nog stimulansen die niet genoemd zijn? Zo ja, welke?

6. Wat heeft de ontwikkeling van die differentiatievaardigheden belemmerd bij u (indien u moeilijkheden heeft ervaren en/of nog ervaart)?

6.1. Denk aan: een negatieve houding (negatieve overtuigingen en ervaringen), soort en/of gebrek aan informele en/of formele professionele ontwikkelingsactiviteiten, soort en/of gebrek aan ondersteuning, soort en/of gebrek aan hulpmiddelen, en drukte (gebrek aan tijd en ruimte)
6.2. Heeft u geprobeerd de belemmering(en) aan te pakken? Zo ja, hoe? Was het wel of niet effectief en waarom?

Afsluiting

1. Zijn er nog vragen, opmerkingen of aanvullingen?
2. Nogmaals bedanken
3. Inlichten over de volgende stappen in het onderzoek
4. Vragen om feedback te ontvangen voor de vragenlijst

Appendix B: Example of the survey

**.
Met dit onderzoek willen we achterhalen welke factoren van invloed zijn (geweest) op de ontwikkeling van differentiatievaardigheden van leerkrachten. Op basis van interviews hebben we een lijst van deze factoren (stimulerend en belemmerend) opgesteld.

De vragenlijst is opgedeeld in vijf fasen bij het differentiëren (met als context rekenen):
1. Onderwijsbehoeften vaststellen
2. Differentiatie in doelen
3. Differentiatie in instructie
4. Differentiatie in verwerking
5. Evaluatie rekenprestaties & leerproces

Per onderdeel wordt eerst gevraagd wat u doet en daarna gevraagd welke factoren een rol hebben gespeeld in uw ontwikkeling.

← →

1. Onderwijsbehoeften vaststellen

* Toelichting: bij sommige vragen wordt gevraagd naar de manier waarop u de (reken)methode gebruikt. Hieronder verstaan we een 'papieren' methode, maar ook een vaste leerroute in bijvoorbeeld Snappet, GynzyKids of MuisWerk.

	Helemaal niet van toepassing op mij 1	2	3	4	Helemaal van toepassing op mij 5	
DO1. Ik analyseer de antwoorden op methodegebonden rekentoetsen om de onderwijsbehoefte van een leerling in te schatten						☐ Ik gebruik geen rekenmethode of vaste leerroute *
DO2. Ik analyseer de antwoorden op methode-onafhankelijke rekentoetsen (bijv. CITO) om de onderwijsbehoefte van een leerling in te schatten						☐ Ik gebruik geen rekenmethode of vaste leerroute *
DO3. Ik schat de onderwijsbehoefte van individuele leerlingen in op basis van ingevulde rekenopdrachten						☐ Ik gebruik geen rekenmethode of vaste leerroute *
DO4. Ik schat de onderwijsbehoefte van individuele leerlingen in op basis van (informele) observaties tijdens de rekenles						☐ Ik gebruik geen rekenmethode of vaste leerroute *
DO5. Ik voer indien nodig diagnostische gesprekken om de onderwijsbehoefte van individuele leerlingen te analyseren						☐ Ik gebruik geen rekenmethode of vaste leerroute *

← →

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1.1. Wat is makkelijk en snel te beheersen?
Wat is moeilijker/ Waar heb je meer tijd voor nodig (gehad)?

(Sleep naar het juiste vak)

Onderwijsbehoeften inschatten op basis van:

Items	Makkelijk/snel	Moeilijk/meer tijd nodig
observaties (formeel en informeel)		

1.2. Welke factoren hebben **u gestimuleerd** in de ontwikkeling van de vaardigheden voor **het vaststellen van de onderwijsbehoeften**?

(Sleep naar het juiste vak)

*Let op! U mag bij de 'top 3 blokken' per blok maar 1 optie slepen.

Items	Top 3: Nummer 1	Top 3: Nummer 2
Mijn houding en overtuigingen		
De verkregen kennis en vaardigheden tijdens de opleiding		
Langdurige inval/vast contract		
Ervaring opdoen		
Training/Cursus (bijv. Sprongen Vooruit)		
Vergaderingen		
Studiedagen		
Andere scholen bezoeken		
Leerkrachten observeren		
Gesprekken op de gang/in de pauze		
Artikelen/boeken lezen		
Ondersteuning van de schoolleiding		
Ondersteuning van de IB'er en/of RT'er		
Ondersteuning van collega's		
Methode		
Werkwijze op de school		
Leerlingvolgsysteem		
(Digitale) leermiddelen/ concrete materialen		
Anders, namelijk ...		

Top 3: Nummer 3	Dit heeft er ook aan bijgedragen:

1.3. Wat maakte het (uw top 3 factoren) zo effectief voor het vaststellen van de onderwijsbehoeften?
(max. 3 zinnen)

←

→

UNIVERSITY OF TWENTE.

1.4. Welke factoren hebben **u belemmerd** in de ontwikkeling van de vaardigheden voor **het vaststellen van de onderwijsbehoeften**?

(Sleep naar het juiste vak)

*Let op! U mag bij de 'top 3 blokken' per blok maar 1 optie slepen.

Items	Top 3: Nummer 1	Top 3: Nummer 2
Sceptische houding		
Gebrek aan aanbod van kennis en vaardigheden tijdens de opleiding		
Kortdurende inval		
Gebrek aan kennis		
Negatieve ervaring(en)		
Gebrek aan ervaring		
Ineffectieve training/cursus		
Gebrek aan training/cursus		
Ineffectieve vergaderingen/ studiedagen		
Gebrek aan vergaderingen/studiedagen		
Ineffectieve ondersteuning van de schoolleiding		
Gebrek aan ondersteuning van de schoolleiding		
Ineffectieve ondersteuning van de IB'er en/of RT'er		
Gebrek aan ondersteuning van de IB'er en/of RT'er		
Ineffectieve ondersteuning van collega's		
Gebrek aan ondersteuning van collega's		
Ineffectieve ondersteuning van de methode		
Gebrek aan ondersteuning van de methode		
Werkwijze op de school		
Ineffectieve (digitale) leermiddelen		
Gebrek aan (digitale) leermiddelen		
Klassenmanagement		
Tijdmanagement		
Anders, namelijk ...		

Top 3: Nummer 3	Dit heeft de ontwikkeling ook belemmerd:

1.5. Wat was/is er (zie uw top 3 belemmeringen) dan precies ineffectief, moeilijk en/of incompleet aan voor het vaststellen van de onderwijsbehoeften?
(max. 3 zinnen)

←

→

Appendix C: Overview promoting factors

Table 9

Overview of Promoting Factors for the Identification of Educational Needs (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
Gaining experience	487	215	117	50	24	24
My attitude and beliefs	366.5	166	92	30	17	27
Obtained knowledge and skills during Teacher Education	174	85	35	24	16	10
Method of working	160	114	18	30	26	40
Support from the academic coach/remedial teacher	155	125	12	29	38	46
Training/course	149	89	17	34	22	16
Support from colleagues	135.5	115	10	25	31	49
Reading books/articles	129.5	100	11	25	29	35
Student monitoring system	120.5	108	10	16	35	47
Mathematics curriculum material	119.5	93	9	25	26	33
Educational resources	91.5	79	9	14	17	39
Seminars	91	70	9	17	16	28
Observing other teachers	61.5	42	6	13	12	11
Long-term substitution or contract	56.5	33	12	5	5	11
Conversations in the hallway and/or during recess	50.5	46	3	10	10	23
Support from school management	24	23	0	5	10	8
Visit other schools	19	15	0	6	5	4
Something else. namely…	16.5	8	4	1	2	1
Meetings	15	14	0	5	1	8

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.

Table 10

Overview of Promoting Factors for the Differentiation in Goals (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
My attitude and beliefs	464	177	128	33	12	4
Gaining experience	410	180	88	59	23	10
Method of working	142.5	100	20	18	31	31
Obtained knowledge and skills during Teacher Education	139.5	64	25	27	9	3
Reading books/articles	127.5	89	9	29	34	17
Support from the academic coach/remedial teacher	122.5	84	10	28	27	19
Mathematics curriculum material	115	91	13	14	32	32
Support from colleagues	111	91	8	19	34	30
Seminars	99.5	63	11	21	18	13
Training/course	94	53	14	16	17	6
Educational resources	71	62	5	12	19	26
Student monitoring system	55.5	48	4	8	19	17
Observing other teachers	51	34	5	12	7	10
Conversations in the hallway and/or during recess	50	43	3	10	12	18
Long-term substitution or contract	35	20	6	5	5	4
Visit other schools	27	20	3	5	4	8
Support from school management	22.5	17	2	5	3	7
Meetings	17	12	1	5	2	4
Something else. namely…	12	8	3	0	1	4

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.

Table 11

Overview of Promoting Factors for the Differentiation in Instruction (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
My attitude and beliefs	436	168	124	23	15	6
Gaining experience	414.5	179	86	67	19	7
Obtained knowledge and skills during Teacher Education	157.5	69	34	23	7	5
Reading books/articles	134	89	12	28	35	14
Training/course	117.5	65	16	26	12	11
Seminars	112.5	62	12	29	16	5
Method of working	99.5	83	11	12	25	35
Observing other teachers	93	54	8	24	20	2
Support from colleagues	91	74	7	14	31	22
Support from academic coach/remedial teacher	88.5	66	7	17	25	17
Mathematics curriculum material	64	56	3	11	24	18
Educational resources	53.5	57	2	9	13	33
Long-term substitution or contract	46.5	22	11	5	1	5
Conversations in the hallway and/or during recess	44	36	1	11	14	10
Student monitoring system	36	32	1	6	17	8
Support from school management	24	23	0	5	10	8
Visit other schools	14.5	10	1	3	5	1
Something else. namely…	13	5	4	0	1	0
Meetings	11.5	10	1	1	5	3

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.

Table 12

Overview of Promoting Factors for the Differentiation in Practice (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
My attitude and beliefs	400	153	112	27	6	8
Gaining experience	399	169	88	56	21	4
Training/course	140	70	22	29	13	6
Obtained knowledge and skills during Teacher Education	126.5	58	25	21	7	5
Method of working	102.5	77	14	12	22	29
Reading books/articles	101.5	68	7	23	31	7
Support from colleagues	95	69	10	16	23	20
Seminars	87	49	6	27	14	2
Educational resources	82.5	73	8	9	25	31
Mathematics curriculum material	82	68	5	15	26	22
Support from the academic coach/remedial teacher	80	63	10	6	29	18
Conversations in the hallway and/or during recess	79	55	5	19	21	10
Observing other teachers	71	46	7	15	16	8
Long-term substitution or contract	33.5	17	7	4	3	3
Student monitoring system	28	22	3	4	7	8
Support from school management	19	14	3	1	6	4
Visit other schools	18.5	12	3	2	4	3
Meetings	16	10	1	5	2	2
Something else. namely…	10.5	5	3	0	1	1

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.

Table 13

Overview of Promoting Factors for the Evaluation of Progress and Process (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
Gaining experience	396	164	90	54	16	4
My attitude and beliefs	368.5	136	106	21	8	1
Obtained knowledge and skills during Teacher Education	144.5	61	35	15	8	3
Support from the academic coach/remedial teacher	141.5	85	19	24	31	11
Seminars	113.5	60	11	33	13	3
Student monitoring system	112.5	83	11	18	33	21
Method of working	103	76	9	19	28	20
Mathematics curriculum material	89.5	68	7	16	28	17
Support from colleagues	87	65	6	18	25	16
Training/course	77	39	11	18	6	4
Reading books/articles	76.5	57	5	15	26	11
Observing other teachers	41	24	7	5	8	4
Conversations in the hallway and/or during recess	38.5	27	1	10	15	1
Long-term substitution or contract	34.5	17	6	6	4	1
Educational resources	30.5	33	1	2	17	13
Meetings	23	13	3	5	3	2
Support from school management	14	12	0	4	4	4
Visit other schools	12.5	8	0	5	2	1
Something else. Namely…	9	5	2	1	0	2

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.

Appendix D: Overview hindering factors

Table 14

Overview of Hindering Factors for the Identification of Educational Needs (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
Time management	297.5	146	70	26	21	29
Lack of knowledge and skills from Teacher Education	211.5	88	54	18	11	5
Lack of experience	171.5	81	33	27	16	5
Lack of knowledge	129	61	23	23	13	2
Ineffective meetings/seminars	111	61	14	24	19	4
Ineffective support from curriculum material	95	60	12	16	22	10
Lack of training/course	95	58	9	24	15	10
Lack of (digital) educational resources	71.5	48	6	16	17	9
Ineffective (digital) educational resources	69	50	7	13	14	16
Classroom management	67	42	8	14	10	10
Ineffective support from the academic coach/remedial teacher	66	42	6	14	18	4
Lack of support from curriculum material	65	44	9	8	17	10
Ineffective training/course	55.5	26	10	10	5	1
Short-term substitution/no permanent contract	48	24	12	3	3	6
Ineffective support from school management	44.5	27	6	8	8	5
Method of working	42.5	35	5	4	13	13
Lack of support from the academic coach/remedial teacher	42	27	6	6	9	6
Ineffective support from colleagues	33	24	4	5	7	8
Sceptical attitude	33	17	6	5	4	2
Lack of meetings/seminars	32.5	22	1	10	8	3
Lack of support from colleagues	27	20	4	3	5	8
Lack of support from school management	26.5	21	1	6	9	5
Something else. namely…	26.5	12	7	1	3	1
Negative experiences	25.5	15	2	7	5	1

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.

Table 15

Overview of Hindering Factors for the Differentiation in Goals (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
Time management	248	128	55	25	18	30
Lack of knowledge and skills from Teacher Education	198	78	52	18	4	4
Lack of experience	188	89	28	45	12	4
Lack of knowledge	165.5	70	42	14	9	5
Lack of training/course	102	60	9	27	18	6
Classroom management	91.5	58	14	15	10	19
Ineffective support from curriculum material	80	50	10	15	15	10
Lack of (digital) educational resources	69.5	54	7	12	14	21
Sceptical attitude	59	23	18	1	2	2
Lack of support from curriculum material	57	34	10	6	12	6
Ineffective support from the academic coach/remedial teacher	52	31	6	12	7	6
Ineffective meetings/seminars	51.5	30	3	18	4	5
Short-term substitution/no permanent contract	39	16	12	0	2	2
Negative experiences	38	18	9	4	1	4
Ineffective (digital) educational resources	36	28	4	4	12	8
Method of working	35	34	2	4	14	14
Ineffective training/course	34.5	19	4	9	3	3
Ineffective support from school management	30.5	19	3	7	6	3
Lack of support from the academic coach/remedial teacher	25	26	0	4	12	10
Something else. namely…	24	9	7	1	1	0
Lack of support from colleagues	22	20	2	1	11	6
Ineffective support from colleagues	20.5	15	3	2	5	5
Lack of meetings/seminars	18.5	13	1	5	4	3
Lack of support from school management	12.5	12	0	2	7	3

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.

Table 16

Overview of Hindering Factors for the Differentiation in Instruction (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
Time management	240.5	113	58	20	18	17
Lack of knowledge and skills from Teacher Education	201.5	81	54	16	4	7
Lack of experience	191.5	86	37	33	13	3
Lack of knowledge	138.5	62	29	20	10	3
Lack of training/course	115	58	18	22	16	2
Classroom management	100.5	54	17	17	11	9
Ineffective support from curriculum material	65.5	44	7	11	19	7
Lack of support from curriculum material	57.5	44	7	7	15	15
Ineffective meetings/seminars	57.5	30	8	12	9	1
Lack of (digital) educational resources	51.5	33	8	7	9	9
Ineffective support from the academic coach/remedial teacher	51.5	31	6	10	12	3
Method of working	46	28	7	8	5	8
Ineffective (digital) educational resources	41	31	6	5	6	14
Short-term substitution/no permanent contract	40.5	17	10	4	2	1
Negative experiences	40	17	8	7	2	0
Ineffective training/course	37	18	5	9	4	0
Lack of meetings/seminars	30	19	1	10	6	2
Sceptical attitude	29	15	5	4	6	0
Lack of support from school management	28	20	1	7	10	2
Lack of support from the academic coach/remedial teacher	25	21	1	5	9	6
Ineffective support from school management	22.5	16	2	4	7	3
Ineffective support from colleagues	18.5	15	1	3	8	3
Lack of support from colleagues	16	12	1	4	3	4
Something else. namely…	14	5	4	1	0	0

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.

Table 17

Overview of Hindering Factors for the Differentiation in Practice (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
Time management	206	94	52	15	13	14
Lack of knowledge and skills from Teacher Education	182	72	48	15	7	2
Lack of knowledge	157.5	64	37	20	6	1
Lack of experience	156	72	27	31	12	2
Lack of (digital) educational resources	118.5	57	23	19	8	7
Lack of training/course	96	49	12	24	11	2
Lack of support from curriculum material	85	55	11	14	18	12
Classroom management	80.5	49	13	11	14	11
Ineffective (digital) educational resources	75.5	48	12	10	13	13
Ineffective support from curriculum material	60.5	39	8	9	15	7
Ineffective training/course	56	26	11	8	7	0
Ineffective meetings/seminars	47	24	5	13	6	0
Short-term substitution/no permanent contract	47	21	11	5	3	2
Method of working	36	23	7	2	8	6
Lack of meetings/seminars	36	18	4	10	4	0
Ineffective support from the academic coach/remedial teacher	32	26	2	4	16	4
Negative experiences	31	17	4	7	4	2
Lack of support from colleagues	30.5	23	2	7	7	7
Sceptical attitude	30	14	8	1	3	2
Something else. namely…	26.5	11	7	2	1	1
Lack of support from the academic coach/remedial teacher	20.5	13	4	1	5	3
Ineffective support from school management	19.5	18	0	4	9	5
Lack of support from school management	15.5	15	0	3	7	5
Ineffective support from colleagues	12	11	0	3	4	4

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.

Table 18

Overview of Hindering Factors for the Evaluation of Progress and Process (ranked from highest to lowest score)

	Total score	Number of times selected	Selected as number 1 (3 points)	Selected as number 2 (2 points)	Selected as number 3 (1 point)	Selected as 'Also helpful' (0.5 points)
Time management	309	134	80	24	12	18
Lack of knowledge and skills from Teacher Education	201.5	79	54	16	6	3
Lack of experience	192	88	36	32	20	0
Lack of knowledge	152	64	33	23	6	2
Lack of training/course	93	53	9	23	19	2
Short-term substitution/no permanent contract	66.5	26	18	5	2	1
Sceptical attitude	65.5	26	19	2	4	1
Lack of support from curriculum material	50.5	35	5	9	14	7
Ineffective meetings/seminars	49.5	28	2	19	4	3
Classroom management	49	31	4	12	11	4
Lack of support from the academic coach/remedial teacher	40.5	30	5	5	11	9
Ineffective training/course	40	18	7	8	3	0
Ineffective support from the academic coach/remedial teacher	39	26	3	9	10	4
Ineffective support from curriculum material	37	27	4	5	12	6
Lack of (digital) educational resources	36.5	29	2	8	10	9
Lack of meetings/seminars	34	24	1	9	12	2
Method of working	29.5	22	3	5	7	7
Negative experiences	25.5	12	5	4	2	1
Ineffective support from school management	20	16	1	3	10	2
Lack of support from colleagues	19.5	15	2	3	5	5
Ineffective (digital) educational resources	19	20	1	0	13	6
Ineffective support from colleagues	16	12	2	1	7	2
Something else. namely…	14	5	4	1	0	0
Lack of support from school management	13	11	1	2	4	4

Note. Some respondents had chosen more than three items for their 'Top 3' promoting factors. Therefore, the total number of selections can exceed the total number of respondents.