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Differentiated instruction in practice: A teacher perspective

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Table of contents

Chapter 1

Introduction

Chapter 1
Introduction

1.1 Introduction

School systems are not always successful in engaging students to maximize their performance. In the Netherlands this results in students aiming to achieve well enough to pass on to the next grade instead of aiming for higher achievements in subjects where this is possible for them (Westenberg, 2011; Westenberg & Van Driel, 2012). This problem has been recognized by the Dutch government, which provided extra funds for initiatives to stimulate student talent development (Dekker, 2013). The idea is that all students should get the opportunity to achieve to their maximum (Westenberg, 2011; Westenberg & Van Driel, 2012). Teachers have an important role in accomplishing this talent development. They can use differentiated instruction (DI) as a pedagogical approach to maximize each students' learning potential (Tomlinson et al., 2003). Several studies, covering a long period of time, have shown that when teachers differentiate their instruction tailored to students' individual learning needs, students' motivation, achievement, and engagement may increase (e.g., Deunk, Doolaard, Smale-Jacobse, & Bosker, 2015; Maeng & Bell, 2015). However, DI is a much debated topic in the educational literature and practice: Although it appears to be important for students, it is difficult for teachers to apply DI in their daily teaching practice (e.g., Dutch Inspectorate of Education, 2016; Tomlinson et al., 2003). Many attempts have been made over the years to help teachers practice DI, but it remains a (pedagogical) approach that teachers have difficulties with (e.g., Graham et al., 2008; Roiha, 2014). Teachers make only minor, if any, adaptations. Those adaptations are often not aimed at all students, but at specific groups, often the low achieving students. Examples of

such minor adaptations are expecting individual accomplishments in individual tasks, providing individual support, and assigning students presentations and projects in which the students have autonomy regarding the specific topic (Graham et al., 2008; Roiha, 2014). The reasons teachers give for limiting their efforts to these minor adaptations are a lack of time, resources, and materials, hindering physical classroom settings, and large class sizes (Roiha, 2014). Teachers view DI as an approach in which they have to make individual lesson plans for all students (Janssen, Hulshof, & Van Veen, 2016); however, with large classes, this requires time they do not have.

To stimulate teachers to implement DI, policies have been put into place (e.g., Mills et al., 2014; Valli & Buese, 2007); to then support teachers in the implementation of DI, professional development trajectories (PD trajectories) have been set up (e.g., De Jager, 2013; Valli & Buese, 2007). However, both these policies and the PD trajectories often failed to produce the desired results. For example, Valli and Buese (2007) found in the US that diversity in classrooms increased as a result of several federal, state, and local policies. PD trajectories were then provided to help teachers cope with the increasing diversity through use of DI. Although teaching practices did change, the changes were confined to grouping students in small teaching-learning groups, and did not evolve beyond that. In the design of these policies and PD trajectories, teacher characteristics such as knowledge, perceptions, and beliefs about DI, and the realities of their classroom practices, are often overlooked (Janssen, Westbroek, Doyle, & Van Driel, 2013). In many cases, teachers consider the policies and PD trajectories impractical, since they feel the ideas behind these initiatives are too far removed from actual classroom practice. Hence, DI initiatives will not or will only partly be adopted (Janssen, Westbroek, Doyle, et al., 2013). On the other hand, positive results have also been observed in these implementation processes (e.g., Hertberg-Davis & Brighton, 2006; Tomlinson, Brimijoin, & Narvaez, 2008). This

occurred especially when the whole school is involved in the change, even the school administrators. When the principal, for example, provided teachers with a safe and secure environment for change and believed in the teachers' ability to change, change was more likely to happen than when the principal was not supportive (Goddard, Neumerski, Goddard, Salloum, & Berebitsky, 2010; Hertberg-Davis & Brighton, 2006). However, these were either small-scale studies with an elaborate report on how implementation in that specific case came to be (Anderson, 2007; Levy, 2008), or larger studies that did not elaborate on what specifically caused those positive results (e.g. Goddard, et al. 2010). In addition, most research that has been done on DI was focused on how to implement it, whether implementation worked, and what the effects on students were (e.g., Deunk et al., 2015; Mastropieri et al., 2006; Tomlinson et al., 2003). Thus, research has shown that teachers do have knowledge about DI, but that most of the time they do not implement it in classroom practice (Brighton, 2003; Roiha, 2014). However, it appears that how knowledge of DI becomes classroom practice has barely been explored. Also, a teacher perspective is often missing in research on DI: what they already know and do, attempt to do and why, and what in their working environments influences their knowledge and practices.

In the current dissertation, the focus is on the teacher perspective with the aim of contributing to a more detailed understanding of what happens to teachers when they are asked to practice DI in the context of an innovation named GUTS (Gedifferentieerd Uitdagen van Talent op school, meaning Differentiated Challenging of Talent in School; see section 1.4). To achieve this goal, we first explored the literature to investigate the influence of the teacher's daily work environment on the implementation of DI. Then, in two empirical studies, we looked in more detail at the choices teachers make regarding DI during practice, by exploring their interactive cognitions of DI in their regular and their

GUTS lessons. Finally, we explored teachers' sense-making processes during GUTS lessons. In taking this perspective, we aimed to contribute to the literature on DI and teacher knowledge, but also to help promote the implementation of DI and teachers' professional learning regarding DI.

1.2 Differentiated instruction

1.2.1 Differentiated instruction within classrooms

Differentiated instruction (DI) is a pedagogical approach in which teachers (proactively) aim to maximize each student's learning potential (Subban, 2006; Tomlinson et al., 2003). To maximize the learning potential of each individual student, teachers take account of differences in the students' learning needs in the process, content, and product of instruction. The students' learning needs can be divided into the three main student characteristics Tomlinson, a leading researcher on the subject of DI, identified as the students' readiness, interest, and learning profile (Tomlinson et al., 2003). The students' *readiness* can best be described by referring to Vygotsky's (1978) zone of proximal development (ZPD). The ZPD is the zone where a student achieves while experiencing minor challenge. This means that the student cannot yet achieve alone at that level, but needs guidance from a teacher, peer, or parent. When teachers take each student's *readiness* into account, it means that they try to teach each student through his/her ZPD. When teachers take account of a student's *interests*, student engagement is likely to be enhanced, and intrinsic motivation will increase (Tomlinson et al., 2003). A student's *learning profile* is the student's preferred mode of learning, and can be influenced by several characteristics such as learning preferences (the ways students prefer to learn), gender, and culture (Tomlinson et al., 2003). In this definition of DI with its specific distinction between the three student characteristics, influences on how students learn such as a student's cultural background are part of the category *learning profile*. However,

especially in current times with a high level of cultural diversity in schools, several researchers argue that it is important to intentionally address students' diverse cultural backgrounds rather than as part of a larger pedagogical approach addressing all kinds of differences between students (Cohen & Lotan, 1995; Santamaria, 2009; Severiens, 2014). These researchers make a distinction between DI as described by Tomlinson et al. (2003), which puts relatively more emphasis on differences between students' cognitive traits (academic DI) and DI that emphasizes creating equal status relationships between students by addressing their cultural backgrounds (cultural DI). The argument is that, from a social justice perspective, Tomlinson et al.'s (2003) definition of DI does not delve deeply into issues of cultural inequality and the influence the students' different cultural backgrounds and home situations have on the learning environment (Severiens, 2014). *Academic* and *cultural* DI can be seen as complementary perspectives on student learning, since they both aim to maximize students' learning potential and learning outcomes. *Academic* DI focuses firstly on interaction between the teacher and his/her individual students' talents and the variety in learning opportunities that should be offered to those different students in order to develop those talents to the fullest (Severiens, 2014). While *cultural* DI is more about the inequality that exists in classrooms as a result of the students' different cultural backgrounds and the teacher primarily attempting to incorporate those into his/her teaching to make sure all students feel addressed (Santamaria, 2009; Severiens, 2014). Moreover, in Tomlinson et al.'s (2003) *academic* DI there is more focus on students' performance, motivation, and learning preferences and in *cultural* DI there mainly is a focus on imposing equal status on all students. This latter can be considered similar to teaching for equity as described by Cohen and Lotan (1995). Since the research described in this dissertation focuses on the innovation GUTS in which teachers were encouraged to differentiate their instruction in order to further develop students'

(academic) talents, we adhered to Tomlinson et al.'s (2003) definition of *academic* DI.

Ideally, DI meets six hallmarks, according to Tomlinson et al. (2003). They state in their literature review that instruction can be called DI when it: (1) is proactive, rather than reactive. DI is thus preferably planned beforehand; (2) uses flexible grouping practices. Small teaching-learning groups are formed and the teacher chooses flexibly between heterogeneous and homogeneous groups; (3) varies in use of materials. The lesson materials can differ per student, according to their learning needs; (4) is flexibly paced. The teacher flexibly adapts his/her pace of instruction to the needs of the different students; (5) is learner-centered. Instruction thus focuses on getting each student ahead; and (6) is knowledge-centered. The teacher ensures that every student understands the subject matter. This *effective* DI that Tomlinson et al. (2003) describe can also be seen as divergent DI (Bosker & Doolaard, 2009). In divergent DI, teachers aim to get as much out of every student as possible, and the teachers' attention is divided more or less evenly between students. This is opposed to convergent DI, where a teacher sets minimum goals that each student should reach (Bosker & Doolaard, 2009). This means that students who achieve well and reach the minimum goals with more ease than lower achieving students often get less attention in class from the teacher than those lower achieving students (Bosker & Doolaard, 2009). Though both types of DI seem opposites, they do not necessarily exclude each other in teachers' classroom practices (Denessen, 2017; Severiens, 2014); teachers can choose every time they decide to take students' needs into account in their teaching, to do this convergently or divergently.

1.2.2 Between-classroom differentiation

DI can take place between and within classrooms. In countries like the Netherlands, where students in secondary education are placed in

different educational tracks, based on achievement, DI takes place between classrooms (Bosker & Doolaard, 2009). In secondary education in the Netherlands, students are tracked several times during their school career. After primary education, around age 12, students are placed in one of three main tracks: pre-vocational secondary education (VMBO), senior general secondary education (HAVO), or pre-university education (VWO). Halfway through their secondary education, students are tracked further, now mainly according to their interests, in combination with their achievements. Students choose a profile based on what they think they will want to study after secondary education. A profile is made up of a set of subjects that offer a student the opportunity to specialize in one of four disciplinary areas: Culture and Society, Economy and Society, Nature and Health, Nature and Technology. The choice for one of the four profiles is based partly on achievement: they consider what subjects they are good at and what would thus be a sensible choice. Students' choice is also based on their interests: they decide what subjects they like and want to receive more education in. In sum, in the Netherlands, between-classroom DI focuses on taking the readiness and interests of groups of students (as opposed to individual students) into account.

In countries where tracking of students occurs, teachers often do not see a need for DI within classrooms (Bosker & Doolaard, 2009), although diversity in the classes is still high (Deunk et al., 2015). However, research into the effects of successful within-classroom DI on students' learning outcomes has found positive results (Deunk et al., 2015; Maeng & Bell, 2015). Specifically, students' engagement and achievement appear to increase when their learning needs are taken into account (Mastropieri et al., 2006; Richards & Omdal, 2007).

1.3 The teacher perspective on differentiated instruction

1.3.1 Implementation of differentiated instruction in practice

In many studies that report the (results of) DI in classrooms, grouping students is the most commonly observed way to differentiate instruction (Deunk et al., 2015; Tomlinson, 2015). Teaching-learning groups can be made based on different student characteristics, like their achievements or interests (Deunk et al., 2015; Subban, 2006; Tomlinson et al., 2003). Students with the same achievement levels and interests can be grouped together in homogeneous groups, but students in the same group can differ on these characteristics in heterogeneous groups. Ideally, the teacher makes flexible use of these different ways of grouping students (Tomlinson et al., 2003). A possible reason many teachers use grouping as a DI method is that it is easier to implement in practice than planning how to instruct each student in an individually preferred way. In secondary education, teachers teach at least five different classes of 25-30 students a day (Janssen, Westbroek, Doyle et al., 2013). Teachers believe that because DI should be planned proactively, an individualized lesson plan for every student needs to be made. With so many students a day and only 15 minutes planning time per lesson, DI seems impossible to implement (Janssen et al., 2016). Teachers consider DI to be an impractical approach, for it lacks congruence and instrumentation, and is high in costs (Janssen, Westbroek, Doyle et al., 2013). For DI to be *congruent* with a teacher's practice, there should be a proper fit between DI approach and the already existing classroom practices; thus it should not require drastic changes (Janssen et al., 2016). An approach to DI is *instrumental* when it provides clear practices or procedures that prescribe what to do to effectively differentiate instruction (Janssen et al., 2016; Rubenstein, Gilson, Bruce-Davis, & Gubbins, 2015). The *cost* of an approach to DI should not be too high; this is the case when the approach is efficient for the teacher and the teacher can expect a return that is in balance with his/her efforts (Janssen et al., 2016). Besides the

impracticality, teachers feel that the regular classroom situation constrains proper experimentation and implementation of DI (e.g., Roiha, 2014; Roy, Guay, & Valois, 2013). At the end of each school year teachers are expected to have taught each student a certain curriculum, or particular subject matter (McTighe & Brown, 2005; Severiens, 2014). In order to do so, teachers often feel they should stick as much as possible to the regular lesson method. Because of its impracticality, DI is, apart from the grouping practices teachers often use, a little-observed approach in everyday classroom practice (Janssen et al., 2016; Subban, 2006). Teachers prefer to teach to the middle and adjust their instruction to the middle-achieving students (Subban, 2006). Also, when teachers use DI methods, they often use a small range of different methods and stick to that (Graham et al., 2008; Roiha, 2014; Roy et al., 2013).

It thus appears that, despite the many years of research into DI and the attempts to implement it, DI is a difficult approach to implement in practice. For that reason, professional development trajectories are being undertaken to support teachers in learning ways to use differentiated instruction (e.g., Bianchini & Brenner, 2010; VanTassel-Baska et al., 2008). However, as mentioned above, those PD trajectories often do not have the desired results; DI is often not implemented as was intended by the trajectories. For example, Bianchini and Brenner (2010) investigated an induction program for beginning teachers. In this induction program special attention was paid to the implementation of DI. Whether the beginning teacher implemented DI was not only decided by that induction program: Bianchini and Brenner (2010) showed how one teacher who began teaching in a school very supportive of DI did indeed implement DI in her lessons, whereas another beginning teacher, who was not supported by her school or her mentor to implement DI, did not implement it. Beecher and Sweeny (2008) and VanTassel-Baska et al. (2008) found positive results on the implementation of DI. However,

their studies were longitudinal studies, with teacher participation in PD trajectories for several years and involvement of the whole school. Changes were visible after eight and three years, respectively. DI is not an approach that is implemented in a short period of time, nor is it likely to be implemented sustainably when the whole school is not involved in a complete change of approach (Severiens, 2014; Tomlinson et al., 2003; Tomlinson et al., 2008). Consequently, it is possible that other factors are at play that influence whether what is learned in a PD trajectory is implemented in practice, and that a step-wise and longitudinal change is necessary (Severiens, 2014).

Schools do not attempt to move towards greater use of DI simply for the sake of change (Tomlinson et al., 2008). DI increases student outcomes, and that is what schools wish to achieve. However, with many change initiatives, there is a general idea of how to increase those outcomes (e.g., through DI), but an explicit theory of improvement is often lacking. A theory of improvement provides an elaborate explanation of what should change in practice and how (Van Veen, Zwart, Meirink, & Verloop, 2010; Wayne, Yoon, Zhu, Cronen, & Garet, 2008). The lack of such a theory of improvement could mean that different context and teacher characteristics influencing teaching practice are not taken into account in the design of an innovation, which could in turn influence implementation as described above.

In this dissertation, we use a teacher perspective to pay attention to those different factors that influence teachers' practices in the implementation of DI.

1.3.2 Teachers' interactive cognitions regarding differentiated instruction

As mentioned above, teachers consider proactive DI difficult to implement. However, even if a teacher plans for proactive DI, situations will arise in class that the teacher needs to respond to (Denessen & Douglas, 2015). During teaching, teachers thus need to make choices regarding the students' needs they are taking into

account, which means that reactive DI will always be present in classroom teaching. Much of the research into (reactive) DI has focused mainly on teachers' knowledge and beliefs about DI, their observable practices, and student outcomes in order to draw conclusions about the teachers' implementation of DI (e.g., Brighton, 2003; Deunk et al., 2015; Graham et al., 2008; Mastropieri et al., 2006). However, there is a reciprocity between teachers' cognitions and insights and their activities in the classroom regarding (reactive) DI that can only be explored by paying attention to the teachers' knowledge of DI *during* teaching (McAlpine, Weston, Berthiaume, & Fairbank-Roch, 2006; Munby, Russell, & Martin, 2001; Verloop, Van Driel, & Meijer, 2001). This practical knowledge of teachers is the knowledge that is embedded within their practices, and it can be considered to consist of two components: (1) knowledge and beliefs; and (2) interactive cognitions (Meijer, Verloop, & Beijaard, 2002). Teachers' knowledge and beliefs are the more normative knowledge and beliefs about what is important to teach and how students' learning should be promoted; these are the cognitions teachers have *about* their practice (Meijer, 1999). Teachers' knowledge and beliefs influence the cognitions that they (un)consciously have during the teaching itself, their interactive cognitions (Meijer, 1999; Verloop, 1989; Verloop et al., 2001). Teachers' interactive cognitions are present *during* practice (Meijer, 1999; Verloop, 1989). What happens in classroom practice in turn shapes the teachers' interactive cognitions, because these cognitions are embedded in the teachers' practices. Interactive cognitions are thus dynamic (Meijer et al., 2002).

Because interactive cognitions are personal in nature and occur in a teacher's mind during teaching, they are difficult to investigate. Think-out-loud protocols are often used to investigate thoughts (Meijer, 1999; Nguyen, McFadden, Tangen, & Beutel, 2013); however, this is not possible during teaching. Therefore, stimulated recall interviews (SRIs) are frequently used when investigating teachers'

interactive cognitions during teaching. In SRIs, teachers are first observed while teaching. During the observations, video recordings are made, which are shown to the teachers in an interview shortly after the observation (McAlpine et al., 2006; Meijer, 1999; Nguyen et al., 2013; Verloop, 1989). During the interview, the teachers watch their own teaching and explain what they were thinking during several teaching actions. The teachers' explanations of their thinking-in-action are considered to be expressions of their interactive cognitions (Meijer, 1999; Nguyen et al., 2013; Verloop, 1989).

The embeddedness in practice and the dynamic nature of interactive cognitions make these a complex teacher characteristic to capture. However, merely examining practices and knowledge as two separate entities will not provide a complete picture of what happens in classrooms when teachers aim to differentiate their instruction (McAlpine et al., 2006). Therefore, in this dissertation, with its focus on the teacher perspective on DI, we investigated teachers' interactive cognitions. More specifically, we focused on what student characteristics teachers take into account when interacting with students and how they do that (Denessen & Douglas, 2015).

1.3.3 Sense-making of an innovation aimed at increasing DI

In most of the above-mentioned studies, the implementation of DI was dealt with as the implementation of an innovation (e.g., Puzio, Newcomer, & Goff, 2015; Smit & Humpert, 2012). Research into the implementation of educational innovations has shown that implementation diverting from the original plan is not a phenomenon that is typical for the implementation of DI (März & Kelchtermans, 2013; Van Veen et al., 2010). Each school and each teacher has individual characteristics that influence how an innovation is received by the teachers within a school. This causes actual implementation to differ from intended implementation, especially when the innovation lacks an explicit theory of improvement (Van Veen et al., 2010; Wayne

et al., 2008). Differing implementation can be interpreted in two ways: as a rejection of the innovation, or as describing the process of the teachers positioning themselves within the innovation (Ketelaar, Beijaard, Boshuizen, & Den Brok, 2012; Luttenberg, Van Veen, & Imants, 2013; Spillane, Reiser, & Reimer, 2002). In line with Luttenberg, Van Veen et al. (2013) and Spillane et al., (2002), we believe that regarding the actual implementation as a rejection of the intended implementation does not do justice to the effort teachers put into the implementation process. It is, therefore, preferable to consider teachers' handling of the innovation as a process of sense-making. Teachers' sense-making processes typically commence when they are confronted with new external expectations (Luttenberg, Van Veen, et al., 2013; März & Kelchtermans, 2013; Spillane et al., 2002). Sense-making can be seen as a dynamic process in which teachers obtain coherence between their own personal frames of reference (their knowledge, beliefs, and practices) and their perceptions of the new external expectations (the perceived situational demands). Sense-making is a dynamic process since it influences both the teachers' personal frames of reference and the innovation. Luttenberg, Van Veen, et al. (2013) described four types of search for meaning teachers can go through: (1) assimilation, when there is a match between the personal frame of reference and the perceived situational demands, and the teacher fits the situational demands within his/her personal frame of reference; (2) accommodation, when there is a match between the personal frame of reference and the perceived situational demands, and the teacher fits his/her personal frame of reference within the situational demands; (3) toleration, when there is a mismatch between the personal frame of reference and the perceived situational demands, and the teacher adheres to the situational demands and maintains his/her frame of reference; and (4) distantiation, when there is a mismatch between the personal frame of reference and the perceived situational demands, and the teacher discards the situational demands.

In addition to describing the teachers' sense-making processes as types of search for meaning, sources of ambiguity and uncertainty can be used to further specify the complex process that teachers go through (Allen & Penuel, 2015; Weick, Sutcliffe, & Obstfeld, 2005). Teachers will experience sources of ambiguity and uncertainty when they are confronted with an innovation and they have no obvious ways to engage in that innovation, because it presents them with a new situation. The sources of ambiguity and uncertainty can refer to teachers' not completely agreeing with the practices they have to implement, lacking proper and sufficient resources for these practices (ambiguity), or not understanding well enough what is expected of them (uncertainty) (Allen & Penuel, 2015). Sources of ambiguity and uncertainty include limited resources, conflicting goals, and role ambivalence.

The research described in this dissertation took place as part of the GUTS project (see 1.4). This project can be seen as an innovation that aimed to stimulate teachers to practice DI. Considering the difficulties that are often experienced with the implementation of DI, we examined the teachers' sense-making of DI in the context of GUTS and, more specifically, whether and how teachers' sense-making in relation to this innovation changed over time.

1.4 GUTS

The empirical studies in this dissertation were conducted in the context of GUTS (Gedifferentieerd Uitdagen van Talent op School, meaning Differentiated Student Talent Development). The primary aim of GUTS was to challenge students in the lower grades of secondary education and give them chances to discover their talents; this was expected to result in increased motivation for school and achievement (Westenberg & Van Driel, 2012). To achieve the main goal of GUTS, teachers were encouraged to practice DI. Both the influences of GUTS on students and on teachers were studied in two separate doctoral

research projects. In the current dissertation, we focused on the teachers. In the PhD research project that took place parallel to the research described in this dissertation, students' perceptions of GUTS and the influences of GUTS on students' motivation and achievement were studied (Wijsman, 2018).

For the current dissertation GUTS was an interesting context to study influences on teachers' implementation of DI, their interactive cognitions of DI, and their sense-making of GUTS lessons, since: in GUTS the whole school was involved (Tomlinson et al., 2008); the teachers got a lot of freedom (De Neve, Devos, & Tuytens, 2015; Schmidt & Datnow, 2005); it was disconnected from the regular curriculum (McTighe & Brown, 2005); and teachers taught more homogeneous groups of students (Janssen et al., 2016; Janssen, Westbroek, Doyle et al., 2013).

The innovation was designed in cooperation between university researchers and a secondary school in the Netherlands that provides bilingual general secondary education (HAVO) and bilingual pre-university education (VWO). Bilingual education means that the school offers lessons in the three lower grades through English, except from the language classes which are offered in regular form. The school can be typified as an innovative school, where often innovations are commenced, like implementing working on laptops during class, Chinese language lessons for all lower grade students, and recently GUTS. The implementation process of GUTS started in the school year 2013-2014 and continued for three years. During those years, teams from both institutions met regularly and discussed and evaluated the innovation. When necessary, at the start of each school year, (minor) changes would be made to optimize GUTS.

Students received several extra lessons (GUTS lessons) in a subject they liked and were already achieving well in; this latter was decided to be the case when students had a mean grade of seven for

that subject[1]. Each student chose at several points during the school year what subjects they wished to follow during the GUTS lessons. In the first year, this project took place, the 7th grade students chose at three points and received two GUTS lessons in subject one, and four GUTS lessons in subjects two and three. In the second and the third years of GUTS, students chose a subject each semester and received approximately eight lessons per subject. At each point when students had to give their preferences for the subjects to receive GUTS lessons in, they selected three subjects and were given one of these. For organizational reasons, it was impossible to give each student their number one choice.

The GUTS lessons that the students followed were designed by the teachers. The teachers were free in the content and specifics of the lessons, since they did not have to fit within the regular curriculum. However, the lessons did have to be related to the regular curriculum, since students needed to be able to transfer what they learned during the GUTS lessons to the regular lessons in order to achieve better during those. In addition, teachers had to make sure the lessons met four criteria: (1) they had to provide *enrichment* for the students in addition to their regular subject-matter; (2) students should be able to experience *autonomy*; (3) *higher order learning*, according to Bloom's taxonomy, had to be stimulated; and (4) the teachers should *differentiate* their instruction during the lessons. Although the GUTS lessons had to meet all four criteria, teachers were specifically requested to differentiate their instruction in the lessons. Because in GUTS the teachers did not have to follow the regular curriculum, because student groups were more homogeneous than in the regular lessons, and because the whole school was involved, it was considered a context in which they could experiment with DI (De Neve et al., 2015;

[1] In the Netherlands students are graded between one and ten on tests, where one means very poor achievement, and ten excellent achievement

Janssen, Westbroek, Doyle et al., 2013; McTighe & Brown, 2005; Tomlinson et al., 2008).

1.5 Overview of the chapters

In this dissertation, we have conducted a literature review and three empirical studies within the context of GUTS. Within these studies, we have taken a teacher perspective on differentiated instruction by focusing on the factors that, in general, influence the teacher's implementation of DI in classroom practice (chapter 2); and what happens in the interaction between the (school) context and the teacher (chapter 5), and between the teacher and classroom practice (chapters 3 and 4), as is illustrated in Figure 1.1.

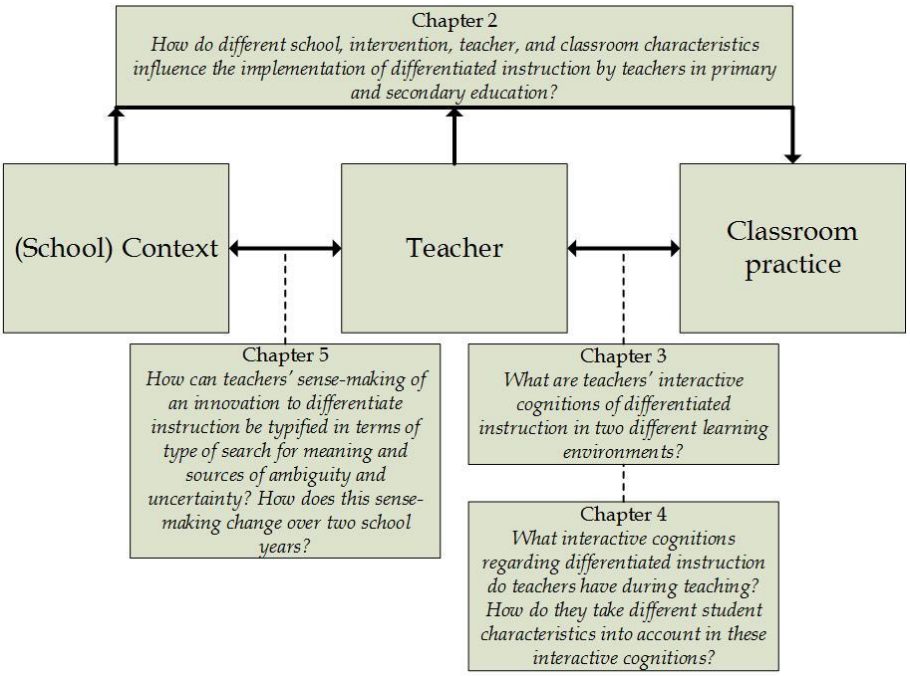

Figure 1.1 Overview of chapters

Chapter 2: The influence of school, intervention, teacher, and classroom characteristics on the successful implementation of differentiated instruction: A review of empirical findings

Since many studies have shown that differentiated instruction is a pedagogical approach that is difficult for teachers to implement, we have conducted a systematic literature review in order to better understand these difficulties. In this chapter we describe that review that aimed to gather an overview of what is known in the literature about what factors influence teachers' implementation of DI and how, by answering the question: *How do different school, intervention, teacher, and classroom characteristics influence the implementation of differentiated instruction by teachers in primary and secondary education?* To select articles to answer this question, we adhered to four inclusion criteria. The article had to be: 1) published in a peer-reviewed journal; 2) about an empirical study; 3) focused on in-service primary and/or secondary teachers, principals, or schools as participants; and 4) aimed at elaborating on factors influencing teachers' practices regarding DI. This selection method provided us with 29 articles. Each article was examined for results and conclusions referring to factors considered to influence the implementation of DI and describing how these factors influenced implementation. These factors were categorized using the supply-use model of student learning outcomes developed by Brühwiler and Blatchford (2011). This approach allowed us to organize all these influencing factors and compose a detailed description of the ways in which they affect the implementation of DI. The elaborated framework can be used in future endeavors to implement DI in (secondary) education.

Chapter 3: Teachers' interactive cognitions of differentiated instruction in regular and talent development lessons

Literature has shown that teachers have ideas about implementing DI, but one of the reasons it is often not implemented is that they feel constrained by the organization of the regular classroom context.

Therefore, in this chapter we investigated the teachers' interactive cognitions of DI in their regular lessons and their GUTS lessons (see section 1.4). The aim of this study was to explore teachers' interactive cognitions during their teaching related to DI and investigate whether these interactive cognitions differed in the two teaching contexts. The research question leading this study was: *What are teachers' interactive cognitions of differentiated instruction in two different learning environments?* In order to answer this question, we used stimulated recall interviews. For these interviews, four teachers were observed during one lesson per context and interviewed 1-2 days afterwards using video clips from the observations. The video clips were selected before the interviews and chosen with the aim of encouraging the teachers to elaborate on their interactive cognitions during different types of teacher-student interactions. The interaction categories were: 1) providing instruction; 2) offering help; 3) giving assignments; 4) calling on a student; and 5) checking up on a student. This method allowed us to investigate whether, in a teaching context like GUTS where teachers had more space to experiment with DI and were stimulated to differentiate their instruction, they had different or even more interactive cognitions of DI.

Chapter 4: Differentiating instruction to stimulate student talent development: A year-long study of teachers' interactive cognitions

In chapter 3 we focused on the differences in teachers' interactive cognitions of DI between their regular and their GUTS lessons. The study described in chapter 4 can be seen as a follow-up that took place in the next school year and with partly the same teachers. To study teachers' interactive cognitions of DI more deeply in this chapter, we decided to follow the teachers during the GUTS lessons and focus on the specific content of their interactive cognitions and how learner-centered they were. The leading questions in this study were: *What interactive cognitions regarding differentiated instruction do teachers have during teaching? How do they take different student characteristics into*

account in these interactive cognitions? These questions were answered using the SRI method, as in the study described in chapter 3. Four teachers each participated in four SRIs, spread out over one school year. During the observation part of the SRI method, an observational scheme was used as a guide. The video clips for the interview part of the SRI method were selected based on the categories of the observational scheme: 1) context/goal setting; 2) student assessment; 3) attention for the individual; 4) instruction and classroom routine; and 5) positive, supportive learning environment. At least one video clip was selected from each category to show the teacher during the interview. Through investigating teachers' interactive cognitions of DI in a context likely to capture them, we aimed to uncover how these cognitions varied between and within teachers.

Chapter 5: Teachers' sense-making processes during two years of an innovation aimed to differentiate instruction

In this chapter we describe a study that focused on teachers' sense-making processes of GUTS. The GUTS lessons, which were separated from the regular curriculum, provided teachers freedom in the specific design of these lessons, as long as they adhered to the four criteria mentioned in 1.4. Therefore, we were interested in finding out how teachers experienced such an innovative context, and addressed the following research questions in this chapter: *How can teachers' sense-making of an innovation to differentiate instruction be typified in terms of type of search for meaning and sources of ambiguity and uncertainty? How does this sense-making change over two school years?* Fifteen teachers filled in a questionnaire during the years 2014-2015 and 2015-2016: using this, we measured their perceptions of differentiated student talent development, their self-reported practices of DI, and their attitudes towards GUTS.

Each teacher's data were typified per school year by the type of search for meaning they went through and the sources of ambiguity and uncertainty they experienced. This provided us with a systematic

view of how the teachers perceived GUTS and how they positioned themselves within GUTS. We then compared this positioning with their personal frames of reference (their perceptions of differentiated student talent development and self-reported practices of DI). The idea was that their personal frames of reference would explain the types of search for meaning and sources of ambiguity they experienced. This would provide a rich description of the complex process of sense-making. We did this for both school years and analyzed whether there were differences between the two school years in the teachers' sense-making processes.

Chapter 2

The influence of school, intervention, teacher, and classroom characteristics on the successful implementation of differentiated instruction: A review of empirical findings

Chapter 2
The influence of school, intervention, teacher, and classroom characteristics on the successful implementation of differentiated instruction: A review of empirical findings[1]

Abstract

In recent decades knowledge about differentiated instruction has expanded. However, difficulties with its implementation in practice are still observed. In order to better understand these difficulties and to further aid efforts to include differentiated instruction in teachers' practice, we systematically reviewed 29 studies that elaborated on factors in teachers' daily practice that were of influence on the implementation of differentiated instruction. The factors found in this review were categorized as school characteristics, intervention characteristics, teacher characteristics, and classroom characteristics. This provided the overview that many different factors in the teachers' daily work environment were of influence on the implementation of differentiated instruction. One of the most important factors appears to be support, since teachers need a safe and secure environment to change. Not all factors described in this review are necessary in every school, nor will they look the same in each school. Therefore, the context in which differentiated instruction is to be implemented, is of great importance. We therefore conclude that in order to implement differentiated instruction effectively, differentiated implementation is necessary.

[1] This chapter has been submitted in an adapted form as:

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. *The influence of school, intervention, teacher, and classroom characteristics on the successful implementation of differentiated instruction: A review of empirical findings*.

2.1 Introduction

2.1.1 The need for differentiated instruction

The need for differentiated instruction (DI) at all levels of education seems to have increased in recent decades. In many countries, governments are developing legislation for inclusive education, in which students with and without learning disabilities are taught in the same classes. As a result, student diversity in the classroom is increasing (Cha & Ahn, 2014; McTighe & Brown, 2005). This growing student diversity presents teachers with a challenge: to educate every student while accounting for their individual needs. If the teacher does not face this challenge, many students will not be completely engaged during the lessons, nor reach their maximum learning potential (Anderson, 2007; McTighe & Brown, 2005). Unfortunately, many teachers experience difficulties with this. Teachers often choose to teach to the middle, which means they adjust their instruction to the students who are in the middle with regard to achievement (Subban, 2006). This way, the level may be too high for some students, and too low for others, but also exactly right for a third group. Subban (2006) describes in a literature review disadvantages of this teaching to the middle: "Ignoring these fundamental differences [i.e., student differences] may result in some students falling behind, losing motivation, and failing to succeed" (p.938). Differentiated instruction, "an approach to teaching in which teachers proactively modify curricula, teaching methods, resources, learning activities, and student products to address the diverse needs of individual students and small groups of students to maximize the learning opportunity for each student in a classroom" (Tomlinson et al., 2003, p.121), is thus necessary.

In the past 15 years several studies among elementary and lower secondary school students have identified increases in student engagement and achievement as a result of DI (Deunk, Doolaard, Smale-Jacobse, & Bosker, 2015; Maeng & Bell, 2015). Thus, students

should be taught in accordance with their individual learning needs (Tomlinson et al., 2003). The learning needs are subdivided into students' *readiness* (achievement level, zone of proximal development), *interest* (motivation, interest), and *learning profile* (ethnicity, SES, learning preferences). Teachers can account for these needs through differentiating in the process, content, and product of their teaching (Tomlinson et al., 2003).

2.1.2 The current state of differentiated instruction in practice

Although a great deal is known about what DI is and its beneficial effects on student engagement and achievement, it is a very little observed practice (Tomlinson, 2015). Graham, Harris, Fink-Chorzempa, and MacArthur (2003) investigated primary grade teachers teaching students basic writing skills and processes, and their differentiated adaptations in their instruction. In this study, Graham et al. (2003) found that the teachers made very few, if any, adaptations: "Although the nationally representative sample of teachers in this study reported an average of four adaptations for the struggling writers in their classrooms, the majority of these adaptations were made by a relatively small proportion of the teachers surveyed. Seventy-five percent of all reported adaptations were made by only 29% of the participating teachers" (p.289). Graham et al. (2008) conducted a follow-up study which provided similar results: many teachers made at least some adaptations for the weaker students, but 42% of the teachers did not make any adaptations at all. Again, 25% of the teachers made two thirds of the adaptations (thus of the 58% of the teachers who reported making adaptations for the weaker students, not even half made the majority of all adaptations).

Among the reasons DI is so difficult for teachers are the many elements that have to be taken into account and the complexity of combining these different elements. Tomlinson et al. (2003) state in their review that DI is most effective when the teacher: (a) plans it

proactively; (b) uses small teaching-learning groups; (c) makes sure the instruction is learner-centered; (d) makes sure the instruction is knowledge-centered; (e) uses flexible pacing; and (f) makes flexible use of different materials. Of all these characteristics of effective differentiation, grouping is the most commonly used by teachers (Tomlinson, 2015). In the US, this is mostly observed in the form of between-class grouping. In countries where students are tracked, e.g., in different streams of secondary education, the type of grouping that is often observed is within-class grouping. The practice of within- or between-class grouping is often based on teachers' perceptions of student achievement, instead of solely on pre-assessment results (Tomlinson, 2015), as recommended by Tomlinson et al. (2003).

The type of DI in teachers' practice is often a reactive type, instead of a proactively planned practice (Tomlinson, 2015; Tomlinson et al., 2003). Roy, Guay, and Valois (2013) show this in their study validating their 'Differentiated Instruction Scale' (DIS), concluding that teachers use these more ad-hoc strategies of differentiation. The two most used strategies were (1) adjusting the amount of work to the students' capacities, and (2) providing the weaker students with extra aids and support. The least used strategies appeared to be (1) adjusting the difficulty of the assignments to the students' capacities, and (2) adjusting the lesson plan format, such as offering the information to students in different orders or providing more explanations.

Roiha (2014) investigated the most often used differentiation methods in Finnish CLIL (Content and Language Integrated Learning) education. The results resemble those from Roy et al. (2013) in that these most often used methods are more like reactive than proactive differentiation: the teachers reported most often that they (1) expected individuals to accomplish similar tasks, (2) provided individual support, and (3) had students produce presentations and projects according to their individual abilities. Although the teachers thus used more reactive differentiation, this does not mean that they did not

consider (effective) DI important. According to Roiha (2014) teachers do see the necessity of it, and they do make an effort to differentiate, but they find it a very difficult practice to implement.

Although definitions of DI are often very similar to Tomlinson et al.'s (2003) definition, practice differs. Anderson (2007) discusses differentiation of the content of literacy education, and how teachers can do this by using different types of texts, like novels or short stories, and providing these to students in varying reading levels. But they can also use different sources, like books on paper or tape, or the internet. In addition, Levy (2008) discusses the existence of different techniques for using assessment to differentiate the content, process, and product. Pre-assessment appears to be very important for teachers to get to know their students' readiness, interests, and learning profiles. However, there are different ways to pre-assess students. For example, a teacher can have students fill in a form to tell what they already know and can do (regarding a specific subject), what they want to know and be able to do, and what they have learned. But, he can also prepare a test, to pre-assess his students. Additionally, Levy (2008) describes how flexible grouping can be used differently: the groups can be based on the students' *readiness*, *interests*, or *learning profiles*. Furthermore, the teacher can choose to use heterogeneous grouping one time, and homogeneous grouping the other.

2.1.3 The implementation of differentiated instruction

In order to better understand the difficulties and possibilities of implementing DI, and to aid future efforts to include DI in teachers' practice, in the current study we systematically reviewed the literature to examine what factors in teachers' working environments influence this implementation, and how.

We mention above that the current state of DI is one where it is often not (effectively) implemented in many instructional situations. With the often found lack of (effective) implementation we mean not

only that teachers do not use effective DI, but that because of their use of ad-hoc methods of DI, DI is often not fully embedded in their practice. Where DI is implemented, that implementation is often described in a way like Levy's (2008) and Anderson's (2007) studies do. The aim of those studies is to provide examples of how difficult DI is when successfully implemented. But, in order to identify the difficulties and possibilities for teachers of implementing DI, there are also studies that, using situated perspective, provide more details about the context in which the implementation of DI took place. This situated perspective gives us information on important factors that influence the implementation of DI. The findings of this type of research are necessary for an optimal (re)design of interventions aimed at fostering teachers' use of DI in their teaching practice.

In order to present the results of this review in a structural manner, we use the multilevel supply-use model of learning outcomes by Brühwiler and Blatchford (2011). Though used in their research to investigate relationships between different factors and levels in school, it was designed to visualize and identify what factors are at play in a teachers' daily work environment (Figure 2.1). In this model, the *supply* for learning, the *use* of learning, and student *outcomes* are combined. Within the supply for learning, several levels ranging from the educational system to teacher characteristics can be distinguished.

In the current study the model was used as a framework to gain a more comprehensive view of what is known about factors influencing the implementation of DI. In order to come to this comprehensive view, we focused on the *supply* part of the multilevel supply-use model of learning outcomes, as this represents the context in which teachers work. We believe that a review focusing on this part adds to what is already known about DI, as reviews on the effects on students have been published. Thus, we know the effects of DI on students in the *use* and *outcome* parts of the model (Deunk et al., 2015), and review studies have been conducted on what DI actually is

(Tomlinson et al., 2003). Furthermore, this review builds on what we already know from the professional development (PD) literature. Reviews on PD (Van Veen, Zwart, Meirink, & Verloop, 2010) often list factors that are generally important when trying to implement new practices. However, DI is a complex and unique pedagogical approach; this emphasizes the need to find an explanation for how those factors can influence the implementation of DI specifically. It was our aim to provide an overview of influencing factors, and how they affect teachers' working environments, which can be used in future endeavors to implement DI.

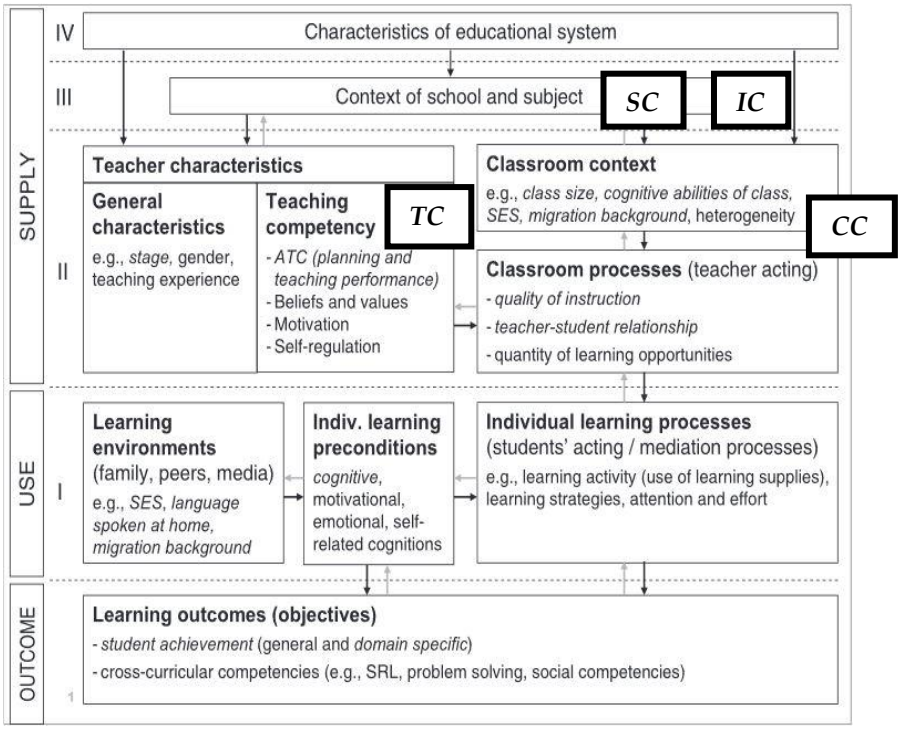

Figure 2.1 Multilevel supply-use model of learning outcomes (Brühwiler & Blatchford, 2011) SC=School characteristic; IC=Intervention characteristic; TC=Teacher characteristic; CC=Classroom characteristic

In sum, in this study we systematically reviewed research into teachers' implementation of DI, with the aim of answering the following research question: *How do different school, intervention, teacher, and classroom characteristics influence the implementation of differentiated instruction by teachers in primary and secondary education?*

2.2 Method

2.2.1 Search strategies and criteria

A systematic literature search was conducted in the databases Web of Knowledge; Educational Resources Information Center (ERIC); and Catalogue of Leiden University. During the searches different combinations of *differentiated instruction* with the following key words were used: teacher characteristics/factors, personal characteristics/factors, individual characteristics/factors, context of school, school factors/characteristics, organizational factors/characteristics, classroom context/characteristics, leadership, administrative support, teacher variables, school variables, implementation, and enabling factors. All searches were conducted within the time span 2003-2015.[2] The titles and abstracts of the search results were checked for several criteria in order to be included for further review. The journal the article was published in, titles, or abstracts had to give information on whether the article was:

1. published in a peer-reviewed journal.
2. an empirical study.
3. focused on in-service primary and/or secondary teachers, principals, or schools as participants.
4. aimed at elaborating on factors influencing teachers' practices with regard to DI.

[2] We searched from 2003, as this was the year the Tomlinson et al. (2003) review was published. We found that from this year on many papers written on the matter used this review as the starting point for explaining the concept of DI.

With regard to the fourth criterion, it is important to remark here that articles specifically had to mention influences on the practice of *differentiated instruction*.

Applying these criteria to the search results gave a total set of 82 articles. The full texts of all these articles were retrieved and read by the PhD candidate. After reading the full-text versions, we excluded several articles. Those articles did not meet the fourth criterion: they did not report influencing factors directly based on empirical data, nor did they elaborate on how those factors influenced implementation of DI. In the end, 29 articles were included.

2.2.2 Data management and analysis

Data collection

To be able to collect data from the remaining articles, we reported relevant information from them in an Access database. First, descriptive data were extracted: country; instruments and aim; context; school type; teachers' years of experience; and the definition of DI the researchers adhered to. We then summarized the results about the influencing factors that enable/constrain implementation of DI.

Coding of the factors

To compile the list of influencing factors, we read the full texts of all articles and searched the results and conclusion/discussion sections for key words like 'influencing', 'hampering' or 'stimulating'. Although such terms carry in it a meaning of a causal relationship, such a relationship was not necessarily found and tested by the authors of the articles. For example, conclusions were often based on self-report data where participants themselves described to have experienced influence from certain factors in their daily working environment. We thus mainly adhered to the respondents' or authors' interpretation of factors as being 'influencing' factors. Sentences like

'… influenced the teachers' willingness to implement DI' were thus considered to contain an influencing factor. Subsequently, we looked for an explanation of how the identified factor worked in the implementation of DI.

Data analysis

We used the multilevel supply-use model of student learning by Brühwiler and Blatchford (2011) to organize our results. After selecting and reading the articles, we labeled them according to the categories in the model (TC for Teacher Characteristic, CC for Classroom Characteristic, SC for School Characteristic, and IC for Intervention Characteristic). Consequently, we ended up adding 'Intervention Characteristic' to 'context of school and subject' and 'Classroom Characteristic' was relevant for both 'Classroom context' and 'Classroom processes', as shown in Figure 2.1. The model allowed us to analyze how certain identified factors related to each other in the implementation of differentiated instruction.

2.3 Results and discussion

We list here the identified characteristics in the same order as in the multilevel supply-use model from top to bottom (Table 2.1). We then elaborate per included article on what we found about how the characteristics influence the implementation of DI.

2.3.1 Characteristics of educational system

School level

The first factor at the level of the educational system which influences the implementation of DI is the school level (Bianchini & Brenner, 2010). In their study aimed at examining the influence of an induction program on beginning teachers' equitable practices in the classroom in the US, Bianchini and Brenner (2010) describe how the director of the induction program claimed in an interview that DI was less 'embraced'

Table 2.1 Overview of factors and references, based on Brühwiler and Blatchford's (2011) model

IV	**Characteristics of educational system**	
	School level	Bianchini & Brenner (2010)
	Policy	Valli & Buese (2007) Mills et al. (2014)
III	**Context of school, subject, & intervention**	
SC	***Principal***	Hertberg-Davis & Brighton (2006) Goddard et al. (2010) Puzio et al. (2015)
	Colleagues	Puzio et al. (2015) Bianchini & Brenner (2010) Cha & Ahn (2014) Smit & Humpert (2012)
	Tools & resources	Boudah et al. (2008) Ciampa & Gallagher (2013) Rubenstein et al. (2015) Sornson (2015) De Jager (2013) Tobin & Tippett (2014) Voltz (2006) Butcher et al. (2014) Cha & Ahn (2014) Puzio et al. (2015) Roiha (2014)
IC	***Intervention***	Ciampa & Gallagher (2013) Walpole et al. (2011) Rubenstein et al. (2015) VanTassel-Baska et al. (2008) Beecher & Sweeney (2008)
II	**Teacher characteristics: Teaching competency**	
TC	***Teacher beliefs***	Brighton (2003) De Neve et al. (2015) Dixon et al. (2014) De Jager (2013)
	Teacher learning activities	Maeng & Bell (2015) Tricarico & Yendol-Hoppey (2012) Santamaria (2009)
	Classroom characteristics	
CC	***Classroom processes***	Brimijoin (2005) Tobin & Tippett (2014)
	Classroom context	De Jager (2013) Roiha (2014)

by secondary school teachers than by elementary school teachers. She explained this as follows: "I think it is actually easier to get elementary teachers to think about instructional strategies because they are more accustomed to differentiating because they are with this [same] class of kids all day. It is very challenging to get junior high and especially high school teachers (…) to be open to the fact that your strategies might not be working [for all students]" (p.176). Thus, in this study, a participant mentioned explicitly what is often suggested in research (Deunk et al., 2015): that teaching in secondary education might be constraining for the implementation of DI.

This characteristic of the educational system is clearly difficult to influence. Schools and teachers can, however, carefully consider which approach to DI is desirable for their specific context.

Policy

As stated in the introduction, more and more policies with regard to DI are being introduced at national, state, and district level in different countries. The aim of these policies is to have an effect on schools' and teachers' practices with regard to DI. Mills et al. (2014) and Valli and Buese (2007) reported such effects in their studies. Valli and Buese (2007) investigated how elementary teachers' roles changed over the course of four years as a result of the implementation of different federal, state, and local policies. The federal government of the USA signed the NCLB (No Child Left Behind) act in 2001 and the state government initiated several standards, tests, etc., to enact the NCLB; in addition, the school district implemented new mathematics and reading curricula and initiated several improvement programs. Looking in detail at the results from the interviews, the authors found positive changes in teachers' collaboration and learning roles. Their findings showed that teachers were working together to group students better for DI. However, the teachers stuck to the grouping and regrouping of students and did not move on to learn more about implementing DI in their classrooms. Teachers' learning with regard to

DI did evolve positively thanks to the PD courses offered by state and school. The teachers learned how to read pre-assessment data for the purposes of grouping and regrouping students and aligning and pacing the curriculum. However, the pre-assessment data were not used to their maximum potential. Discussions about using these data to change practices and actually implement DI did not take place. This left the main conclusion less positive than some of the results suggested.

Mills et al. (2014) explored the Teaching and Learning Audit in the Australian state Queensland, which served to investigate school performance in all government schools in the state. Apparently, of all eight dimensions that were measured in the audit, 'differentiated classroom learning' was the lowest scoring dimension in all schools. In this study, one school was selected that scored 'medium' on that dimension. During the study, which took three years, interviews were held with 11 teachers and nine staff members, classroom observations were carried out, and the authors gave workshops. The findings reported in the case study revealed that, apart from practices such as streaming and individualized plans, DI was not implemented deeply. The authors called the implemented forms of DI '*narrow*', as they either did not take the individual student into account in enough detail, for example, by streaming students, or they considered the individual in too much detail.

Schools need to work in accordance with certain policy decisions made at national or state level. Adequate support for teachers appears to be necessary. We saw, for example, in Valli and Buese's study (2007) that a school district adding its own policies to the national and state policies put a lot of extra pressure on teachers and was not beneficial to the implementation of DI. We see in the following sections what effects school context might have (Goddard, Neumerski, Goddard, Salloum, & Berebitsky, 2010; Puzio, Newcomer, & Goff, 2015).

2.3.2 Context of school, subject, and intervention

SC: Principal

Hertberg-Davis and Brighton (2006) found that a safe and secure environment for change, attained and maintained by the principal, made teachers more willing and able to differentiate their instruction. In the larger study of which this study examining the principal's influence on teachers' willingness and ability to differentiate was a part, the teachers and principals received professional development training with regard to DI. The principal's influence was measured in depth at three secondary schools using interviews with the principals and teachers, classroom observations, and the field notes of coaches. Each school's principal offered a different level of support for the intervention and teachers: one principal was very supportive, the second showed weak support, and the third was '*sabotaging*' the intervention. The principal who was very supportive of the intervention had teachers in his school who were making noteworthy efforts to change. In addition, principal support appeared to be very important to teachers' attempts to change, because it made them feel comfortable about changing. Starting to differentiate instruction is a change that stretches many teachers beyond the limits of their comfort zones. A principal who believes that his teachers are able to change, and gives them an environment in which they feel safe stepping outside their comfort zone, has a positive influence on the implementation of DI. Goddard et al. (2010) added to these findings that principals' instructional support can have a positive influence on teachers' perceptions of the use of DI in their schools. The authors administered surveys within 77 primary schools measuring the teachers' perceptions of the use of DI and their school leaders' instructional support. They used hierarchical linear modelling to analyze the results. Goddard et al. (2010) concluded from the results that teachers' perceptions of principals' instructional support positively predicted the use of DI in their schools. This supports the notion that the principal is a key factor in implementing DI schoolwide.

In addition, the authors concluded that a principal simultaneously has to be an instructional and a transformational leader in order to improve instruction.

Other actions from the principal that enable the implementation of DI were reported by Puzio et al. (2015), who investigated using interviews with the teachers and principals how principals supported differentiation in the domain of literacy in their school. The authors focused on the principal as a learning-centered instructional leader, meaning that the principal was both an instructional leader (focusing on the instructional development of teachers) and a learning-centered leader (focusing on the impact of policies and the principal's practices on student learning). They found that principals can function in a school as learning-centered instructional leaders. They saw three practices with which the principals supported the implementation of DI: (1) by fostering mutual engagement between teachers; (2) by fostering alignment between perspectives and practices; and (3) by acting as brokers, thus participating in two different groups. In the case of this study, the principals, for example, co-constructed communities of practice around differentiation, and brought in the support of key district personnel who could offer a variety of instructional support, such as expert speakers. These conclusions were drawn on the basis of the principal and teacher interviews the authors held at three of the 31 schools involved in a larger study (see Cordray, Pion, Brandt, Molefe, & Toby, 2013).

Summarizing the above, we conclude that the principal has to be supportive of the teachers in their endeavors to implement DI, both by being focused on teachers' instructional development and by making teachers feel comfortable in making major changes to their regular teaching practices. A very important example of making teachers feel

comfortable is that the principal has to be aware that a practice like DI stretches teachers beyond their comfort zones and is very demanding.

SC: Colleagues

Puzio et al. (2015) found not only the principal to be important for the implementation of DI: teachers' colleagues appeared to be an important factor, too. When the principal provided teachers with structured time to discuss instruction and ways to differentiate with each other, collaboration with regard to instruction really took place. In addition, this collaboration appeared to be very important for the teachers in learning how to differentiate, as became clear from the standardized open-ended interviews the authors held with teachers and principals. The results of these interviews showed that teachers shared resources with each other during that collaboration time, and also narratives, including instructional suggestions, stories about teaching and students, and so on. In one of the three primary schools in which this study took place, this caused the teachers to develop a common language around their practice, which was an invaluable tool according to the teachers. As a result of the collaboration that took place, the teachers reported using an array of different techniques to differentiate their instruction (Puzio et al., 2015). Also, the observations in the investigated school showed increases in DI practices.

Another study in which the importance of colleagues came to the fore was described by Bianchini and Brenner (2010). This study was organized around an induction program aimed at training beginning teachers to teach in equitable and effective ways. The authors used interviews with beginning teachers (and their mentors and induction professionals), observations of the induction seminars and several lessons, and their performance assessment products as methods to examine the effects of this induction program. The data showed, for instance, that beginning teachers wishing to differentiate instruction could observe colleagues using differentiation to teach a unit, a few days before they had to teach it themselves. The authors concluded

from the interviews with the beginning teachers that teachers who were supported by colleagues and mentors in implementing DI were able to expand and enhance their practices with regard to DI.

Interaction with colleagues is important for the implementation of DI. Cha and Ahn (2014) investigated four teachers and five community members (parents, administration personnel, and a special teacher) in a Korean primary school. They used interviews about participants' difficulties and tensions in DI practice in order to come up with design guidelines for a teaching tool for DI. In the interviews, all teachers mentioned the identification of student characteristics as the most important part of DI practice. In their view, this could be facilitated by different means, including communication with other teachers (class teachers and subject teachers) and community members. However, although the reason was not explained in detail, according to Cha and Ahn (2014) opportunities for interaction between teachers had decreased over time as a result of their not feeling at liberty to discuss students' negative attitudes with each other. Open communication about student characteristics would help teachers in getting to know students' needs and reflecting these in instructional strategies (Cha & Ahn, 2014). Thus, one of the guidelines for a teacher tool that facilitates DI is that it has to enable communication among community members.

Finally, Smit and Humpert (2012) used teacher questionnaires to measure, among other things, the practice of DI and team culture in order to identify factors that may support the use of DI. The authors found correlations between team culture and (the practice of) DI, suggesting the same as the studies reported above: readiness for innovation, shared pedagogical visions, a supportive team climate, and availability for discussing pedagogical topics – which Smit and Humpert (2012) capsulize under the term pedagogical team culture – within the school are important facilitators for the implementation of DI in teachers' practice. The authors did not discuss which of these

aspects of a pedagogical team culture were more important to this positive correlation, and which less important.

The above studies demonstrate that the implementation of DI is preferably not an endeavor of an individual teacher. A team culture in which colleagues are available for collaboration is desirable. Teachers should then be able to communicate freely and clearly about their students and their practices, in order to get to know them and their needs.

SC: Tools, resources, and time

Not only are the principal and colleagues important for the implementation of DI, but appropriate tools, resources, and time can make implementation easier, too (Cha & Ahn, 2014; Puzio et al., 2015; Rubenstein, Gilson, Bruce-Davis, & Gubbins, 2015). Several researchers have reported that teachers were willing to implement DI, and sometimes had training in how to differentiate, but found it difficult or even impossible to implement in the end, because the right tools, resources, and time were lacking (De Jager, 2013; Roiha, 2014; Tobin & Tippett, 2014). Time appears to be one of the most essential elements: Tobin and Tippett (2014) describe how even in a project with a successful professional development program for the implementation of DI, a lack of time was a serious constraint for the five teachers who were interviewed. De Jager (2013) and Roiha (2014), too, describe this lack of time as an important constraint on implementing DI. Roiha (2014) found this first in interviews with three secondary school teachers and later in a questionnaire administered to 48 secondary school teachers in Content and Language Integrated Learning (CLIL) education in Finland. De Jager (2013) administered questionnaires to 607 secondary school teachers in South Africa, and in response to the open-ended question "what hampers the implementation of differentiated learning activities?" (p.86) she found that many teachers mentioned their workload. The teachers said they

had little time for differentiated lesson planning, as they were burdened with frequent curriculum changes, in-service training, etcetera. When teachers in those cases also do not receive proper and sufficient equipment, they feel constrained and are less willing or unwilling to implement DI at all (De Jager, 2013). What exactly that equipment should be, was not explicitly stated.

In line with this, Rubenstein et al. (2015) described how in their study the supply of appropriate materials, like pre-assessment tests, was of significant importance for teachers to differentiate their instruction. Although the teachers in their study were aware of the importance of pre-assessment to DI, they did not use it, or did not know how to use it. Furthermore, the above-mentioned interview study by Puzio et al. (2015), which demonstrated the importance of both the principal (support) and collaboration with colleagues, suggests that the implementation of DI was even further enhanced by the principal's efforts in helping the teachers to access a variety of resources and DI experts, purchasing a variety of new materials , and giving them the opportunity to attend conferences. Puzio et al. (2015) do not provide examples of resources and materials teachers should have access to.

In addition to the more general materials and resources, there are more specific tools. Several authors have tested the influence of specially designed tools on teachers' ability and willingness to implement DI. An overview of those tools and a short description of each can be found in Table 2.2. Below, we elaborate on how each of these tools helped teachers to implement DI.

Boudah, Lenz, Schumaker, and Deshler (2008) found in their action research study that a tool like the Unit Organizer Routine facilitated DI. The Unit Organizer Routine aims to help teachers in planning unit instruction and enable them to help students see the bigger picture. The tool consists of two pages, to be filled in by teachers together with their students. The first page is a visual overview of the

current unit (one broad topic) being taught, what its place is in the bigger picture, the previous and next units, and some details about the current unit. The second page is to be filled in throughout the unit and

Table 2.2 Differentiated instruction tools and their influence on the implementation of DI

Tool	**Description**	**Reference**
Unit Organizer Routine	A two-page tool teachers fill in together with their students. The goal is to collaboratively construct a visual overview of the current unit and its place in the bigger picture.	Boudah et al. (2008)
Curriculum Customization Service	A web-based tool that helps teachers "to explore online materials relevant to key instructional objectives (according to the Earth science curriculum) and to save digital resources to an individual account." (p.12)	Butcher et al. (2014)
Ipod Touch + apps	A mobile device that in classrooms can be used with educational apps, in order to function as a digital learning device.	Ciampa and Gallagher (2013)
Essential Skills Inventory	An inventory tool for teachers, inviting them to collect baseline data of all students in all learning domains. After all baseline data are gathered, teachers should systematically update data in two domains per week throughout the year.	Sornson (2015)
M²ECCA-framework	A framework that emphasizes major aspects of instruction, and that should enable teachers to implement differentiated instruction.	Voltz (2006)

consists of adding and connecting relevant and important details in an expanded visual map of the unit. From interviews with the teachers it appeared that the tool enabled them to differentiate during whole-group instruction, which helped students, especially lower-achieving students and students with learning disabilities, to achieve better, as became clear from the analysis of the teacher grade books. Another tool that helps teachers in planning their lessons for DI is the Curriculum Customization Service (CCS), investigated by Butcher, Leary, Foster, and Devaul (2014). The year-long adoption of this technology-based planning tool was investigated among 11 secondary school science teachers, using interviews, in order to determine the degree to which the tool influenced the teachers' thinking about instruction and their instructional strategies. From the structured interviews it appeared that this tool facilitated more constructive teacher thinking. They discussed the use of technology in their lessons during more constructive instruction, instead of during directive instruction. In addition, teachers focused more on student-centered strategies: a tool like the CCS thus enables teachers to implement DI strategies more easily.

Another study focused on the M²ECCA framework, which can be used as a planning tool for teachers to better prepare them for DI (Voltz, 2006). In addition, the framework is said to help with planning for multicultural education. Figure 2.2 is the visual representation of the framework, showing the importance of the methods of instruction, the materials the teachers use, the environment in which the students are learning, the content they are learning, the collaboration between different teachers, and the assessment they administer. Although the framework does not visualize how the different elements are interrelated, Voltz (2006) found in the results of questionnaires administered among 44 primary school teachers that the framework had enhanced the teachers' ability to make lesson adaptations for DI.

How exactly teachers used the framework to make these adaptations remains unclear from Voltz's (2006) descriptions of the results.

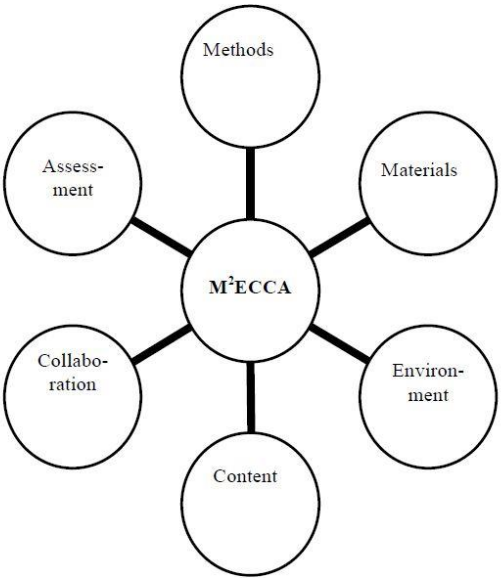

Figure 2.2 M²ECCA Framework (Voltz, 2006)

Besides planning tools that appear to have a positive effect on the implementation of DI, there are tools that can be used either to feed the planning (the Essential Skills Inventory described in a study by Sornson, 2015) or during the lessons to make it easier for teachers to differentiate (the iPod Touch with educational apps, as described by Ciampa and Gallagher, 2013). With the Essential Skills Inventory (ESI), teachers routinely use formative assessment to keep track of their students' progress and are supposed to use these data to adapt their instruction (Sornson, 2015). The ESI is intended for K-3 years; each year the ESI consists of 7 to 8 domains and 30 to 33 skills on which teachers can measure students' progress. After the first six weeks, in which the teachers are taught to collect baseline data, at least two skills in at least two domains should be updated every week, measuring which students are proficient, which are developing proficiency, and which need intensive support. Teachers can use this information to plan their

lessons. The principal also has a role in building and keeping up with this routine of formative assessment, as (s)he is supposed to organize monthly data review meetings with the teachers. In this study, 31 primary school teachers were selected by their principals as using the ESI with fidelity and filled in a survey which consisted of a self-assessment of their behavior and skills. The findings showed that when teachers used the ESI with fidelity (i.e., they updated at least two domains weekly) they reported more use of DI strategies than before they used the ESI.

Ciampa and Gallagher (2013) focused on how the use of a mobile device like the iPod Touch, in combination with educational apps, influenced student learning and engagement. All teachers in the study (n=14) followed eight professional learning sessions to learn about the iPod Touch and how to integrate it in their classroom instruction. The sessions were set up according to the principles of DI, in order to meet the individual teachers' learning needs. In order to measure the influence of the iPod touch in the classroom, after five months of professional learning, 10 teachers were interviewed in a semi-structured individual interview. The teachers explained how the iPod Touch and the educational apps helped them differentiate their instruction, leaving the authors to conclude that the iPod Touch apps were not only a "source of fun and entertainment" (p.322), but also had benefits for student learning and enabled DI.

Different tools have been developed to help teachers implement DI. Research shows that these tools can be effective: for instance, they can make DI less time-consuming. Also, in addition to specific tools, it would be beneficial if teachers had access to enough and appropriate resources, and had enough time to plan for DI.

IC: Intervention

Schools and teachers need to obtain knowledge and learn strategies to act on the policies and use the tools and materials aimed at DI (De

Jager, 2013). Therefore, in several studies reported in this review, interventions were aimed at the implementation of DI (VanTassel-Baska et al., 2008; Walpole, McKenna, & Morrill, 2011).

Generally speaking, it appears important for such an intervention to make sure the context is right for implementation of DI. For example, an intervention that is designed within the framework of DI itself has a greater chance of really changing the teachers' practices towards using more DI (Brimijoin, 2005; Ciampa & Gallagher, 2013; Walpole et al., 2011). In other words, these studies underscore the importance of the 'teach what you preach' principle. In the six-year-long study by Walpole et al. (2011), this was found after the fourth year of implementing the government-initiated policy 'Reading First'. Working together with over 2,000 teachers in 153 primary schools in the American state Georgia, the authors found that in the professional learning that was part of the approach to implementing Reading First, the teachers did not begin reaching their instructional goals until the authors and coaches were successful in differentiating their professional support goals and strategies.

More support for a context of DI interventions designed using the principles of DI comes from the iPod Touch study by Ciampa and Gallagher (2013). Although it was not at the heart of this study to examine whether and how the professional learning that accompanied the implementation of the iPod Touch influenced the correct implementation of use of the device and enabled DI, the authors concluded that the differentiated set-up of the professional learning was important for the teachers to learn about how to use the device.

Rubenstein et al. (2015) also demonstrated the importance of intervention design when implementing the use of a 'tool' that should facilitate DI. In their study, the teachers were provided with pre-differentiated curricula in order to help them implement DI. Pre-differentiated curricula consist of pre-assessments and coordinated tiered lesson activities. The teachers could choose from various options

what to offer the students (as opposed to having to plan it all themselves). The teachers participating in the study also received professional development training over two days. During the first day, at the beginning of the PD, the teachers were given an overview of the complete study that was to take place, received demonstrations of lessons they were supposed to give during the study, and attended a discussion about the main ideas of the curricula. Halfway through the study, the second day of PD took place; the teachers were prompted to create their own lessons from the principles that made up the different units they taught. In the end, the tools appeared to have a positive influence on the teachers' implementation of DI. This result, however, went hand-in-hand with the fact that the use of the tool was accompanied by PD, which was probably also of influence on the implementation. It was not mentioned what specific elements from those days of PD helped the teachers.

VanTassel-Baska et al. (2008) investigated 37 primary school teachers who received training during a three-day summer institute and a one-day winter institute over a period of three years. During all years, the teachers were observed to examine changes in their instructional behavior towards more use of DI. The first summer institute was focused mainly on reviewing the project implementation guide and training in the teaching models. After that, during the subsequent institutes, differentiated training topics were provided and issues from the previous institute were addressed. The classroom observations demonstrated results that pointed towards strong positive effects on the teachers' DI behavior over the three years, with more stable implementation of DI in the third year. This result was confirmed by the results with regard to students' engagement. Again, the specific elements in the PD contributing to these results were not mentioned.

Similar results were reported by Beecher and Sweeny (2008) in their article describing an eight-year PD course taking place at one

school in the US. They describe several initiatives related to the use of enrichment and DI, with the aim of closing the achievement gap. The whole journey of this school was described in their article, which ended with the conclusion that the PD offered a differentiation model and an accompanying matrix, and that the combination served as an effective way of implementing DI in the teachers' practice.

What we can learn from the different intervention studies reported on in this review is that specific interventions focused on implementing DI appear, as intended, to be helpful. They succeed by providing teachers with ways to differentiate, for example, by supplying them with pre-differentiated curricula (Rubenstein et al., 2015), or by applying the 'teach what you preach' principle (e.g., Walpole et al., 2011). Also, the most effective interventions lasted three to eight years; for interventions to have positive outcomes, their duration should be considered.

2.3.3 Teacher characteristics

TC: Teacher beliefs

High efficacy beliefs (e.g., teacher efficacy, self-efficacy) appear to have a positive influence on the implementation of DI in Belgian and American primary and secondary education (De Neve, Devos, & Tuytens, 2015; Dixon, Yssel, McConnell, & Hardin, 2014). In Belgium, policymakers and researchers have called for the implementation of DI in the classrooms to deal with growing student diversity. Because of this, and the already known difficulty of the implementation of DI, De Neve et al. (2015) administered questionnaires to beginning teachers (0.25-5 years of experience) in primary education ($n_{schools}$=65) to measure factors that may play a role in the learning processes of beginning teachers regarding DI. With the results of the questionnaires, the authors calculated correlations and found that more autonomous teachers indicated greater use of DI strategies. Teachers' self-efficacy, too, appeared to be essential for the teachers'

implementation of DI. Dixon et al. (2014) found similar results in the US, but then for primary and secondary school teachers across the whole range of experience. Like De Neve et al. (2015), the authors used questionnaires to examine the teachers' efficacy (the Teacher Efficacy Scale, by Woolfolk, Rosoff, & Hoy, 1990). They found that the extent to which a teacher felt able to use different instructional strategies was the best predictor of differentiation (Dixon et al., 2014). Another significant predictor of differentiation in the classroom was a teacher's personal efficacy. A clear explanation of the difference between teacher efficacy and the teachers' personal efficacy was not provided by the authors.

Beliefs teachers hold about addressing academic diversity or about their students might both enable their implementation of DI or constrain it (Brighton, 2003). In her study of teachers' beliefs about teaching in diverse classrooms, Brighton (2003) identified four beliefs that emerged from the interview, observation and document data that conflicted with DI. Those four beliefs were: (1) "Teacher is an entertainer" (p.186); (2) "Teaching is talking; listening is learning" (p.189); (3) "When faced with an academic challenge, students will resist and shut down" (p.193); and (4) "Equity and fairness for students means all students do the same thing" (p.196). In her conclusion, Brighton (2003) states that these beliefs inhibit teachers in their efforts to "create and sustain learning environments compatible with meeting diverse learning needs" (p.200). In contrast, De Jager (2013) describes how a teacher's attitude towards teaching and including diversity can facilitate the implementation of DI. One of the teachers in her study states: "Teachers need to have a passion and a positive attitude to include learners with barriers" (p. 88).

From the above studies, we conclude that when implementing DI it is important to take differences in beliefs between teachers into account and, accordingly, organize a custom-made implementation, including

particularly the alignment of beliefs with DI, and increasing teachers' (self-)efficacy and autonomy regarding DI.

TC: Teacher learning activities

Above we discussed how collegial relationships, such as collaboration and sharing knowledge, can be beneficial for the implementation of DI (Bianchini & Brenner, 2010; Cha & Ahn, 2014; Puzio et al., 2015). Although the principal can provide time and structure for teachers to collaborate, the teachers themselves have to take responsibility for using that time and structure to collaborate. When teachers do not greatly value their relationships with colleagues and are not open to their feedback, the development of their abilities to differentiate might be less successful than when they do value them (Tricarico & Yendol-Hoppey, 2012). In their study examining the development of alternative certification candidates as planners and implementers of DI, Tricarico and Yendol-Hoppey (2012) investigated three teachers taking part in an apprenticeship program for primary schools and engaged in a PD course focused on DI. The teachers were observed on several occasions and the authors studied documents, like lesson plans, to further understand their development. With regard to relationships among colleagues, the authors illustrate the case of one of the apprentice teachers, who decided to revise her lesson according to her own vision, ignoring her colleagues' feedback. She ended up with a lesson that did not differentiate appropriately.

Another activity that might benefit teachers when using DI as a pedagogical framework is learning more about special education processes, as suggested by Santamaria (2009): she describes the changes two primary schools in California, US, went through to close the achievement gap. DI is an important concept in her description of the developments both schools went through over five years. The developments were recorded using observations, recorded conversations with school personnel, and other documents within the schools. One of the important lessons Santamaria draws from both

schools' 'journeys' in closing the achievement gap is that, when teachers who have learners with special educational needs in their classes learn more about special education processes, they are better able to provide the best teaching practices and support for diverse students. In addition, Santamaria (2009) focused on DI in combination with Culturally Responsive Teaching (CRT), an approach in which teachers deliberately adjust their instruction to take account of students' cultural backgrounds. She mentions that the one can complement the other "when attention is given to the cultural and/or linguistic needs of students, resulting in enhanced learning and student motivation" (p.241).

Maeng and Bell (2015) investigated seven secondary science teachers who were considered proficient in differentiating instruction by their colleagues, to find out how they implemented DI. By observing, interviewing, and examining teaching artefacts, the authors found out the importance of knowing about and starting to plan from the students' learning preferences. The authors conclude from their study that when teachers take their students' learning preferences as starting point, it facilitates their incorporation of differentiation strategies. Also, when teachers decide to use formative assessment, it is important that they use the data. Maeng and Bell (2015) found that when teachers used formative assessment, but failed to use the data it provided, they were unable to incorporate activities that accounted for differences in student readiness, and were thus unsuccessful in implementing DI.

2.3.4 CC: Classroom processes

There are factors in teachers' interactions with their students that can facilitate teachers in differentiating their instruction. Brimijoin (2005) states, based on her previous experience of investigating DI and a current case study, that teachers who create the appropriate learning community within their classroom practice DI with more ease than

teachers who do not. The appropriate learning community is one where the teacher confers status on students for contributions, sets high expectations for students, and gives them positive feedback on successes and unique perspectives. Furthermore, certain practices, like using anchor activities and task cards, help in differentiating instruction. Anchor activities and task cards provide meaningful activities students can autonomously fall back on when they have finished their work and are waiting on further or new instructions. They can help students anchor the instruction in experiences to enrich and reinforce their learning. In addition, when such practices lead to positive student reactions, teachers are more inclined to sustain that implementation of DI (Tobin & Tippett, 2014). Tobin and Tippett (2014) investigated the possibilities and potential barriers primary school teachers perceived when learning about and implementing DI in a PD project, and how their understanding of DI changed. Although this PD helped the teachers to differentiate, it was not directly the PD that helped them to fully implement DI, but the classroom processes afterwards. In the PD course, the teachers attended workshops emphasizing different aspects of DI through demonstrations, mini-lectures, etcetera. The authors collected data from observational field notes, pre-questionnaires, and teacher discussions. Afterwards, the teachers received a post-questionnaire and semi-structured interviews were held. Also, student samples of DI products were collected. Because of this extensive set of data, the authors were able to draw conclusions on what the teachers learned from the workshops, and also on what worked in the classroom for teachers in differentiating their instruction. What especially appeared to help teachers to implement DI and maintain the implementation were the effects the teachers saw that DI had on the students. Thus, successful implementation of DI not only benefits the learners at the time, but also has more sustainable outcomes as the teacher will continue to develop his practices towards greater use of DI.

2.3.5 CC: Classroom context

The last set of characteristics which we were able to define as influencing the implementation of DI concerns the classroom context. An often-mentioned constraining factor within this category is the large class size with which many teachers are confronted. With a large number of students in one classroom, there are more different needs, and teachers perceive it as a more time-demanding task to plan for and act upon all those different needs (De Jager, 2013; Roiha, 2014). De Jager (2013) (N>600) and Roiha (2014) (N=51) conducted survey studies in which several reasons (not) to differentiate and challenges of implementing DI were described. More detailed information on how these factors influence implementation is lacking. What was reported next to the size of the class is the physical setting within the classroom, which can feel constraining for DI (Roiha, 2014): 66% of the teachers who filled in the questionnaire mentioned this as one of the most challenging issues of differentiation. In addition, interviews with a small number of teachers showed that teachers feel that the standard classroom setting is impractical when trying to implement DI. Roiha therefore recommends decorating the classroom and arranging the desks differently to create more space and open up more areas for differentiation.

2.4 Conclusion

The studies incorporated in this review took place in different contexts and/or investigated the influence of those different contexts. For example, Hertberg-Davis and Brighton (2006) provided insight in how the attitude of the principal regarding an intervention aiming at the implementation of DI appeared to have a significant effect on the success of that intervention. Hence, one of the most important lessons for the implementation of DI coming forward in this review is: context matters. This leads us to conclude that to implement DI, *differentiated implementation* is necessary. There is no one-size-fits-all solution for

implementing DI, applicable to each school, all teachers, having favorable effects on all students.

In addition, we cannot conclude from the current overview what characteristic is most important, it is likely that this depends on the context in which DI is to be implemented. Nor can we conclude whether each characteristic is explicitly related to the implementation of DI or also applicable to the implementation of other approaches. However, certain characteristics clearly are explicitly related to the implementation of DI, and it is in linking these characteristics with other, more generally applicable characteristics that this overview adds to the literature elaborating on these more generic characteristics.

Furthermore, we believe that this systematic review of the literature not only shows that implementation of DI should be differentiated, but also that the different characteristics should be considered in combination. For example, the results have shown that small class sizes are favored by teachers, but when the physical classroom setting is not adapted to differentiated teaching methods, teachers can still feel constrained in implementing DI. Also, teachers should have enough time to plan for DI in that classroom, and appropriate tools should be at the teachers' disposal. What those tools are, depends on the context: how big classes are, but also whether the teachers can work together with their colleagues to learn about and plan for DI. The relations between the different characteristics are also visible in Brühwiler and Blatchford's model (Fig. 2.1). Many of the boxes with characteristics have recurrent arrows to connect them, suggesting that those characteristics are related to each other.

Not only in the practice of implementing DI should the relations between the different characteristics be taken notice of. These relations should be the focus of future studies as well. As it would be unfavorable to figure out a one-size-fits-all approach to the implementation of DI, it is important to understand how characteristics are related to each other.

In this review, we found that the results and conclusions of most studies appear to be based on self-report data. Often, the researchers held interviews with teachers, principals, or other school personnel, or administered questionnaires, asking what the participants themselves experienced. Data which are often considered to be more objective, like classroom observations to see what is really happening, are only available in a minority of the studies reported in this review. In addition, in using these methods, the researchers often focused on the teachers without making explicit connections to students' perceptions or achievement.

We further suggest that in future studies methods like multiple-case studies, focusing on all stakeholders engaged in the implementation and on both the perceptions and the practices of those stakeholders, should be used. For example, the effects of the implementation of DI on students have been investigated often (Deunk et al., 2015), but not incorporated into studies also looking at the teachers. Rather, most studies, also those incorporated into this review, focus on only one group of stakeholders. We believe that studies focusing on all stakeholders are important to get a better grasp of what actually happens in practice when (attempting to) implementing DI.

Finally, future studies could also take account of the cultural context in which the implementation of DI is taking place. In this review, we did extract the different countries the studies were from, but we were unable to find out whether certain findings were related to the specific prevailing culture of that country or school.

Based on the overview of different factors arising from current research that have an influence on the implementation of DI, we argue that to implement DI effectively, differentiated implementation is necessary. Although factors like small classrooms, an adjusted physical classroom setting, and a safe and supportive environment to change seem to be of great importance for successful implementation,

each specific school setting requires a specific way of bringing these and other factors together.

Chapter 3

Teachers' interactive cognitions of differentiated instruction in regular and talent development lessons

Chapter 3
Teachers' interactive cognitions of differentiated instruction in regular and talent development lessons[1]

Abstract

In this study, we explored teachers' interactive cognitions of differentiated instruction in the context of their regular lessons and in extracurricular talent development lessons. Stimulated recall interviews were conducted with four secondary school teachers in the Netherlands. We found that teachers' interactive cognitions varied depending on the context. More specifically, it appeared that in the extracurricular talent development lessons teachers focused more on small groups or individual students, than in the regular lessons. Also, it was found that teachers often take student characteristics into account, however, teachers differ in how they do this. The study provides a valuable starting point for professional development trajectories that take differences between teachers into account.

[1] This chapter has been submitted in an adapted form as:

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (under review). *Teachers' interactive cognitions of differentiated instruction: An exploration in regular and talent development lessons*.

3.1 Introduction

In secondary education in many countries, teachers are usually confronted with classrooms of approximately 25 students who have different learning needs. These differences need to be considered, to maximize each student's learning potential (Tomlinson et al., 2003). Across different countries and different school levels, most teachers perceive differentiated instruction (DI) as an important element of their teaching. However, they also encounter difficulties when implementing it (Bosker & Doolaard, 2009; Janssen, Hulshof, & Van Veen, 2016; Tomlinson, 2005). More specifically, they argue that it is difficult to take every individual student's needs into account in a classroom with so many students. Teachers perceive planning in advance to make individualized lesson plans for every student as taking too much time (Janssen, Westbroek, Doyle, & Van Driel, 2013).

Many researchers have described what teachers' practice of DI looks like (Graham et al., 2008; Roiha, 2014; Roy, Guay, & Valois, 2013). Teachers mostly do not use DI, and if they do, they have a limited set of DI strategies. These studies have typically focused on observation of teaching practices, and looked for sets of strategies that they considered to be exemplary of DI (Deunk, Doolaard, Smale-Jacobse, & Bosker, 2015; Tomlinson et al., 2003). Although in literature proactive DI is mentioned as a hallmark of effective DI, planning for DI is complex for teachers, and classroom reality typically needs immediate responses. Teachers therefore will use reactive DI practices as well (Denessen & Douglas, 2015). By observing teachers, research focuses on the outcomes of those responses, rather than taking the teacher knowledge that is embedded within those actions into account. Previous research has shown that merely investigating behavior does not do justice to the complex, unstable, and context-specific reality of teaching situations (Meijer, 1999). Studies on teachers' interactive cognitions, teachers' knowledge that is embedded in their practice, have provided more insight into that complex reality of teaching

(Meijer, 1999; Verloop, 1989). Therefore, in this study we investigated teachers' interactive cognitions of DI in two different learning environments: the regular classroom environment and an extracurricular environment with a focus on student talent development. Teachers did not have to follow a set curriculum and were encouraged to differentiate their instruction in this extracurricular environment. Therefore, by looking at these two environments we get a comprehensive view of teachers' interactive cognitions of DI and determine whether these cognitions are different depending on the type of environment. The study was guided by the following general research question: *What are teachers' interactive cognitions of differentiated instruction in two different learning environments?*

3.2 Theoretical background and conceptual framework

3.2.1 Differentiated instruction

Differentiated instruction can be defined as "an approach to teaching in which teachers proactively modify curricula, teaching methods, resources, learning activities, and student products to address the diverse needs of individual students and small groups of students to maximize the learning opportunity for each student in a classroom" (Tomlinson et al., 2003, p.121). This definition mostly focuses on academic DI. This means that a teacher, together with his students, capitalizes on the strengths of his/her students, overcoming their weaknesses (Corno, 2008). In addition, a teacher can also focus on incorporating students' cultural backgrounds in the lesson content and equally dividing status across students from different cultural backgrounds, also known as teaching for equity, or cultural DI (Cohen & Lotan, 1995; Severiens, 2014).

In this study, when we mention DI, we focus specifically on teachers' academic DI, since the teachers in the extracurricular classroom environment were encouraged to differentiate their

instruction with regard to students' academic talents. The students' cultural backgrounds, in this definition of DI are part of the students' learning profile, one of the student characteristics teachers take into account when differentiating instruction, and were as such also accounted for in this study (Tomlinson et al., 2003). Focusing on this academic DI, the two main tasks for a teacher are to plan for DI in his/her lessons and to assist (groups of) students in their work on assignments (Smit & Humpert, 2012). During both those tasks, a teacher takes his/her students' individual learning needs into account (Smit & Humpert, 2012; Subban, 2006; Tomlinson et al., 2003). These learning needs can be typified by three student characteristics: (1) student readiness (the level at which students can perform with moderate challenge); (2) student interest (students' interests and motivation); and (3) student learning profile (students' SES, ethnicity, learning preferences, etc.) (Tomlinson et al., 2003). In section 1.2.1 these student characteristics have been described in more detail.

Research studying DI has concluded that, when implemented well, DI can be beneficial to students' motivation, engagement, and achievement (e.g. Deunk et al., 2015; Mastropieri et al., 2006). DI is considered to be implemented well when the teacher, amongst others, makes use of flexible grouping and plans DI proactively (Deunk et al., 2015; Smit & Humpert, 2012; Tomlinson et al., 2003). The necessity of proactive DI does not imply that reactive DI is less important. Events during teaching will occur that require teachers' immediate responses in which they take students' learning needs into account (Denessen & Douglas, 2015).

Since teachers often experience difficulties with the implementation of DI, we value it important to take on a teacher perspective and explore teachers' thinking-in-action during teacher-student interactions. In this study, we focused on teachers' interactive cognitions of DI for small groups or for individual students while (a)

providing instruction, (b) offering help, (c) calling on students, and (d) giving assignments (Tomlinson, Brimijoin, & Narvaez, 2008).

3.2.2 Teachers' interactive cognitions

In literature, teachers' interactive cognitions are considered part of teacher knowledge (Meijer, 1999; Verloop, 1989). Teacher knowledge relates to teachers' actions while teaching, and accounts for the complexity of interactive teaching and thinking-in-action (Munby et al., 2001). The concept of teacher knowledge is based on the idea that there is reciprocity between the whole of teachers' cognitions and insights and their activities in the classroom (Verloop, Van Driel, & Meijer, 2001). What is referred to as interactive cognitions within teacher knowledge, is the knowledge that is active in a teacher´s mind during classroom teaching (Verloop, 1989). This type of knowledge is specifically important in the context of using DI strategies. Although teachers should aim to plan their use of these strategies in advance as much as they can, students' individual needs and interests often become apparent during classroom teaching, requiring teachers to recognize them and respond to them on the spot (Denessen & Douglas, 2015; Tomlinson et al., 2003). To investigate these interactive cognitions, stimulated recall interviews (SRIs) are commonly used (Meijer, 1999; Verloop, 1989). In studies of teacher planning, teachers' interactive cognitions have often been investigated using think-out-loud protocols when they are planning their lessons. However, when they are teaching, it is impossible for teachers to think out loud about what they are doing (Meijer, 1999). Therefore, teachers' lessons are recorded on video, and afterwards, teachers are asked to reconstruct their thinking while they were teaching.

3.2.3 The current study

In the current study, we aim to provide a more comprehensive understanding of teachers' interactive cognitions of DI by

investigating it in two different learning environments: (1) regular lessons; and (2) talent development lessons. In the talent development lessons, as mentioned above, teachers were encouraged to differentiate their instruction. In addition, students themselves selected the subjects in which they wanted to follow the talent development lessons, which means there is self-differentiation among the students. More specifically, the students differentiate for themselves in the subject that is to be learned based on their achievement and interest in the subject (Severiens, 2014). As a consequence, the self-differentiation leads to a smaller range of differences between students' readiness and interests in the talent development lessons compared to the regular lessons. Teachers thus have to make relatively smaller adjustments in their teaching to meet students' learning needs (Deunk et al., 2015). In addition to the more homogeneous group of students that results from self-differentiation, the teachers did not have to adhere to the regular curriculum in these lessons. This makes the talent development lessons an opportune context to experiment with DI (De Neve, Devos, & Tuytens, 2015; McTighe & Brown, 2005).

3.3 Method

3.3.1 Context: Talent development lessons

Data were collected in the bilingual secondary school in the Netherlands that participated in the project GUTS, as was described in 1.4. The current study took place in the first school year GUTS was implemented (2013-2014). This year, the GUTS lessons, with a length of 100 minutes (2 lesson hours), all took place on Wednesday afternoons between November and June. These lessons did not have to relate directly to the regular curriculum, but the content had to be related to the subject matter from the regular lessons. The teachers, thus, had to design new lessons that would be enriching and motivating for all students. To increase the likelihood that all students

experienced the lessons as enriching and motivating, teachers were specifically requested to plan for DI in these lessons.

3.3.2 Participants

Eight first-grade teachers (student age 12) of the participating school were asked to participate in this study. The teachers were selected on the basis of their subject clusters: science (e.g., Biology, Mathematics), language (e.g., Dutch language and literature, French), society (e.g., History, Geography), and creative (e.g., Art and Design, Drama). One teacher from each cluster was willing to participate. For the relevant characteristics of the participants, see Table 3.1.

Table 3.1 Characteristics of participants

Teacher (gender)	***Alex (m)***	***Bert (m)***	***Carla (f)***	***Debra (f)***
Subject	Mathematics	History	Art & Design	Dutch language
Years' experience	3	20	6	1
Education	University	Higher Professional Education	University	University

3.3.3 Procedure

Data collection

As mentioned in the theoretical framework of this chapter, SRIs were used to investigate teacher knowledge. All four participating teachers were observed twice while teaching – first during a talent lesson (100 minutes) and second during a regular lesson (50 minutes), chosen together by the first author and the teacher. The observations were video recorded, and this video material was used to help the teachers to relive the lesson and think out loud about what they were thinking during a certain teacher-student interaction and why they were

undertaking it. This served to elicit the teachers' considerations behind their interactions with students, which could provide insight into their interactive cognitions (Meijer, 1999; Nguyen, McFadden, Tangen, & Beutel, 2013).

In many studies in which SRIs were used, teachers were shown video recordings of complete lessons, and the teachers themselves paused the video when they were aware of having had a certain thought during an activity (Meijer, 1999; Verloop, 1989). As we were only interested in teachers' interactive cognitions of DI, we decided to show the teachers only those teacher-student interactions in which we expected they were considering students' characteristics (Nguyen et al., 2013). This meant that the PhD candidate, who conducted the SRIs, selected clips from each videotaped lesson to discuss with the teachers.

Table 3.2 Teacher- student categories for the SRI and descriptions of these interactions

Teacher-student interaction	**Description**
Providing instruction	Teacher provides instruction in what is going to happen during the lesson and/or the subject matter.
Offering help to a student	Teacher helps students with the problems or difficulties they encounter
Giving assignments	Teacher gives students assignments to work on during and/or after the lesson.
Calling on a student	Teacher picks out a student to answer a question/ask a question.

Each of the clips showed a teacher-student interaction in one of the following categories: (1) providing instruction; (2) offering help; (3) giving assignments; and (4) calling on a student. The categories are explained in Table 3.2. We were specifically interested in teachers' interactive cognitions during teacher-student interactions in the above-mentioned categories, since these are common in teachers' practice and

likely to show up in both types of lessons. When watching the video clips afterwards, it appeared that most teacher-student interactions fell into one of these four categories – which are explained in Table 3.2. In selecting the clips, we made sure that each category of teacher-student interactions was discussed at least once in the SRIs. This would make comparison of both environments and of the different teachers more feasible. Thus, four clips containing the four teacher-student interactions were chosen to show the teachers. Further selection criteria for the video clips were quality (audibility and visibility) and best fit within the category. After each video clip, the teachers were asked what they were thinking during that particular interaction, and what made them act in that way. The interviews were all recorded on an audio recorder and afterwards transcribed verbatim.

Data coding

The first step in coding the SRIs was coding the interactions that were discussed in the interviews. In the transcripts of the interviews, the teacher-student interactions were retraced and coded with the names of the categories in which they fell. In all interviews, talking about a certain interaction triggered the teachers to also explain something about other interactions that occurred during the lesson. These interactions were also coded. It appeared that not all of these interactions fell into the categories that were made up in advance. Therefore, a new category was added and named 'checking up on a student', now covering all teacher-student interactions in the collected data. The interactions that fell into this category were those where the teacher was walking around the classroom, looking at or asking about what and how the students were doing.

After the coding of the teaching behavior, teachers' interactive cognitions were coded. A teacher's reasoning behind an observed interaction was considered an interactive cognition. If the teacher's interactive cognition showed that the teacher considered a student's needs, a code with a student characteristic (readiness, interest, and/or

learning profile) as described by Tomlinson et al. (2003) was added to the teacher-student interaction code. Table 3.3 shows the student characteristic codes with their descriptions.

Table 3.3 Codes of teachers' interactive cognitions of student characteristics, and their descriptions

Student characteristic	**Description**
Readiness	Teacher considers student readiness when (s)he makes sure that his/her support, feedback, and tasks are at the right difficulty level for the individual student.
Interest	Teacher considers modifying instruction to take account of interest and/or to enhance individual students' (or small groups of students') motivation, productivity, and achievement.
Learning profile	Teacher considers adjusting instruction to the student's learning profile, referring to the student's preferred mode of learning, environment, emotions, interactions, physical needs, intelligence preference (analytical, practical, creative), gender, culture, etc.

An example of a teacher's interactive cognition with student characteristics is this quote from Carla (Art & Design): "[I explained it verbally, because] I want them to think for themselves, to form their own image… I know, if I give them examples, they will copy them, they will do exactly the same thing" (interaction category: offering help; student characteristic: readiness). We coded *readiness* for this quote, since the teacher argues that she wants the students to move forward from what they already can and do.

An example of a teacher's interactive cognition without knowledge of differentiated instruction is Alex (Mathematics), who explains the following after being asked about his reasons for telling

the students what is going to happen during the lesson: "I don't do this every lesson. I mean, a routine is pretty well established, start the same way, do the same things, finish the same way. So, one day I do something a little bit different [and I tell them], like today. But when it is just a normal lesson [not], it's what you can expect" (interaction category: providing instruction; student characteristic: none). For this quote, no student characteristics were coded, as the teacher did not seem to take the students' needs into account when choosing this way of starting the lesson.

Data analysis

After coding all cases, we conducted cross-case and within-case analyses. For the cross-case analysis, the numbers of the interactive cognition codes per teacher-student interaction were compared across lesson types and across lesson types per teacher. Reliability was aimed at by using a member-check (Miles & Huberman, 1994); the teachers were asked by email whether they recognized themselves in the analyses and, if not, to comment on the data. To answer this question, they were provided with the lesson descriptions and quotes used in the current paper. In addition, one of the supervisors coded 75% of the interviews (6 interviews), and this was compared with the coding of the PhD candidate. Cohen's kappa was calculated at 0.66, which can be considered sufficient. However, to further assure the quality of the coding process, the PhD candidate together with the supervisor discussed the coding scheme and process, and adapted it where we found this to be necessary.

The quantitative analyses were supplemented by qualitative analyses. For this, a summary of every lesson was made for each teacher. In these summaries, we focused on results complementing the quantitative results. It should, therefore, be noted that although the summaries are a good illustration of each lesson, more activities were undertaken by the teachers than are described.

3.4 Results

This section reports quantitative and qualitative comparisons of teachers' interactive cognitions during regular and GUTS lessons to answer the research question: *What are teachers' interactive cognitions of differentiated instruction in two different learning environments?*

Table 3.4 shows the frequencies of each teacher activity discussed during the SRIs. It also provides the frequencies of the student characteristic codes readiness (R), interest (I), and learning profile (LP), reflecting the teacher knowledge evident in those teacher activities.

In some instances, more than one student characteristic was coded in a teacher-student interaction. Therefore, the sum of all frequencies of the student characteristic codes can outnumber the frequencies of the teacher-student interactions. For example, in the two rightmost columns in Table 3.4, *calling on a student* was coded five times (GUTS), the student characteristic *readiness* twice, *interest* once, and *learning profile* once; and on two occasions *no* student characteristic codes were linked to a teacher activity.

The results presented in Table 3.4 show that the frequencies of almost all teacher-student interactions for all teachers were equal for both types of lessons. Only two teachers had one or two interactions which varied depending on the learning environment. For Bert, *checking on a student* occurred more often during his GUTS lesson (7) than in his regular lesson (1). Debra had substantial differences between her GUTS and regular lessons for *calling on a student* (GUTS=1; regular=6) and for *providing instruction* (GUTS=0; regular=3).

Table 3.4 Frequencies of codes of teachers' interactive cognitions of student characteristics, related to teacher-student interactions per teacher

Teacher-student interaction	Student characteristic	Alex		Bert		Carla		Debra		Total	
		GUTS (*n*=18)[e]	*Regular* (*n*=20)	*GUTS* (*n*=17)	*Regular* (*n*=22)	*GUTS* (*n*=20)	*Regular* (*n*=22)	*GUTS* (*n*=3)	*Regular* (*n*=20)	*GUTS*	*Regular*
Calling on a student		**1**	**3**	**2**	**3**	**1**	**1**	**1**	**6**	**5**	**13**
	R[a]	1	1	0	2	1	1	0	5	2	9
	I[b]	1	1	0	0	0	0	0	0	1	1
	LP[c]	0	1	0	1	0	1	1	1	1	4
	none[d]	0	1	2	0	0	0	0	1	2	2
Checking on a student		**1**	**1**	**7**	**1**	**1**	**1**	**2**	**2**	**11**	**5**
	R	1	0	6	1	1	0	1	1	9	2
	I	0	1	3	0	0	0	1	0	4	1
	LP	0	0	1	0	1	0	0	0	2	0
	none	0	0	0	0	0	1	0	1	0	2
Giving assign-ments		**0**	**0**	**0**	**1**	**0**	**2**	**2**	**1**	**2**	**4**
	R	0	0	0	0	0	2	0	1	0	3
	I	0	0	0	0	0	0	0	0	0	0
	LP	0	0	0	1	0	0	0	0	0	1
	none	0	0	0	0	0	0	2	0	2	0
Offering help		**3**	**1**	**1**	**2**	**4**	**3**	**1**	**2**	**9**	**8**
	R	2	1	1	1	3	3	0	1	6	6
	I	0	0	0	0	1	0	0	0	1	0
	LP	0	0	0	1	0	0	0	1	0	2
	none	1	0	0	0	0	0	1	0	2	0
Providing instruction		**1**	**3**	**1**	**2**	**1**	**1**	**0**	**3**	**3**	**9**
	R	0	0	0	0	1	1	0	1	1	2
	I	1	0	1	1	1	1	0	0	3	2
	LP	0	0	0	1	0	0	0	0	0	1
	none	0	3	0	0	0	0	0	2	0	5
All		**6**	**8**	**11**	**9**	**7**	**8**	**6**	**14**	**30**	**39**
	R	4	2	7	4	6	6	1	9	18	24
	I	2	2	4	1	2	1	1	0	9	4
	LP	0	1	1	4	1	1	1	2	3	8
	none	1	4	2	0	0	1	3	4	6	9

[a] R = Readiness; [b] I = Interest; [c] LP = Learning Profile; [d] none = no student characteristic

To provide a more comprehensive view of the above findings, the qualitative results are presented next. For each individual teacher, we discuss their most prominent result from Table 3.4 and we relate this to their lessons. All lessons that were discussed in the SRIs are summarized, and some quotes from the teachers that highlight how they spoke about student characteristics are used in these summaries in order to make the teachers' interactive cognitions as concrete as possible.

3.4.1 Carla (Art & Design, 6 yrs. experience)

Table 3.4 shows that Carla's GUTS and regular lessons were more or less the same with regard to the teacher-student interactions and her interactive cognitions of student characteristics.

Carla's GUTS lesson started with brief instructions given to the students by her colleague. After this, the students got to work on their paintings. All students were given the same assignment for their painting: to copy a painting by Vincent van Gogh. The students got to choose themselves which painting to copy (student interest). Sometimes Carla walked up to students who made it clear they needed her help; as Carla explained in the SRI, she would then help them in a way she thought was most suitable for that particular student (student readiness). She also told in the interview that even if students did not have a particular question, she would still stop by them, since she knew that some of the students would have more trouble working than others (student readiness). For example:

> Interviewer: "I saw you doing something with him which I didn't see you do with other students. I mean, there are times you take the paint brush out of the student's hand, (…) and then you take over. But with him, you take over and then he paints himself, but you stay with him."

Carla: "Because (…) I know that some know exactly what they are doing, what they have to do. (…) [but] I know that he will return to me after five minutes, so it's better if I stay with him for a while, because I know he is like that, that he says 'I don't know any more what I have to do, what do I do (…)' (…) or asks others what they are supposed to do, and then I'd rather stay with him." (student readiness)

During Carla's regular lesson, she provided the instructions at the beginning of the lesson herself, as only one teacher is present. After the instructions, in which all students were given the same assignment, the students got to work on their individual projects; they got to choose themselves what picture they would do (student interest). The teacher explained in the SRI that although all students had the same assignment she would allow a student with difficulties to do an easier version of the assignment (student readiness). The reason she chose a challenging version was that she thought this class needed the challenge to stay motivated:

> "Yes, because this class is very talkative, they're really sharp, and well, I thought, (…) show me what you can do. (…) and they say, 'yes miss, this is really easy' (…) Well, then bring it (…) and in the end it is great to see that when you give them an extra challenge, that they can do it that they also get that feeling 'oh, okay, yeah I really can do it'." (student interest and readiness)

In the interview she also clarified that when students needed help, she would give it, like in the GUTS lesson, as she saw fit for the particular student she was helping (student readiness). However, simply walking to a student to see how (s)he was doing was something she did less frequently. In the SRI she made it clear that not all students would find it fair if some students got more help than others when the

assignment was for a grade. Nevertheless, as stated above, Carla tried to help individual students as much as possible in both types of lessons, when she thought it was needed.

3.4.2 Debra (Dutch language, 1 yr. experience)

Debra's results in Table 3.4 show two prominent differences: (1) *calling on a student* (GUTS=6; regular=1), and (2) *providing instruction* (GUTS=3; regular=0). This contrasts the frequencies for *checking on a student* (GUTS=2; regular=2) and *offering help* (GUTS=1; regular=2). In her GUTS lesson, there were two teachers for only three students. Therefore, more presence of *checking on a student* and *offering help* could have been expected in the GUTS lessons. Debra's explanation is illustrated below.

Debra gave the GUTS lessons together with a colleague, who started the whole class instruction for the three students. The students were given instructions for the assignment central to the lesson at hand. All students were given the same assignment, one working alone and two together, but they were provided with a minimum set of rules: the students could choose their own subject and their own way of completing the assignment. Debra especially focused on the two girls working together, by looking from time to time at how they were doing. In the SRI she explained that she let them work as much as possible on their own and only helped the girls when they asked for help:

> "Yes, a teacher constantly watching you, you know, they also should have the opportunity to do their own thing and discuss stuff with each other, without me watching. Alone, they can give each other feedback, while if I sit there, they can't really speak freely." (student interest)

During Debra's regular lesson, she instructed the students classically in a new subject and then let them work on assignments from the

textbook. When Debra saw, as she said in the interview, that (almost) all students had completed one or two assignments, she would project the answers on the whiteboard to let them check their answers. An example of her approach:

> "Sometimes I do it step-by-step; orthography is always convenient to project and this projecting always goes pretty fast. And because it is not a very difficult assignment, (…), they can do it themselves. But that first one I wanted to [discuss with them] as an example, because it is a completely new topic. But I thought, the rest they will see for themselves." (student readiness)

A few answers were discussed during whole-class discussion. Debra explained that sometimes she let random students give the answer, and other times she called on students who were not paying attention in spite of needing the instruction (student readiness).

3.4.3 Bert (History, 20 yrs. experience)

Bert's results in Table 3.4 show a big difference in the frequencies of *checking on a student* (GUTS=7; regular=1), and when doing this, he always considered student characteristics during the GUTS lesson. His interactive cognitions mostly focused on students' *readiness* (6). Bert's regular lesson was mainly whole-class instruction; while in the GUTS lesson small group-work was central with Bert regularly checking on them.

Bert's GUTS lesson started with a short recapitulation of the previous two GUTS lessons. Next, the students worked independently in groups of three or four who all had the same assignment, but they could decide on their own topic (student interest). During his walk around the classroom, Bert discovered that the students had trouble finding the right information. So he gave them in a short whole-class moment more detailed instructions:

> "But as I started to notice that it would be a long process, I thought I should give them more simple sources. I found History for Kids and while it was intended that they would read primary sources, this appeared to be too difficult. So I also let them read secondary sources, (…), and that did work, but it was too difficult anyway for some groups." (student readiness)

The students continued to work in their groups, and Bert walked by the groups. He would help some groups more than others or in different ways. For example, he told one group exactly the same as he had first said in English, only then in Dutch, as Bert felt that the cause of their problem might have been the language barrier rather than the difficulty of the task at hand (student readiness and learning profile).

Almost all of Bert's regular lesson was whole-group instruction in the subject matter. Bert told a story about an important historical battle and certain impacts this had. He used this type of instruction because he feels most comfortable with it, he explained in the interview. Also, he said that some students have told him throughout the years that they find his lessons very interesting (student interest). The whole-class instruction started with a recapitulation of the previous lesson, and he let this flow into the subject matter of the current lesson. During his instruction, he sometimes asked students questions; Bert explained in the SRI that these questions were useful for checking whether they already knew anything about the subject, or for getting them to think about certain concepts (student readiness). When a student did not know the answer, he would adjust his response:

> Interviewer: (video) "So you ask, who lives in the south, then you point at someone. You don't really get an answer, so you repeat the question [and let someone else answer]. Could you explain why you do it like that?"

Bert: "No, I do a lot of things, I just do something that seems suitable and then, yeah, because I think if someone like me clearly sees, that first student doesn't know the answer. Yes, then I think I'm embarrassing her." (student readiness)

Towards the end of the lesson Bert gave the students an assignment. One student did not understand the assignment and the teacher used the same strategy as he used in his talent lesson: he explained the assignment in Dutch (student learning profile).

3.4.4 Alex (Mathematics, 3 yrs. experience)

The most salient result in Table 3.4 for Alex occurred when *providing instruction* (GUTS=1; regular=3) while considering students' *interest* during the GUTS lesson, but not during the regular lesson. Out of all student characteristics, it is apparent that during the GUTS lesson, he mostly used knowledge of the students' *readiness* (4). However, the ways he answered students' questions in the two lessons give a different view. In his GUTS lesson, he adjusted his (way of) answering to small groups and individual students. During his regular lesson, he mostly aimed to adjust his way of answering to the level of the whole class. Thus, while focusing in both lessons on student *readiness*, in his GUTS lesson, he was more focused on small groups and individual students, and in his regular lesson he focused on the whole class.

Alex's GUTS lesson was set up around a certain assignment the students had to complete. The teacher started the lesson with a short movie on the subject in order to get the class's attention and then provided whole-class instruction in what they were about to do, in order to get them to think about what was expected of them. He thought students would like this approach more than simply telling them to be quiet and immediately listen to him explaining what they were about to do (student interest). Next, he asked them to set up and

work in groups of four while he sat at his desk, available for student questions:

> "What I want them to do is have as much independence as possible. And so I want to give them the space to figure things out, work together. If I'm constantly hovering there, telling them what they have to do, (…) they are just waiting for me to answer their question." (student readiness)

When the students had questions, they would come up to his desk with them. How he answered a question depended partly on the student. During the SRI he made clear that if he expected that the student should know the answer, or at least part of it, he would ask the student questions back in order to let him answer his own question. He would also adjust his explanation or answer when he expected a student to have difficulty understanding it (student readiness).

During Alex's regular lesson, he discussed a test the students took the previous week. He started with the distribution of the graded tests, during which he informed the students about their results. He explained in the SRI that his evaluation of the results did not depend on the grade alone, but also on his expectation of what grade the individual student should be able to get (student readiness). He discussed the test during whole-class instruction by letting students nominate questions from the test they would like to have explained. Every question was answered stepwise during this whole-class instruction; with each step, the students had a chance to answer these steps in order to get to the final answer. The teacher sometimes let the student answer who asked the question initially, and sometimes asked a different, randomly chosen student:

> "Well, so I just call random students, it keeps them paying attention, keeps them involved, cause they might have an answer, or they might… especially in this class, it's a very quiet

> class, they have a question, but they're not going to put a hand up, so I just call them." (student interest and learning profile)

Checking the test took most of the lesson. At the end, the students worked on their homework.

3.4.5 Final remarks

These qualitative results show four very different teachers with respect to teaching different types of lessons and having different interactive cognitions. We believe these results give more depth to the quantitative results shown in Table 3.4. For example, the regular lessons Alex and Bert taught were whole-class-oriented lessons; therefore, the student characteristic codes resulting from these lessons should be interpreted differently as they were focused on larger groups of students or the whole class most of the time, rather than on individual students. For Alex this is partly true for the GUTS lesson, too: the interactive cognitions regarding student characteristics he used did not always reflect characteristics of individual students or small groups of students. In addition, for Carla, there were no clear differences in the tables between the two types of lessons, nor did the description show many differences. The biggest difference is in the way she helped students and checked on them. She said she could do this more freely during her GUTS lesson; in the regular lesson, students might not think it fair if she attended to some students more than others. Debra included student characteristics more during her regular lesson than during her GUTS lesson, but her GUTS lesson was a very different lesson for her, as she said in the interview, because there were two teachers present for only three students, and she focused mostly on two girls working together. This could have provided more considerations of student characteristics (because it might have been easier to take account of their needs), but it made her uncomfortable, causing her not to interact much with them.

3.5 Conclusion and discussion

3.5.1 Teachers' interactive cognitions

In this study teachers' interactive cognitions of DI were explored in two different contexts (regular and GUTS lessons). More specifically, we focused on teachers' interactive cognitions of student characteristics. We found that teachers' interactive cognitions were focused on at least one student characteristic in their decision of how to approach the group of students or an individual student during teacher-student interactions. We were thus able to determine that teachers are learner-centered in their provision of instruction, a typical characteristic of DI (Tomlinson et al., 2003).

In addition, the focus on interactive cognitions adds to previous studies in which was concluded that teachers have knowledge of DI, but have trouble implementing it. This study shows how teachers consider differences in student characteristics teachers use to inform their decisions about instructional strategies (Bosker & Doolaard, 2009; Meijer, 1999; Tomlinson, 2005).

3.5.2 Differences between learning environments

The focus of this study was to explore the differences in teachers' interactive cognitions across the two different learning environments. During the SRIs, it appeared that teachers' interactive cognitions of student characteristics during the regular lessons did not differ much from the interactive cognitions during the GUTS lessons (Table 3.4). A difference that could be found, concerned the focus of the student characteristics: during the regular lessons the teachers apparently mostly considered the whole class, while in the GUTS environment, small group or individual student characteristics were more at the center of the teachers' interactive cognitions. This underscores the aforementioned idea of the GUTS lessons providing an environment in which DI is possibly easier to achieve for teachers, as the group of students in this environment is less heterogeneous in motivation for

and achievement in the subject (Deunk et al., 2015; Tomlinson et al., 2003; Tomlinson et al., 2008). In more homogeneous classrooms it is easier for the teacher to get an overview of the different learning needs and (s)he only needs to make minor adjustments to his/her teaching (Deunk et al., 2015). In addition, another explanation might be the relatively high level of autonomy for teachers in designing their GUTS lessons (De Neve et al., 2015). However, providing autonomy only helps when teachers feel efficacious to differentiate their instruction. In the findings, we noticed for example that for Debra, who felt quite uncertain in an environment with little structure and a small group of students, her interactive cognitions showed many similarities in both contexts.

Overall, we argue that apparently teachers do know more about DI than is often observed in their practices and that a different learning environment can help teachers in practicing this knowledge.

3.5.3 Implications, limitations and future directions

We explored teachers' interactive cognitions of DI in two different in-school learning environments (regular and GUTS) with SRIs in this study. As there was no set curriculum for the GUTS lessons and the student groups were more homogeneous, we thought it might be easier for teachers to differentiate in those lessons (De Neve et al., 2015; Tomlinson et al., 2003; Tomlinson et al., 2008). The results indeed pointed in that direction: teachers had more interactive cognitions with individual student characteristics in the GUTS lessons, whereas they used more whole class-characteristics in their regular lessons.

In this study, we focused on the student characteristics that teachers take into account during certain types of teacher-student interactions. We hereby did not attempt to identify whether the teachers' reactive DI was more focused on process, content or product (Tomlinson et al., 2003). However, we recognize that it is possible that since we focused specifically and intentionally on teachers' reactive

(and unplanned) DI, DI in the process of instruction was more present in this study, rather than the content and product since they appear to be more planned by teachers (Tomlinson et al., 2003).

Although differences in teachers' interactive cognitions might have been expected, based on the personal nature of these cognitions (Meijer, 1999; Verloop et al., 2001), these differences could imply that teachers' readiness for differentiating instruction varied (Smit & Humpert, 2012). In the introduction of this chapter, we argued that to increase student achievement, it is important to teach students through their zones of proximal development (Tomlinson et al., 2003). In a future study, therefore, it would be useful to look at each teacher's starting point and at the education and training he has received in differentiated instruction. Also, an understanding of teachers' beliefs is important (Meijer, 1999; Munby et al., 2001; Verloop et al., 2001). Beliefs are described in many studies as intertwined with and hard to distinguish from knowledge (Pajares, 1992). This is because beliefs are strong convictions, and the forming and change of these convictions is related to knowledge. Both knowledge and beliefs are important when teacher change – e.g. towards more DI – is desirable (De Neve et al., 2015; Van Veen, Zwart, Meirink, & Verloop, 2010). Using this information on previous experiences and beliefs, the teachers' ZPDs could be mapped. In future professional development initiatives in the context of DI, we argue that teachers' individual needs should be taken into account as much as possible.

Chapter 4

Differentiating instruction to stimulate student talent development: A year-long study of teachers' interactive cognitions

Chapter 4
Differentiating instruction to stimulate student talent development: A year-long study of teachers' interactive cognitions[1]

Abstract

Despite the considerable interest in differentiated instruction in education practice and research, it is still the case that little differentiated instruction has been observed in practice. This study investigated teachers' interactive cognitions regarding differentiated instruction, to improve the support available to teachers in implementing this pedagogical approach. Four teachers participated in stimulated recall interviews in the context of talent development lessons in the lower years of a secondary school. Each teacher was observed for four lessons over two semesters and interviewed shortly afterwards using video clips from various teacher-student interactions. The interview data were analyzed to determine how learner-centered the teachers' interactive cognitions were and which student characteristics (readiness, interest, and/or learning profile) the teachers took into account. We concluded that the interactive cognitions varied between and within teachers regarding learner-centeredness and the student characteristics they considered. For example, for two out of the five categories of teacher-student interactions, teachers mainly considered students' readiness, whereas in another interaction they mainly considered interest. Thus, this research study indicates that the variety in teachers' interactive cognitions should be considered both in subsequent research and in efforts to support teachers as they implement differentiated instruction.

[1] This chapter has been submitted in adapted form as:

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4.1 Introduction

There has been a great deal of research into differentiated instruction (DI) both in the Netherlands and abroad (Bosker & Doolaard, 2009; Graham et al., 2008; Dutch Inspectorate of Education, 2016; Tomlinson et al., 2003). DI is usually defined as taking differences between students into account in the process, product and content of teaching, whether proactively or reactively (Bosker & Doolaard, 2009; Tomlinson et al., 2003). Many studies have addressed the extent to which teachers respond to differences between students (Graham et al., 2008; Dutch Inspectorate of Education, 2016) and the effects of these actions on their students' learning outcomes (Deunk, Doolaard, Smale-Jacobse, & Bosker, 2015). A study examining teachers' perceptions of and knowledge about DI (Brighton, 2003) found that teachers consider DI to be important, given its positive effects on students' learning outcomes and motivation (Deunk et al., 2015). However, secondary school teachers often see it as impractical for classes of 25-30 students (Janssen, Hulshof, & Van Veen, 2016). In this study, we tried to gain more insight into how teachers attempt to cater for differences between students in their lessons and the interactive cognitions regarding their attempts. Greater insight into teachers' interactive cognitions during lessons should enable better support to be given to them for their classroom practice. An important assumption for this study was that different teachers may have different interactive cognitions which affect how they adapt their practices, depending on the teacher him/herself, specific characteristics of the student the teacher is interacting with and the type of learning activity. For this reason, it is not suitable to provide support to teachers as they implement DI in a one-size-fits-all approach.

The questions that we set out to answer in this study were: *What interactive cognitions regarding differentiated instruction do teachers have during teaching? How do they take different student characteristics into account in these interactive cognitions?*

The method we used to explore interactive cognitions *during* teaching was stimulated recall interviews (SRIs). On this basis, we obtained more insight into the variety of context-specific interactive cognitions that the teachers had while they were teaching.

4.2 Theoretical framework

4.2.1 Differentiated instruction

The concept of differentiated instruction

Differentiated instruction can take two forms: between classes and within classes. Between-classroom DI can be seen, for instance, in the structure of secondary education in the Netherlands (as explained in 1.2.2), which tracks students in different school levels (Bosker & Doolaard, 2009). Within-classroom DI occurs when the teacher makes pedagogical choices to take differences between students in a class into account. Regardless of whether it is being organized within or between classes, DI can be seen as "an approach which proactively takes individual differences between students into account" (Mastropieri et al., 2006; Richards & Omdal, 2007; Tomlinson et al., 2003). According to this definition of DI, which can be considered academic DI, differences between students can generally be divided into three different types of student characteristics (Tomlinson et al., 2003): *readiness*, *interest* and *learning profile* (section 1.2.1). By taking these student characteristics into account, the teacher creates an environment in which each student can be successful and develop his/her academic potential to the full (Subban, 2006). In addition to academic DI, cultural DI can also be distinguished. In this latter type of DI, taking into account cultural differences between students is more at the forefront, whereas in academic DI, students' cognitive capabilities and talents are more central (section 1.2.1) (Severiens, 2014; Tomlinson et al., 2003). In this study we adhere to the definition of academic DI.

Research into differentiated instruction

Various studies have provided evidence for DI's positive influence on students' performance at school (Deunk et al., 2015; Mastropieri et al., 2006; Richards & Omdal, 2007). In fact, DI contributes to higher learning outcomes in students of different age groups. Deunk et al. (2015), for example, point in their review to the cognitive effects of DI by ability grouping: various positive effects on the language skills of children in nursery school and on the reading skills of primary school students. Higher scores on standardized physics and chemistry tests were found by Mastropieri et al. (2006) and Richards and Omdal (2007) as a result of DI in secondary schools. In the study by Mastropieri et al. (2006), the DI consisted of students working in small groups of two or three on physics and chemistry tasks which were adapted in level of difficulty to be suitable for the students' abilities. The DI in Richards and Omdal's study (2007) took the form of *tiering*, a method which involved dividing the students into three ability groups. Then the content, process, and product of the series of lessons central to the research project was tailored to suit the knowledge and skills of the students.

These studies found positive learning outcomes because of successful implementation of these methods of DI (Deunk et al., 2015; Mastropieri et al., 2006; Richards & Omdal, 2007). The implementation usually involved a lengthy and intensive process geared to the effective implementation of DI. The teachers were coached in this by researchers and workshop leaders and/or a supply of materials developed by the researchers was provided which students could work on at different levels (Deunk et al., 2015; Mastropieri et al., 2006; Richards & Omdal, 2007). However, that implementation is by no means always effective is clear from a recent report of the Dutch Inspectorate of Education (2016), which concluded that there is still very little DI being practiced in secondary school classrooms in the Netherlands.

The complexity of differentiated instruction

DI is a complex task for teachers whether they are coached or not. This is because it requires them to make conscious and reasoned choices in what they do (Denessen & Douglas, 2015). As explained in section 1.3, these decisions should preferably be taken proactively at different levels. However, because of the large classes and lack of planning time, this is a great challenge for secondary school teachers (Janssen et al., 2016; Janssen, Westbroek, Doyle, & Van Driel, 2013). In practice teachers make many decisions about how to teach a student during classroom teaching, when the situation demands it. Thus, alongside proactive DI, they are usually also engaged in reactive DI (Denessen & Douglas, 2015). It is important, therefore, when supporting teachers to implement DI, not only to focus on the proactive form, but also on the choices they make in the classroom, or the teachers' interactive cognitions during teaching.

4.2.2 Teachers' interactive cognitions

Interactive cognitions during classroom teaching

Our research addressed teachers' interactive cognitions *during* teaching. Research on teachers' cognitions frequently refers to the concept of practical knowledge in this context (Meijer, 1999; Verloop, Van Driel, & Meijer, 2001). Teachers' practical knowledge is the knowledge that underlying the teachers' actions and can be seen as comprising two elements: (1) knowledge and beliefs; and (2) interactive cognitions (see 1.3.2). Therefore, research that only looks at teachers' knowledge and beliefs does not, by definition, give a complete picture of what guides their actions, argue McAlpine, Weston, Berthiaume, and Fairbank-Roch (2006). To study what goes on in teachers' heads when they are teaching, we also need their interactive cognitions (McAlpine et al., 2006; Meijer, Verloop, & Beijaard, 2002). Interactive cognitions are dynamic. They are cognitions that a teacher, consciously or unconsciously, has when

operating in a complex situation, such as many interactions in the classroom (Meijer et al., 2002). This term, in our opinion, conveys the idea that it concerns the teachers' consideration as they are making choices in their approach to students.

In this study, we set out to explore the particular interactive cognitions that come into play when teachers are trying to take differences between students into account during classroom teaching. This led us to focus on different student characteristics. By focusing on this we gained more insight into the extent to which teachers make allowances for differences between students in their unconscious and deliberate actions; in other words, to what extent their interactive cognitions incline towards differentiated instruction.

Interactive cognitions concerning student characteristics

In this study, we operationalized DI by investigating how the teachers' interactive cognitions were centered on the students and which student characteristics (readiness, interest or learning profile) the teachers mainly took into consideration when adapting their teaching to meet individual students' needs (Subban, 2006). When a teacher is aware of differences in *readiness*, *interest* and/or the *learning profiles* of students in a class, and tries to bridge the gap between those characteristics and the material to be learned, that teacher is engaged in learner-centered teaching (Bransford, Brown, & Cocking, 2000). A teacher that engages in learner-centered teaching, assigns competence and ability to all students (Turner, Christensen, & Meyer, 2009). In practice this means, for instance, that the teacher adapts the instruction during the lesson (and the lesson preparation) to meet the needs of the class or of a small group of students, because those students either do not have an adequate understanding of the material or do not find it interesting, but without those students feeling to be incompetent. The extent to which teachers do or do not take student characteristics into account in their interactive cognitions when they are teaching determines the extent to which their teaching can be described as

learner-centered. Where several student characteristics are considered, or where the instruction is adapted to small groups or individual students, that teacher's approach is said to be highly learner-centered (Bransford et al., 2000; Turner et al., 2009).

To sum up, this study set out to explore whether and which student characteristics were included in teachers' interactive cognitions when they were making choices about how to approach students during teaching. In other words, we investigated whether teachers took into account students' *readiness*, *interest* and *learning profiles* and, if so, how they did that. How the teachers took student characteristics into account was defined in this study by how learner-centered their interactive cognitions were.

The interactive cognitions were identified and recorded in the context of GUTS. We believed that this context would enable us to obtain a good picture of how teachers allow for differences between students in their teaching. A stimulated recall method (McAlpine et al., 2006; Meijer, 1999; Nguyen, McFadden, Tangen, & Beutel, 2013) was used to explore individual teachers' different interactive cognitions during the GUTS lessons. By specifically doing this with different teachers during different types of interactions (such as setting goals, giving instruction and giving positive attention), we produced a varied picture of their interactive cognitions. In doing so, we hoped that this study would lead to a better understanding of the complexity of reactive DI in classroom teaching, which could lead to indications for supporting teachers as they implement DI in their day-to-day teaching practice.

4.3 Method

4.3.1 Context: Differentiated challenging of talent in school

This study took place in the second year (2014-2015) of the implementation of GUTS (see 1.4). This year, students then had eight extra lessons in one of the three subjects they chose. The teachers

designed these lessons and incorporated four criteria: (1) enrichment; (2) autonomy; (3) higher order thinking skills; and (4) differentiated instruction. This last aspect was the key aspect for the purposes of our research.

4.3.2 Participants

Four teachers volunteered to work with us in the current study; two of these teachers (Alex and Carla) also participated in the study described in chapter 3. Table 4.1 provides a summary of basic facts relating to the four teachers' experience. The teachers were approached by the PhD candidate, who aimed as far as possible to recruit teachers of different subjects and with varying degrees of experience.

Table 4.1 Relevant details of participating teachers

Teacher (gender)	***Alex (m)***	***Carla (f)***	***Emma (f)***	***Frank (m)***
Subject	Math	Art & Design	French	Dutch
Years' experience	4[a]	7[a]	35	2
Years' experience with GUTS	1	1	0	1
Education	University	Higher Professional Education	University	University

[a] Alex's and Carla's years' of experience differ from their years' of experience in Table 3.1, since the study described in this chapter took place one year after the study described in chapter 3

All the teachers had set up a project for the GUTS lessons which they would work on over eight lessons per semester. Alex, who had about 15 students in the first semester and about 20 in the second, had designed a series of lessons for both semesters around a demo for a

computer game in which the students could build rockets and launch them into space. The students had a different aim each lesson, for example, in one lesson the aim was to orbit the moon. Carla had designed a different project for each of the two semesters and she had about 25 students in her class both times. In the first semester, the students had to produce a painting showing characteristics of the Dutch Golden Age. For example, a student could choose a well-known painting from the Golden Age and copy it in a more modern style but in a way that made it still recognizable as originating from the Golden Age. In the second semester, each student had to choose a work of art and draw a copy of it. After that each student had to produce 24 sketches based on their own drawing so that their own drawing would run into that of the next student. In this way, a video recording of all of the students' sketches would create the impression of one drawing merging and changing into the next. Emma had set up a fictitious exchange with a French secondary school for the first semester (about 16 students). The students had to organize this and think about all kinds of issues that would arise, from composing fictitious emails to the school to arranging where the Dutch students would sleep when they visited France. In the second semester (about 18 students) they had to work in groups to produce a mini play after first watching a French film for inspiration. Frank had different projects for the two semesters and also smaller projects within the semesters. In the first semester about seven students in the class worked on language style and poetry among other things. For example, they had to rewrite a poem in the language of the street. In the second semester, the 17 students spent the first four lessons debating. After that they spent two lessons examining certain aspects of language in depth. In the remaining lessons the students had to set up, carry out and present a mini investigation into some aspect of the Dutch language.

4.3.3 Instruments

We used stimulated recall interviews (SRIs) to investigate the teachers' interactive cognitions (see also chapter 3). In this study, we tried to help teachers to relive their lessons by letting them watch parts of the lessons we observed on video and asking them what was going on in their heads at that specific moment, what they were thinking while teaching the lesson.

During the recording of the videos, observations were noted in an adapted version of the 'Classroom Observation Form for Summative Assessment of Differentiated Instruction' (Tomlinson, Brimijoin, & Narvaez, 2008). The form was adapted so that the observations would not be summative assessments of the teachers, by not only noting whether a particular type of action took place or not, but also what that interaction looked like at the time. In addition, we made some changes to the form to make it more suitable for the Dutch school context. For example, an item that asks whether the teacher at least meets a 'state learning standard' in the lesson was taken out. The resulting adapted version consisted of five categories of actions instead of eight. An overview of these five categories and a short description of them can be found in Table 4.2, whereas the complete observation for can be found in Appendix A.

4.3.4 Procedure

Data collection

Each teacher took part in four SRIs – two per semester in the 2014-2015 school year. In these SRIs, we showed video clips with different types of teacher-student interactions, as in chapter 3.

One clip was selected for each category on the observation form (see Table 4.2 for a summary of the categories) that fulfilled as far as possible the following criteria: (a) clarity of the recording; (b) visibility of the teacher and students involved in the interaction; and (c) best fit with the category to which it is allocated. For the category *instruction*

and classroom routine we chose two video clips. This is because the idea with this category was to compare interactions with two different students or groups of students, in order to get a good idea of possible differences in the teacher's approach to teaching different students. If it was not possible to find a clip within a category of sufficiently high audio and visual quality, a second clip was selected to improve the chance of obtaining usable data.

Table 4.2 Brief descriptions of categories of teacher-student interactions

Type of interaction	Description
Starting position/setting goals	The teacher is explicit in setting goals and/or tries to establish the context/starting position by explicitly or implicitly incorporating students' prior knowledge into the lesson.
Student assessment	The teacher arranges a (pre-)assessment of the students (and adapts the lesson in the light of the results).
Attention for the individual	The teacher ensures that the individual is central to the lesson and is given attention. This involves giving students a role in planning/evaluation/ sharing their achievements.
Instruction and class routine	The teacher uses different routines in the class, e.g. direct whole class instruction, individual and small group work.
Positive, supportive learning environment	The teacher ensures a positive learning environment by praising students or through other positive approaches.

The teachers watched the selected clips one at a time during the SRIs. The recording was paused after each fragment and the teacher was asked: "What were you thinking here?" If a teacher found it difficult to answer this question, they were then asked to explain what they were doing in the fragment and this often flowed naturally into talking about their thoughts at the time. Asking the teachers what they were

thinking during the lesson was intended to get them to make their interactive cognitions explicit. The SRIs lasted for 30-60 minutes and took place in empty classrooms or the staff room, wherever the teacher felt most comfortable. Audio recordings were made of the interviews which were later transcribed verbatim for later analysis.

Data analysis

The analysis of the transcribed interviews consisted of six phases. Preceding this analysis, the PhD candidate studied the transcripts in detail to familiarize herself with their content. Then, the first phase of the analysis was performed. In this phase, we retrieved the interactive cognitions from the transcripts of the SRIs. To this end each SRI of each teacher was divided into five parts (corresponding with the five categories of teacher-student interactions) and put into a summary. As a result of this process five summaries were produced for each teacher; one for each type of interaction containing the interactive cognitions for that type of interaction from the four SRIs with that teacher. The part of a teacher's answer which revealed information about the reasons why this specific *interaction,* with that/those *student(s)*, took place in that *manner*, was treated as an interactive cognition and so included in the summaries. One of the summaries, for example, was labelled *context/goal setting*, the same as the interaction category. That document contained the interactive cognitions for that interaction that emerged from the four SRIs. In Alex's first SRI, for instance, there was his interactive cognition during this interaction: "I just tell them what they are going to do. (…) there is nothing exciting about second-year math. [So] in order to do things that are more exciting, you need more skills or it has to be something like [this program], where you are not doing math, but playing with something that you'll be able to do with math in the future." We also checked at this stage whether the teachers' interactive cognitions were congruent with the category into which they had been placed in the first instance during the observation.

In the second phase, the content of the teachers' interactive cognitions was analyzed and described. The interactive cognitions were annotated with information on how the interactive cognition was learner-centered, that is how the teacher was trying to take account of individual students and which students. To this we added whether teachers considered student characteristics, and if so, which.

The third phase was the production of matrices: one for each semester. We summarized the interactive cognitions from the same semester in the matrices under each interaction category. The reason for producing a separate matrix for each semester was that a block of GUTS lessons took up one semester, so this method brought the interactive cognitions from one block of lessons together. The summaries of all the teachers were brought together into one matrix, while maintaining the separation between teachers and interactions (see Table 4.3 for an example of part of this matrix). If for a specific interaction, no interactive cognitions were discussed for a particular teacher, we entered no summary in the matrix but noted 'not applicable', see: Alex – student assessment (Table 4.3). Phase four was the production of more generic descriptions of the teachers' interactive cognitions based on the summaries in the matrices. These descriptions were then put into new matrices. Characteristics, details and the like that could be seen as typical of that teacher and his/her subject were left out as much as possible, naturally ensuring that the essence of the interactive cognition remained intact. The purpose of this was to enable comparison of the interactive cognitions of different teachers and comparison of the two semesters. Thus, the summary for Alex from Table 4.3 became: "students from the school year in question are interested in how to learn certain subject knowledge and skills and the aim of the series of lessons and the explanation should take account of this."

Table 4.3 Matrix with summaries of teachers' interactive cognitions during student-teacher interactions in semester 1

Type of interaction	**Carla**	**Frank**	**Emma**	**Alex**
Context/ goal setting	The teacher tries either to establish what level the students are at, or she assumes that there is a certain point from which the students can progress, and she tries to provide such help and instruction that they can make progress at their own tempo and level. She does this within the time constraints and the scope of the task in hand, with a particular focus on helping students who are behind to achieve a certain minimum standard.	The teacher reviews previous lessons with the students to establish what prior knowledge they have or what they have learned in previous lessons. He gives them tips on how to use their prior knowledge in the current assignment and, on another occasion, he tries to get the students to a point where he thinks that they need to be in the first couple of minutes of the lesson in order to make further progress in the lesson.	The teacher has one ultimate goal for all the students in the first instance, which she helps them to reach. As soon as the students seem to have reached that goal or are getting close, she helps them to exceed it. In both cases she always starts from what the students already know, recognizing that there are differences between what students know, and takes this as the starting point for helping them to reach their goals.	The teacher believes that he has designed a task that is more fun for the students, given the current level of their knowledge and skills. The teacher has tried to make a virtue of their lack of knowledge and skills by allowing them to approach the subject in a different way. He offers them methods that he thinks are fun. In doing this he does not make any direct distinctions between students.
Student assessment etc.	The teacher is actively working…	The teacher wants to know…	The teacher ensures that during the lesson…	n/a.

In phase five we compared the interactive cognitions of different teachers and the two semesters for similarities and differences. As the aim of our research was to investigate what interactive cognitions teachers had and not which interactive cognitions occurred most frequently, matching interactive cognitions were combined, regardless of which teacher or which semester they originated from. Next, we indicated whether students' *readiness*, *interest* and/or *learning profiles* were considered in the interactive cognitions. To show differences between interactive cognitions and the type of learner-centeredness even more clearly in the matrices, the interactive cognitions were listed vertically under each interaction. For the type of learner-centeredness we mainly looked at who the teachers directed their interactive cognitions at and how. Interactive cognitions at the top of the matrices were more centered on the whole class or specific groups of students and those at the bottom were more centered on individual students. If, for example, a teacher mainly took into consideration characteristics of a whole class of students or a certain age group, this would appear above an interactive cognition that took account of characteristics of individual students. An example is provided by this interactive cognition in *context/goal setting*: "students have progressed at different rates in earlier lessons and this is each student's individual starting point for a new lesson, which you can respond to in a class discussion or by summarizing the progress in class by offering them general suggestions that they can each use in their own way to achieve their goals." This interactive cognition was labelled with the student characteristics *readiness* and *learning profile*.

The sixth and final phase was undertaken to show the variation more clearly and to enable the content of the interactive cognitions to be described better. The categories with teacher-student interactions were divided into subcategories which, for example, were related to what the teacher hoped to achieve through the interaction. *Context/goal setting*, for example, was subdivided into: *Aim of context/goal setting* and

students' prior knowledge. By *students' prior knowledge* was meant what prior knowledge the teacher assumed/knew the students had and to which (s)he ultimately geared his/her interaction. This stage ultimately produced Tables 4.4 to 4.8, which are discussed in the results section.

An audit of the last stage of the analysis was performed, so that we could guarantee the quality of the analysis (Akkerman, Admiraal, Brekelmans, & Oost, 2008). An independent auditor compared the outcomes of stage five with those of stage six and then checked them for visibility, comprehensibility, and acceptability. The independent auditor approved the analysis on these three points.

4.4 Results

4.4.1 Context/goal setting

Table 4.4 shows the teachers' interactive cognitions of DI while they were establishing the context and/or setting goals with the students. The interactive cognitions in this category of teacher-student interactions can be divided into two subcategories: those that the teachers had in relation to the aim of their specific approach to setting goals (*aim of context/goal setting*); and those that they had in relation to their considerations of the prior knowledge that the students brought to the lessons (*students' prior knowledge*).

The teachers' interactive cognitions in the subcategory *aim of context/goal setting* varied from primarily teacher-centered (Frank's first interactive cognition in Table 4.4) to those aimed at the goals of individual students (the last interactive cognition of Carla and Emma in Table 4.4). The first interactive cognition is primarily teacher-centered because it starts from what the teacher wanted to know. Frank considered it important to know what happened in the previous lesson during which he was not present. Frank said: "Of course, they are the best ones to tell us what they did last time. Now, (…), there were two

Table 4.4 Interactive cognitions of DI relating to context/goal setting (R=readiness; I=interest; LP=learning profile)

Teacher-student interaction	Interactive cognitions		Student characteristic	Teacher
Context/goal setting The teacher is explicit in setting goals and/or tries to establish the context/starting position by explicitly or implicitly incorporating students' prior knowledge into the lesson.	**Aim of context/goal setting**	• teacher knows the situation regarding the last lesson		Frank
		• class:		
		○ understands connection between lessons	R	Alex, Frank
		○ understands the purpose of the series of lessons and is motivated to work toward it	I	Alex
		○ understands concept and can work further toward the same goal	R	Alex
		○ is starting from the same starting position and can work toward the same goal	R	Frank
		○ understands the purpose of the series of lessons and how to work toward it thanks to interim target	R	Alex, Carla
		• individual:		
		○ student can build on his/her own achievements and so reach his/her own goals	R; R+LP	Carla, Emma
	Students' prior knowledge	• n/a.; teacher wants to know what happened in the last lesson		Frank
		• class:		
		○ related to standard of year group	R	Carla, Frank
		○ related to interest of year group	I	Alex
		• groups within the class, related to knowledge of concepts	R	Alex
		• individual:		
		○ related to progress since previous lesson(s)	R	Carla, Emma
		○ related to standard and personal background	R+LP	Carla

students who really spoke out and after that, of course, I'm going to go over it again. But it is mainly about reviewing it, what they have learned from it, what they have done."

The interactive cognition that both Carla and Emma expressed was centered on individual students. It was about letting them proceed at their own pace so that they could reach their own goals. This quotation from Emma illustrates this: "They already knew what they had to do: try to think up other situations and compose dialogues about them. So I gave them a couple of examples to look at and they had to think up the rest themselves: what were they going to choose, what did they have to watch out for and how would they do that, and how could they apply what they already knew to new topics."

With this interactive cognition the teacher is taking into consideration the students' achievements (*readiness*) with respect to the aim of the series of lessons. Carla defined this interactive cognition as follows: "Last time she didn't really understand what she had to do. (…) So I showed her some examples of paintings from the Golden Age and said that she could start working from there, because she, she doesn't knuckle down to her work, it's laziness rather than tiredness, she's really very unresponsive and because of that (…)we are going to persevere with this now." This quotation shows that the teacher is not only taking the student's *readiness* into account but also, with her unresponsiveness, a personal trait (*learning profile*). Similar variation was found with respect to *students' prior knowledge*, namely a continuum from focused on the teacher to focused on the level and personal background of individual students.

It is also striking that the interactive cognitions relating to *aim of context/goal setting* were mainly formulated by the teachers at class level, while for *students' prior knowledge* the interactive cognitions were more widely distributed over individual students and the class. However, looking at the class, what emerges is not so much

characteristics of a particular class, such as the level, but assumptions based on the year group of the students in that class.

Overall, what we found with respect to this teacher-student interaction was that the interactive cognitions relating to this interaction were mainly based on the *readiness* of the students.

4.4.2 Student assessment

Table 4.5 provides some insight into the teachers' interactive cognitions of DI relating to *student assessment*. The interactive cognitions that the teachers had when assessing the students fell into three subcategories: aim of the interaction (*aim of the assessment*), what was being assessed (*assessment of*), and who had initiated the assessment (*assessment by*). Table 4.5 shows a less varied picture in the interactive cognitions relating to student assessment by the different teachers than that which was found in the area of setting goals. The absence of Alex in this Table is conspicuous. It is explained by the fact that after checking the agreement between the teachers' answers and which type of observed interaction they had been classed under in the analysis, it turned out that all of Alex's interactions that had been observed as student assessment did not belong there. Possible explanations for this could be that Alex does less student assessment in his lessons than other teachers, or that the way he does his assessment did not become clear in the observation as assessing students. The interactive cognitions of the other three teachers that emerged from the 12 interviews are summarized in Table 4.5 in two to three points in each of the three subcategories.

Table 4.5 Interactive cognitions of differentiation during student assessment (R=readiness; I=interest; LP=learning profile)

Teacher-student interaction	Interactive cognitions		Student characteristic	Teacher
Student assessment The teacher arranges a formative (pre)-assessment of the students (and adapts the lesson in the light of the results).	**Aim of assessment**	• to offer direct help with current problem	R	Frank
		• to help students with a poor attitude to work to change their attitude	I	Emma
		• to be able to offer individual support during the lesson	R	Carla
	Assessment of	• individual students		
		○ progress	R	Emma, Frank
		○ attitude to work	I	Emma
		○ standard of work	R	Carla
	Assessment by	○ questions from students	R	Frank
		○ teacher	R; I	Carla, Emma, Frank

The variation in learner-centeredness for *aim of assessment* can be seen in the differences between the interactive cognitions of Frank and Carla. Frank said that he assessed the students to offer them help with the current problem so that they would then be able to make progress with the assignment: "I hoped this short interruption would help her to get back to work." Carla explained that for her the aim of the assessment was to enable her to tailor the support she offered to the students taking their individual abilities into account. An example of how she then guided a student is provided by this quotation: "That's why I gave him an option to try it on sketch paper first and then I said I'd get back to him [the trick is to simplify the task]." The learner-

centeredness of what the teachers assessed (*assessment of*), and of who guided the assessment (*assessment by*) varied minimally. Teachers always assessed individual students and assessment was guided by the students' questions or whether the teachers went around all the students to check how they were getting along.

In general, it is clear that *readiness* was the student characteristic that occurred most frequently in the teachers' interactive cognitions relating to student assessment, and *learning profile* was not found at all during this type of interaction.

4.4.3 Attention for the individual

Table 4.6 shows the teachers' interactive cognitions while they were paying attention to individual students and involving students in planning lessons. Regarding the *aim of attention for the individual*, it became clear that the teachers had different interactive cognitions while providing that attention. An example of a teacher's interactive cognition connected with students' motivation can be seen in this quotation from Alex: "These two are in the middle, so if I support them and help them a bit, they may come to like it and manage to get something done. But if I don't do that, they can become distracted and give up." In the case of the other two interactive cognitions, the teachers considered it important that the students got an idea of their progress and achievements. An example of this is provided by Emma who explained why she had given her students a particular assignment as part of the project: "Also that it is their responsibility, they have the autonomy, (…), because they decide what they are going to investigate, it's their choice. (…) [This assignment] is for them, so that later they can say to themselves: 'OK, I've done that and that and all that in this and that way and that's why I did it like that'."

Table 4.6 Interactive cognitions of differentiation related to attention for the individual (R=readiness; I=interest; LP=learning profile)

Teacher-student interaction	**Interactive cognitions**		**Student characteristic**	**Teacher**
Attention for the individual The teacher ensures that the individual is central to the lesson and is given attention. This involves giving students a role in planning/ evaluation/ sharing their achievements	**Aim of individual attention**	• to take advantage of motivation in order:		
		○ to prevent loss of motivation during completion of the task	R+I	Alex, Frank
		○ to motivate students to take a broader interest in the subject	I	Alex
		• to give students an idea of:		
		○ their progress, so that they can experience a sense of responsibility and autonomy	I+LP	Emma
		○ their achievements, so that they can build on these in the current and subsequent tasks	R	Carla
	Student characteristics	○ class	I+LP	Emma
		○ students with a certain level of motivation:		
		○ poorly motivated and poorly performing students	R+I	Alex, Frank
		○ well-motivated students	I	Alex, Frank
		○ individual students	R	Carla

Table 4.6 shows that the student characteristic *interest* was the one that occurred most frequently in the teachers' interactive cognitions. This means that the interactive cognitions during the teacher-student

interaction *attention for the individual* were mainly based on a different student characteristic from those that the teachers had during the interactions *context/goal setting* and *student assessment*, which mainly seemed to be based on the *readiness* of the students.

4.4.4 Instruction and class routine

Table 4.7 shows how the teachers' interactive cognitions during teaching and classroom routines were learner-centered and which student characteristics were taken into account. These interactive cognitions are broken down into two subcategories: *aim of instruction* where the interactive cognitions show what the teachers were aiming at with their instruction; and *aimed at* where the interactive cognitions indicate who the teacher aimed his/her instruction at. The interactive cognition under *aim of instruction* that is least learner-centered is directed at the expectations the teacher (Frank) had. Frank said that he gave the observed instruction because it was necessary to keep the class discussion going, as the debate threatened to come to a halt: "I had to intervene here because nothing was happening, the discussion fell silent, the whole debate. (…) This [was] the proposition that most students had chosen and I knew that nothing had been said about it, or too little, certain elements were missing." An example of an interactive cognition centered on individual students was provided by Carla and was directed at one student who is given appropriate instruction to enable him to complete the assignment within the terms of reference in a way that suits him and challenges him: "Typically he had chosen the simplest with two lines and then a red plane or so and then I think, yes, you need to challenge yourself a bit more (…) and I don't know his style, but I know that it was very easy for him to produce that very simple picture, with those two lines. That's why I said 'just take a look at [that other painting]'."

Table 4.7 Interactive cognitions of differentiation related to instruction and classroom routine (R=readiness; I=interest; LP=learning profile)

Teacher-student interaction	Interactive cognitions		Student characteristic	Teacher
Instruction and classroom routine The teacher uses different routines in the classroom, e.g. whole class instruction, individual and small group work	**Aim of instruction**	• to hold a class discussion that proceeds according to the teacher's expectations	R	Frank
		• individual students may:		
		○ complete the task as intended	R+I	Alex
		○ complete the task	R+LP	Emma
		○ complete at least part of the task by the end of the series of lessons	R+I	Frank
		○ be allowed to complete the task in their own way	R+I	Emma
		○ be allowed to complete the task in a way that the student challenges him/herself	R+I	Carla
	Aimed at	○ class	R	Frank
		○ types of students:		
		○ under time pressure	R+I	Frank
		○ with questions	R+LP	Emma
		○ with problems	R+I	Alex
		○ all students, individuals	R+I	Carla

In the interactive cognitions that show who the teachers were taking into account while they were teaching, three types of learner-centeredness were observed: (1) an interactive cognition where it is clear that the instruction had to be addressed to the whole class; (2) interactive cognitions concerned with students from a particular 'group', i.e. those with problems, questions, or those experiencing time pressure; and (3) an interactive cognition where the teacher has geared the instruction to all the students as individuals. In the interactive cognitions aimed at groups of students, we found that the teachers did

always take students' individual characteristics into consideration, as this quotation from Frank illustrates: "[He] was obviously having some difficulty finding a good poem. Of course, I said to him 'yes, now listen, you could just take some song lyrics', it's kind of the same principle, not exactly a poem, but you could say that the two genres often overlap. (…) and he may just have something in his head like: 'I like that song.'"

When Table 4.7 is compared with Tables 4.4, 4.5 and 4.6, it is noticeable that all of the interactive cognitions in this Table apart from one contain two student characteristics, whereas in the three interaction categories discussed earlier, there was only one. In Table 4.7 it was a combination of *readiness* and *interest* that occurred most frequently – the two student characteristics that also occurred most frequently in Tables 4.4, 4.5 and 4.6, but there they were usually found on their own and not combined.

4.4.5 Positive, supportive learning environment

Finally, Table 4.8 distinguishes a number of interactive cognitions in which different forms of learner-centeredness are present. This category is also subdivided into two subcategories: (1) *aim of the support*, in which the teachers' interactive cognitions relate to their aims in engaging in certain positive approaches and providing specific support to the students; and (2) *assumption*, in which the interactive cognitions describe the basis on which the teachers offered their support. It is clear from *aim of the support* that the variation within the interactive cognitions shows that by adopting these positive approaches the teachers were trying in different ways to establish a situation where the students would always be able to make progress with the task. In one interactive cognition, for example, this was combined with the idea of increasing the students' motivation, as Alex explained in an interview: "They need a bit more explanation about how to balance [the rocket] correctly. (…) And I enjoy helping the boy,

Table 4.8 *Interactive cognitions of differentiation related to the provision of a positive, supportive learning environment(R=readiness; I=interest; LP=learning profile)*

Teacher-student interaction	**Interactive cognitions**		**Student characteristic**	**Teacher**
Positive, supportive learning environment The teacher ensures a positive learning environment by praising students or through other positive approaches	**Aim of the support**	• to help the student to make progress with the task and:		
		○ to become more motivated	R+I	Alex, Frank
		○ to be able to use knowledge gained through praise from the teacher given with explanations when completing parts of the task later	R+LP	Emma
		○ to be able to use knowledge gained through praise from the teacher given with explanations to fulfil his/her own goals later	R+LP	Carla
	Assumption	• individual student:		
		○ who has done something well in the task	R+I	Alex, Frank
		○ every student does something well and/or has a good attitude to work	R+LP	Carla, Emma

because he failed his math. (…) He's just lazy, he's bright enough, he just doesn't want to work." In another interactive cognition, this was combined with ensuring that the students could complete personal targets with positive support from the teacher Carla: "Because she can paint awfully well and I know that, but I also know that she's a bit of a perfectionist and because of that it can take a very long time. (…) that's why I wanted to encourage her to focus on the things that she

has already done well." Two interactive cognitions were observed in the subcategory *assumption*, both of which were centered around the individual student: the first where teachers assume that a student should be praised when they have done something well in the assignment, and the second where the teachers assume that all students do something well at some point in the lesson and they should all be praised for this.

Table 4.8 shows that the teachers' interactive cognitions were always coupled with two student characteristics and that, after *readiness*, *learning profile* occurred most frequently in the interactive cognitions.

The tables above show that the teachers always – with one exception – included student characteristics in their interactive cognitions. The student characteristic that occurred most frequently was *readiness*, but this also depended on the teacher-student interaction to which the interactive cognition related. In the areas of *instruction* and *providing positive support*, teachers often took two student characteristics into consideration. Our results also show that nature of learner-centeredness in the teachers' interactive cognitions varied from directed at the class to directed at the individual student.

4.5 Discussion and conclusion

4.5.1 Discussion, conclusion and limitations

The research questions in this study were: *What interactive cognitions regarding differentiated instruction do teachers have during teaching? How do they take student characteristics into account in these interactive cognitions?* To enable us to answer these questions, four secondary school teachers participated in stimulated recall interviews in which they were asked about their interactive cognitions during different types of teacher-student interactions in their lessons.

The results show that the interactive cognitions of the teachers in our study were mainly directed at the student characteristic *readiness*, whether or not in combination with the *interest* or *learning profiles* of their students. They took the *readiness* of their students into account in a number of different ways. Within the different categories of teacher-student interactions, variation was observed in the learner-centeredness of the interactive cognitions. At the level of the subcategories identified in the types of teacher-student interactions, we found variation in: (a) the aim of the interaction (teachers wanted to meet the students' needs as and when they arise or they also wanted to anticipate and meet future needs); and (b) who the interactive cognitions during the interactions were directed at (class, groups, individual students). It also emerged from the interactive cognitions that teachers rarely if ever saw it as their role to challenge their students or get them to exceed themselves. The teachers' interactive cognitions relating to DI in this study revealed mainly convergent DI (Bosker & Doolaard, 2009). However, the aim of GUTS was that the teachers would help students to develop their talents further. In other words, the aim was for them to use divergent DI to enable each student to reach his/her zone of proximal development (ZPD) (Subban, 2006). The teachers were given freedom in the design of their GUTS lessons to subsequently give the students more autonomy. The fact that we mainly found convergent DI in this study could reflect the fact that divergent DI is more complex than convergent differentiation (Bosker & Doolaard, 2009).

Differences in interactive cognitions were also found between the categories of teacher-student interactions. In *context/goal setting* and *student assessment*, *readiness* of the students was the most frequent characteristic found in the interactive cognitions. On the other hand, the interactive cognitions during *attention for the individual* were mainly directed at the students' *interest*, whether or not in combination with *readiness* or *learning profile*. In the case of the interaction types

instruction and classroom routine and *positive, supportive learning environment*, in virtually all the interactive cognitions *readiness* in combination with *interest* or *learning profile* was considered. One finding that was common to all of the categories was that *learning profile* occurred least often of all the student characteristics in the interactive cognitions. These results are similar to those of previous studies into the effects of DI (e.g. Graham et al., 2008), which found that when teachers successfully implemented DI into their day-to-day teaching, this was often directed at students' *readiness*. In this study *learning profile* was the student characteristic considered the least by the teachers, probably because it requires that the teachers know their students and details of their backgrounds well. Another explanation could lie in the nature of the student characteristic *learning profile*. The students' learning profile is actually a category of student characteristics, of which the students' cultural background is one. Appropriately incorporating culture requires an additional approach to DI, for example teaching for equity or culturally responsive teaching (Cohen & Lotan, 1995; Santamaria, 2009; Severiens, 2014).

Based on interviews with a small number of teachers, we found great variation in teachers' interactive cognitions in relation to taking differences between students into account in different types of lesson situations. This finding ties in with studies which concluded that teachers' practical knowledge is dependent of the context, situation, and individual (Gholami & Husu, 2010; Meijer, 1999; Verloop et al., 2001). Teachers may start from the same knowledge base but, depending, for instance, on the specific moment in the lesson or the students in their class, different teachers may have different interactive cognitions during the same type of interaction. As far as the provision of further support for teachers is concerned, this dependency on context, situation and individual means that a 'uniform' approach to the implementation of DI is neither desirable nor even possible for teachers.

In order to value the conclusions from this study, we should remark that in this study we focused on a part of Tomlinson et al.'s (2003) definition of DI by operationalizing DI as how teachers took student characteristics into account during teacher-student interactions. Teachers' use of proactive DI was, for example, not studied, given the methods and aim of the study. Therefore, it is possible that we mainly captured how teachers differentiate in the process of their teaching, rather than also the adjustments teachers make in the content and/or product, which seem to be more planned adjustments (Tomlinson et al., 2003).

It is important that we make clear that the results and conclusions in our study cannot be generalized unconditionally. After all, the research was conducted with only four teachers and in a specific context (GUTS). The teachers were expected to develop projects that met four criteria: (1) enrichment; (2) autonomy; (3) higher order thinking skills, according to Bloom's taxonomy; and (4) differentiated instruction. Despite its limited scope, a large variety of interactive cognitions were found, showing that the teachers used reactive DI in different ways.

4.5.2 Recommendations and practical implications

In the theoretical framework of this chapter, we argued that to support teachers to develop their actions with respect to DI, it is important to know what interactive cognitions underlie their actions. The results of this study indicate that teachers do usually take differences between students into account in their interactive cognitions during lessons. The variety in interactive cognitions that we found leads us to make two recommendations for the further implementation of DI.

Based on the finding that teachers' interactive cognitions, although mainly geared to students' *readiness*, are dependent on the context, situation, and person, means that it is necessary to provide teachers with as much differentiated support as possible. Supporting

teachers close to their practice, for example by means of SRIs, allows existing interactive cognitions to be explored (further) and then compared with other options in order to differentiate between different types of teacher-student interactions.

Second, this study provides evidence that DI is often practiced in schools already. This DI seems to be mainly convergent DI. Not all situations require convergent DI and so it may be worthwhile to help teachers to become more familiar with divergent DI, which they could then use to facilitate students to exceed their own expectations. To do this it is important to support teachers by offering them methods they can use to help their students to reach their own ZPD (Subban, 2006).

The method we chose, SRIs with video clips, turned out to be suitable for exploring the variety of teachers' interactive cognitions (McAlpine et al., 2006; Meijer et al., 2002). The method could also serve as a training instrument for supporting teachers as they implement DI. A coach or trainer could, for instance, use SRIs to help teachers who want to implement DI to explicate their interactive cognitions relating to DI, as described by Van Veen and Janssen (2016). It makes teachers more aware of what is going on in their heads while they are teaching and on that basis, they become able to formulate new learning objectives for themselves. Teachers can also learn from each other by exchanging and discussing their own interactive cognitions during teaching.

The way we used SRIs in our research, by selecting clips beforehand, does mean, however, that the interpretation of the action based on the interactive cognition remains the job of the observer. The teacher does not literally link the action that takes place to the reason for that action (Janssen, Westbroek, & van Driel, 2013; Van Veen & Janssen, 2016). One way to take this interpretation out of the hands of the observer is to adopt the method of using SRIs used in much research into practical knowledge (McAlpine et al., 2006; Meijer, 1999; Verloop, 1989). In these studies, the teachers were shown a recording

of the whole lesson, as explained above in the Method section. The teachers had to pause the video when they recalled an interactive cognition. The disadvantage of this method, for our research, was that it reduced the chance of interactive cognitions emerging that were specifically related to DI. Another possible method for studying teachers' interactive cognitions linked to specific actions could be a laddering interview. In this type of interview, a teacher discusses with the interviewer the goals (s)he is pursuing in a representative lesson and what actions (s)he took during the lesson to achieve those goals (Janssen, Westbroek, & van Driel, 2013). This allows goal-means hierarchies to be identified and it also produces an overview of the interactive cognitions underlying teachers' actions.

A laddering interview in combination with SRIs could be used in a professional development program. A coach or trainer could adapt the professional development to the goal-means relationships identified in the laddering interview and then support the teachers by allowing them to make situation-specific interactive cognitions explicit using SRIs (Janssen, Westbroek, & Van Driel, 2013; Janssen, Westbroek, Doyle et al., 2013; Van Veen & Janssen, 2016). This study provides evidence that teachers need differentiated support in order to further develop their use of DI. Hopefully, by working with professional development plans that are tailored to the individual and the specific situation, a contribution can be made to the effective implementation of DI.

Chapter 5

Teachers' sense-making processes during two years of an innovation aimed to differentiate instruction

Chapter 5
Teachers' sense-making processes during two years of an innovation aimed to differentiate instruction[1]

Abstract

In the current study teachers' sense-making of an innovation during which they experimented with differentiated instruction was studied during two school years. Using answers to a questionnaire, 15 teachers' sense-making processes were characterized by three types of search for meaning: assimilation, adaptation, and toleration. We further specified the teachers' sense-making through their experienced sources of ambiguity and uncertainty (limited resources and conflicting goals) and a detailed description of their personal frames of reference. We concluded that the teachers varied in their types of search for meaning during both school years, though most teachers were found to use assimilation in the second school year. Their experienced sources of ambiguity and uncertainty and their personal frames of reference, though becoming more similar to each other, still differed after two school years. A possible reason for the variety in teachers' sense-making is the freedom they had in the implementation of differentiated instruction: several teachers were positive about this from the start, others needed more support and guidance. This study hereby provides additional insight in the advantages of freedom in the implementation of an innovation, but also show the importance of proper support and guidance to ensure effective implementation.

[1] This chapter has been submitted in an adapted form as:

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5.1 Introduction

Research on educational innovations has shown that these often do not turn out in practice the way they were designed in theory (Luttenberg, Van Veen, & Imants, 2013; März & Kelchtermans, 2013; Van Veen, Zwart, Meirink, & Verloop, 2010). The way an innovation is implemented is influenced by its objectives and the context in which it is to be implemented (the innovation's situational demands) as well as by "the dynamic process by which individuals and groups [of teachers] make meaning from the environments in which they operate" (März & Kelchtermans, 2013, p.15). Luttenberg, Van Veen et al., (2013) argue that this sense-making is an interaction between teachers' perceptions of the situational demands and their personal frames of reference. Teachers' sense-making of innovations can be seen as a process, as noted by März and Kelchtermans (2013), for teachers dynamically try to find coherence between their own personal frame of reference and the contextual factors during the course of the innovation.

In the current study, we explore this dynamic process of sense-making in the same context as the studies described in chapters 3 and 4: GUTS. In this context teachers might perceive that they have space to innovate and take risks (Allen & Penuel, 2015), which is especially relevant regarding the criterion that teachers had to plan for differentiated instruction (DI) in their GUTS lessons. Research on DI has shown that it is an educational approach that teachers have difficulties implementing (Janssen, Hulshof, & Van Veen, 2016; Tomlinson et al., 2003). Thus, especially in the case of DI it appears to be important that teachers perceive the space to be self-determined and to try out different educational approaches (De Neve, Devos, & Tuytens, 2015). On the other hand, an innovation with space to innovate and take risks can be interpreted as having too little structure, causing teachers to be confused and experience ambiguity (Schmidt & Datnow, 2005). In sum, different teachers experience and handle

innovations (to implement DI) differently, especially a loosely-structured innovation like GUTS (Luttenberg, Van Veen, et al., 2013; Schmidt & Datnow, 2005; Tricarico & Yendol-Hoppey, 2012). It is therefore interesting to study teachers' sense-making processes in such a context. To characterize teachers' sense-making, we will use Luttenberg, Van Veen, et al.'s (2013) types of search for meaning combined with a typification of the sources of ambiguity and uncertainty the participating teachers experienced throughout the innovation (Allen & Penuel, 2015). We aim to get a comprehensive understanding of the dynamic process of teachers' sense-making and thus study the teachers at two points in time, each one year apart (März & Kelchtermans, 2013). This leads to the following research questions: *How can teachers' sense-making of an innovation to differentiate instruction be typified in terms of type of search for meaning and sources of ambiguity and uncertainty? How does this sense-making change over two school years?*

5.2 Theoretical framework

5.2.1 Differentiated instruction

Teachers who differentiate their instruction aim to proactively take their students' individual learning needs into account in the process, product, and content of their teaching (De Neve, et al., 2015; Deunk, Doolaard, Smale-Jacobse, & Bosker, 2015; Tomlinson et al., 2003). Two general forms of DI can be distinguished: convergent and divergent DI (Bosker & Doolaard, 2009; Deunk et al., 2015). Convergent DI is the aim, when teachers hold minimum goals for the whole class and guide all students towards those goals. In divergent DI, teachers guide each student to reach their maximum learning potential. Much research has already been done into the effectiveness of DI (both convergent and divergent) on student learning (e.g., Deunk et al., 2015), teachers' perceptions and practices of DI (e.g., Brighton, 2003), and how they can incorporate it into their practice (e.g., Tomlinson, Brimijoin, & Narvaez, 2008). DI appears to be beneficial for students' achievement,

motivation, and engagement (Deunk et al., 2015; Graham et al., 2008), but many problems have been described in the literature regarding the incorporation of DI into practice (Hertberg-Davis & Brighton, 2006; Janssen et al., 2016; Smit & Humpert, 2012; Tomlinson et al., 2003). Teachers may not view DI as a challenge to innovate their teaching, but rather as a burden (Smit & Humpert, 2012). Many teachers see DI as an impractical approach, especially when it comes to planning proactively for it (Janssen et al., 2016). Contextual factors like support during the implementation of DI are of great importance (Hertberg-Davis & Brighton, 2006). When DI is to be implemented in a school, but the principal does not provide the teachers with a safe environment for change, implementation is unlikely to happen as planned (Hertberg-Davis & Brighton, 2006). As a result of these and other experienced problems with the implementation of DI, certain DI practices remain an add-on in many cases, instead of a fully implemented pedagogical approach (Smit & Humpert, 2012).

5.2.2 Educational innovations

In most studies on DI, its implementation of DI is dealt with as an educational innovation (e.g. Puzio, Newcomer, & Goff, 2015; Smit & Humpert, 2012). Previous studies on educational innovations have shown that their implementation does not come easily. Often the implemented innovation is not exactly as it was intended to be (März & Kelchtermans, 2013; Van Veen et al., 2010). Most of these educational innovations were designed with the goal of increasing student achievement, motivation or other learning outcomes, but lacked an explicit and elaborated theory of improvement (Van Veen et al., 2010; Wayne, Yoon, Zhu, Cronen, & Garet, 2008). This is often visible in the design of these innovations: different (theoretical) ideas on how to enhance student learning are creatively combined into an innovation that is carried out in a school, expecting that student outcomes will increase. What seems to be overlooked is *how* these ideas are to be

implemented and with that, the crucial role of teachers in the implementation is often underestimated.

Teachers are at the center of educational change (Schmidt & Datnow, 2005). In many cases of educational innovation, teachers are expected to take innovations as these are offered by the school or government and implement them as intended (Luttenberg, Van Veen, et al., 2013). However, schools and teachers have their own characteristics (local area, administrators, students, etc.) that have a powerful influence on implementation processes (Luttenberg, Imants, & Van Veen, 2013; März & Kelchtermans, 2013). In addition, teachers' prior knowledge influences how they interpret innovations (Allen & Penuel, 2015; Spillane, Reiser, & Reimer, 2002), and emotions play a role in these processes, especially when it comes to teachers' own classroom practices (Ketelaar, Beijaard, Boshuizen, & Den Brok, 2012; Schmidt & Datnow, 2005; Van Veen & Lasky, 2005). These personal influences often result in adapted innovation practices, and diversity in the actual implementation across schools. Especially when innovation designs are less structured and specific, implementation is diverse (Schmidt & Datnow, 2005). In other words, there is an interaction between the situational demands of the innovation (characteristics of context in combination with characteristics of the innovation) on the one hand, and teachers' dynamic processes of sense-making of the innovation, on the other hand (Luttenberg, Van Veen, et al., 2013; März & Kelchtermans, 2013). Ketelaar et al. (2012) describe this "teachers actively position themselves in relation to an innovation" (p.273).

5.2.3 Teachers' sense-making

In the current study, teachers' sense-making is defined as the interaction between teachers' personal frames of reference and their perceptions of the situational demands (Ketelaar et al., 2012; Luttenberg, Van Veen, et al., 2013; Spillane et al., 2002). The teachers'

personal frames of reference consist of current practices, prior knowledge, beliefs, and other characteristics that influence how they perceive and interpret the world around them (Allen & Penuel, 2015; Spillane et al., 2002). For example, teachers' beliefs about how students should be taught or their ideas on how to practice DI influence how they will perceive an innovation that is aimed at stimulating student talent development through DI. The situational demands are the external expectations that are placed on teachers coming from policy, school, an innovation, etcetera (März & Kelchtermans, 2013). Although these demands can be considered objective, teachers will perceive them in their own way. Consequently, when studying sense-making, *perceptions* of the situational demands should be taken into account. However, the context in which teachers' sense-making takes place is not merely background, but a constituent element in that process (Spillane et al., 2002). Hence, both the objective situational demands and teachers' perceptions of these demands are important elements for understanding teachers' sense making processes.

Studies on sense-making describe and classify in different ways the processes teachers go through when they are confronted with (new) situational demands in a structural manner. Luttenberg, Van Veen, et al. (2013), as mentioned in section 1.3.3, describe the sense-making process as different types of search for meaning: (a) *assimilation*; (b) *accommodation*; (c) *toleration*; or (d) *distantiation*.

In the context of the implementation of the *Next Generation Science Standards* in the US, Allen and Penuel (2015) analyzed teachers' interviews for the sources of ambiguity and uncertainty they experienced in order to describe the sense-making processes they went through. This method stems from the idea that sense-making occurs when teachers go through 'crises' because they experience ambiguity and uncertainty (Allen & Penuel, 2015; Weick, Sutcliffe, & Obstfeld, 2005). Sense-making is then a way to resolve or deal with these ambiguities and uncertainties (Weick et al., 2005). Sources of this

ambiguity and uncertainty can include conflicting goals, limited resources, and role ambivalence (section 1.3.3) (Allen & Penuel, 2015).

5.2.4 The dynamic process of sense-making

Teachers' sense-making processes can have a large influence on the implementation of innovations. For example, when a teacher experiences limited access to resources, and searches for meaning through assimilation, an adjustment of the teaching practices might occur in terms of minor variations to what the teacher already knows and does, rather than as a truly different way of teaching (Spillane et al., 2002). The innovation thus will be implemented in an adapted form, or the school (or other stakeholders) will decide to adapt the innovation because of the outcomes of teachers' sense-making processes. These processes will then be influenced by new innovations or by colleagues adapting the innovation differently (Ketelaar et al., 2012; März & Kelchtermans, 2013; Spillane et al., 2002). These recurrent effects of the sense-making process show that teachers' sense-making is not only a complex, but also a dynamic process (Ketelaar et al., 2012).

In the current study, we will focus on the process of sense-making, and particularly on its dynamic element. More specifically, differences in how individual teachers make sense of an innovation at different points in time will be examined.

5.3 Method

5.3.1 Context: The innovation: GUTS

The current study took place within the innovation GUTS. As described in section 1.4, in GUTS teachers designed and taught GUTS lessons to stimulate differentiated student talent development and thereby increase the students' motivation and achievement. This innovation in which the teachers did not have to follow a set curriculum and had a lot of freedom, could provide them with the

necessary autonomy teachers need to implement DI (De Neve et al., 2015; McTighe & Brown, 2005).

GUTS was implemented in the school in cooperation between researchers from the university and a group of administrators and teachers in the school. During the whole course of the implementation process – from 2013-2014 to 2015-2016 – the teams from both institutions met regularly to discuss the innovation. Each year it was evaluated and the teams decided what changes would be made within the innovation. Table 5.1 provides an overview of the characteristics of the innovation in each of the three school years.

Table 5.1 Details of GUTS and its main differences throughout the school years

School year	Grades involved	Details of GUTS
2013-2014	7	10 GUTS lessons through the year in three subjects (two in subject 1, four in subject 2, four in subject 3). Lessons took place on Wednesday afternoons between November and June at the end of the school day and lasted 100 minutes.
2014-2015	7, 8	8 GUTS lessons per semester, a different subject each semester: thus, more time per subject. Times of the lessons alternated. Several regular lessons had to be canceled to free up time for the GUTS lessons. Again, lessons lasted 100 minutes. In the second semester, classes combined students from 1st and 2nd grades.
2015-2016	7, 8, 9	GUTS lessons for 7 and 8 as in 2014-2015. The GUTS lessons had their own place in the schedule and regular lessons no longer had to be canceled. Again, the moment in the day alternated. 9th grade did not follow GUTS lessons, but carried out a personal project.

Note: The personal project of the 9th grade is not explained in detail, as this and teachers' participation in that was beyond the scope of the current study.

5.3.2 Participants

In this study, 15 teachers (seven male) from the school where GUTS took place, participated voluntarily. The teachers represented four different subject clusters within the school: Humanities, STEM (Science, Technology, Engineering, and Mathematics), Arts, and Languages. Teaching experience among these teachers ranged from two to 28 years. Table 5.2 provides an overview of the different teachers (names are pseudonyms) and their subjects.

Table 5.2 Descriptives of the participating teachers

Subject	**Teacher (sex)**
English language	Sarah (f), Helga (f), Gideon (m)
Dutch language	Rita (f), Frank (m)
Chinese language	Nicole (f)
German language	Quint (m)
Spanish language	Julia (f)
French language, Drama	Irma (f)
Art & Design, Art History	Paula (f), Mark (m)
PE	Leon (m)
Mathematics	Alex (m)
Biology	Kate (f)
History	Otto (m)

5.3.3 Instruments

In most of the studies focused on sense-making, retrospective interviews were carried out, in which teachers were requested to explicate their sense-making (Luttenberg, Van Veen, et al., 2013; Weick et al., 2005). In the current study, to make sure all teachers were asked the same questions and to decrease the chances of getting socially desirable answers, a questionnaire was developed (Ballou, 2008; Trobia, 2008). In this questionnaire, the teachers had to respond to five open-ended questions. Table 5.3 shows the specific questions in the questionnaire and what these aimed to measure.

Table 5.3 Concepts, variables and questions in the questionnaire

Concept	Variable	Questions
Perception of situational demands	*Attitude to GUTS*	What do you think of GUTS until now? Please elaborate in a few sentences.
Personal frame of reference	*Perception of differentiated student talent development*	What is, according to you, differentiated student talent development? As a teacher, how can you stimulate each students' talent development?
	Practice of DI	When planning your lessons, do you plan (how) to differentiate your lessons? If so, could you elaborate to what extent you plan your differentiation? What student characteristics do you take into account when differentiating instruction? (for example readiness, interest, learning profile)

We used a direct approach asking teachers how they understood differentiated student talent development, and what they thought of GUTS as an innovation to this. Questions on differentiated instruction were designed based on the review article by Tomlinson et al. (2003). The questions were open-ended, to provide teachers an opportunity to elaborate as much as they wanted and in their own words (Roulston, 2008). As Table 5.3 shows, the teachers' attitudes to the innovation were considered to represent their perceptions of the situational demands, as these include both teachers' opinions of the innovation

and what they perceive the innovation to be. The teachers' perceptions and practices were together considered to be their personal frames of reference, in line with Spillane et al.'s (2002) description of the teachers' personal frames of reference, as described above.

5.3.4 Procedure

Both school years, the questionnaire was administered by the end of October/beginning of November (halfway through the first semester), digitally and on paper. The teachers first got an invitation to fill in the questionnaire digitally; if they did not respond or if they said they had lost the link to the digital questionnaire, they received the questionnaire on paper. Each administration of the questionnaire was around the same time the first GUTS lesson of the school year took place.

Data coding

To explore the teachers' sense-making, their perceptions of the situational demands were coded according to how they felt about GUTS and the sources of ambiguity and uncertainty they experienced (Allen & Penuel, 2015). These codes were used to compare teachers' perceptions of the situational demands with their personal frames of reference to characterize their types of search for meaning per school year (Allen & Penuel, 2015; Luttenberg, Van Veen, et al., 2013). The teachers' personal frames of reference were also coded to further specify their sense-making.

Teachers' perceptions of the situational demands

As described above, teachers' attitudes to GUTS were considered to be a measure of their perceptions of the situational demands. Teachers' attitudes to GUTS were coded for how they felt about the project (positive, ambivalent, or negative). If teachers felt positive about GUTS, they were considered to experience no sources of ambiguity

and uncertainty. However, if they were ambivalent or expressed negative feelings, the explanations for those feelings were labelled as their sources of ambiguity (Allen & Penuel, 2015). These explanations were further categorized in *limited resources* and *conflicting goals*. When teachers mentioned having limited access to (proper) resources and time, the source of their ambiguity was *limited resources*. When teachers said they did not think GUTS was executed correctly according to their perceptions of differentiated student talent development, this was typified as a *conflicting goal*.

Teachers' personal frames of reference

The teachers' personal frames of reference were retrieved from their perceptions of differentiated student talent development and their practices of DI. We first coded the answers to both questions on teachers' perceptions of differentiated student talent development. The answers were coded for mentioning the four criteria of a GUTS lesson (enrichment, autonomy, higher order learning, and differentiated instruction), and whether the teacher considered talent development as situated within a school subject or to occur regardless of school subject.

Next, the practices of DI were coded. We considered DI to be the main approach with which differentiated student development could be stimulated, and this was also communicated to the teachers. Since the idea of GUTS was to challenge students to develop their talents, which means that divergent DI would be preferable, the answers to the two questions on their practices were coded for convergent or divergent DI. Although, in several cases none of the two was coded as it was not always possible to distinguish one of the two types of DI from their answers. Teachers' practices were coded as convergent if they mentioned main lesson goals that all students should accomplish (Bosker & Doolaard, 2009). If a teacher mentioned having extra assignments for weak and/or strong students, this was

not valued as having students achieve different goals, more in line with their own competences. Divergent DI was coded if a teacher mentioned helping every student achieve as much as possible (Bosker & Doolaard, 2009).

Data analysis

Types of search for meaning

Teachers' perceptions of situational demands were then compared with their personal frames of reference, and it was determined whether their personal frames of reference or their perceptions of the situational demands of the innovation were more dominant. Table 5.4 provides explanations of when we thought a teacher's type of search for meaning could be characterized as *assimilation*, *accommodation*, or *toleration*. In the current study, *distantiation* was not considered a type of search for meaning

Teachers' sense-making processes

After all data for both school years were coded and analyzed, both cross- and within-case analyses were made across the school years. The aim of these analyses was to explore whether teachers' sense-making changed between 2014 and 2015 and how this happened for the individual teachers. In addition, we compared the changes in teachers' sense-making with the changes that were made to GUTS.

The quality of the analyses was ensured by inviting an independent coder, a researcher familiar with research into DI, to code five teachers, and afterwards discussing the results. In this discussion, the coding scheme as well as the coding process was discussed and agreement was reached on several minor adjustments of the scheme and process. The adjustments consisted mainly of defining the different codes and rules for assigning codes more clearly. For example, initially the codes convergent or divergent DI for each answer regarding teachers' practices of DI were assigned. However, after discussion it was decided that the teachers' answers regarding

Table 5.4 Types of search for meaning as described by Luttenberg, Van Veen et al. (2013) and the applied definitions in the current study

Type of search for meaning	Description
Assimilation	There is a match between teachers' perceptions of GUTS and their personal frames of reference regarding differentiated student talent development. Also, they are positive or ambivalent towards GUTS, but mainly stay true to their own frame of reference. (Most teachers who felt ambivalent and were placed in this category had *limited resources* as source of ambiguity.)
Accommodation	There is a match between teachers' perceptions of GUTS and their personal frames of reference regarding differentiated student talent development. However, they feel somewhat ambivalent or negative towards GUTS and feel they have to adapt their personal frames of reference to the situational demands of GUTS. (Most teachers who felt ambivalent and were placed in this category, had *conflicting goals* as source of ambiguity; teachers who felt negative and were placed in this category, had *limited resources* as source of ambiguity.)
Toleration	Teachers are ambivalent or negative towards GUTS when they have to do something during GUTS that is different from what they want to do (in total or within GUTS). (Teachers who felt ambivalent were positive about the idea behind GUTS, but had *conflicting goals* and *limited resources* as sources of ambiguity; teachers who felt negative and were placed in this category were negative about the idea behind the innovation, and had *conflicting goals* and perhaps *limited resources* as source(s) of ambiguity.)
Distantiation	Not used in the current study. Teachers had to teach GUTS lessons and could not simply give a regular lesson if they distanced themselves from the innovation. In addition, if teachers did decide to organize their GUTS lessons so that they would be very similar to their regular lessons, this would not be clear from the questionnaires.

their practices sometimes did not provide all the information necessary to confidently code those practices as convergent or divergent DI.

5.4 Results

5.4.1 Teachers' search for meaning and sources of ambiguity

Fall 2014

Table 5.5 shows the results regarding the teachers' sense-making as typified by their search for meaning, the sources of ambiguity and uncertainty they experienced and personal frames of reference in 2014. The table shows that seven teachers' types of search for meaning could be characterized as *assimilation*. Three of those teachers experienced no sources of uncertainty and ambiguity and three experienced *limited resources*. Only Mark appeared to have *conflicting goals* as a source of ambiguity. Mark was mainly very pleased with GUTS and seemed to be able to do as he liked, but he made the following remark regarding the goals of the intervention: "I really enjoy doing GUTS, but especially with [pre-university students] or kids that (…) really like my subjects."

Four teachers were assigned to *accommodation* as type of searching for meaning. These teachers experienced either *conflicting goals* and *limited resources,* or only *conflicting goals* as sources of ambiguity. They thus experienced such differences between their own frame of reference regarding how GUTS should be executed and the situational demands, that they adjusted their frame of reference to what was expected of them in GUTS. Irma (*limited resources* and *conflicting goals*) said: "[It is] not clear enough what is expected from us (teachers) and kids. (…) Why [is it] not reward[ed] with a grade? But [it is] also a lot of fun!" Thus, Irma did what was expected of her and enjoyed teaching the GUTS lessons, but she perceived that one of GUTS' goals (transfer of knowledge and motivation to regular lessons) conflicted with one of her own (reward students with grades). In addition, she experienced not to have the proper resources at her

Table 5.5 Teachers' sense-making by type of search for meaning and source of ambiguity in 2014

2014 Perceptions of the situational demands: Source of ambiguity	None	Limited resources	Conflicting goals	Both
Type of search for meaning				
Assimilation	**Otto –** Divergent DI, providing autonomy, and higher order learning regardless of subject **Gideon –** DI, providing autonomy, and higher order learning within subject **Paula –** Convergent DI, within subject	**Nicole –** Convergent DI, and enrichment within subject **Sarah –** Convergent DI within subject **Rita –** DI within subject	**Mark –** Convergent teaching, and enrichment within subject	
Accommodation			**Julia –** DI, and enrichment within subject **Helga –** Convergent DI within subject	**Irma –** Convergent DI **Leon –** DI within subject
Toleration			**Frank –** Convergent DI, and providing autonomy within subject **Kate –** Convergent DI within subject **Quint –** Convergent DI, and enrichment regardless of subject **Alex –** Convergent DI regardless of subject	

disposal to receive guidance in what was expected of her (and her students).

Finally, the four teachers who could be typified as using *toleration* as type of search for meaning in 2014, had *conflicting goals* assource of ambiguity and uncertainty. They participated within GUTS as was expected of them, but their goals for GUTS differed from the actual goals of GUTS. Quint explained this as follows: "The development of talent is focused on 'school subjects'. This is a rational choice, but in my opinion, other factors like getting an idea of your underlying competences, play an important role in developing and using your talent." Quint participated in GUTS as was expected of him, but appeared to maintain his own personal frame of reference.

Fall 2015

Table 5.6 provides the results for the teachers' sense-making in 2015. In the school year 2014-2015 GUTS was embedded within the daily schedule replacing regular lessons. In 2015-2016 the school stopped replacing regular lessons with GUTS, thus embedding GUTS lessons within the regular timetable.

What stands out in Table 6 is that in 2015 most teachers (n=10) could be characterized as using *assimilation* as type of search for meaning in GUTS. Also, within *assimilation*, more teachers (n=3) experienced *conflicting goals.* These three teachers said they liked the project, but still had some reservations. For example, Sarah stated: "A nice addition but on the other hand, not something new for English (…). Also, what I am concerned about most is that I often hear about the kids not enjoying it and it is an extra addition to their workload." Especially interesting in this category are Kate, Quint, and Alex, whose types of search for meaning were labeled with *toleration* the year before. These teachers' changes in type of search for meaning might be related to the changes that were made to GUTS each year. Those changes were made because the school and team of researchers felt that GUTS needed to fit better within the school.

Three teachers' types of search for meaning within GUTS could be typified as *accommodation,* and they experienced *conflicting goals* as a source of ambiguity and uncertainty. Two of them (Gideon and Nicole) could be characterized with *assimilation* the year before, and either experienced no sources of ambiguity (Gideon) or experienced *limited resources* (Nicole). In 2015, both searched for meaning through *accommodation* and experienced *conflicting goals*. Nicole's response when asked what she thought about GUTS: "(…) I think it would be best if the students do not get extra lessons as an extra challenge, but have to do something outside the classroom. With the subject Dutch language [they can], for example, start a school newspaper, with the subject Music [they can], for example, start a band, (…). I probably sound really negative about GUTS, which I am not, but the way we designed it now, to me, is quite boring."

The number of teachers assigned to *toleration* as type of search for meaning fell from four in 2014 to two in 2015. Only one, Frank, was assigned to *toleration* in both years. His sense-making remained largely the same. He continued to believe that the goals he held for differentiated student development conflicted with the goals of GUTS: "I don't think GUTS makes students get better grades. Many students see GUTS as something [obligatory]…" Julia, the other teacher assigned to *toleration* in 2015, not only experienced *conflicting goals*, but also *limited resources*: "I think (…) the real challenge is not there, because GUTS is mandatory for everyone. (…) you are not 'special' when you receive GUTS lessons. Secondly, the way it is going now, students get sorted into subjects of their second or even their third choice. This is not stimulating, nor motivating. (…)."

Table 5.6 Teachers' sense-making by type of search for meaning and source of ambiguity in 2015

2015 Perceptions of the situational demands: Source of ambiguity / Type of search for meaning	None	Limited resources	Conflicting goals	Both
Assimilation	**Otto –** Divergent DI, providing autonomy, and higher order learning regardless of subject ***Mark –*** *DI, and providing autonomy within subject*	**Rita –** DI, and providing autonomy within subject ***Paula –*** *DI, and providing autonomy within subject* ***Leon –*** *DI within subject* ***Helga –*** *Convergent DI, and providing autonomy within subject* ***Kate –*** *DI within subject*	***Sarah –*** *Convergent DI, and providing autonomy within subject* **Quint –** Convergent DI, and enrichment regardless of subject **Alex –** Convergent DI within subject	
Accommodation			***Nicole –*** *Convergent DI within subject* ***Gideon –*** *Divergent DI, providing autonomy, and higher order learning within subject* ***Irma –*** *Divergent DI*	
Toleration			**Frank –** Convergent DI within subject	***Julia –*** *Divergent DI, providing autonomy and enrichment, regardless of subject*

Note: *italics* indicate differences in the teachers' source of ambiguity between 2014 and 2015; underlines indicate differences in the teachers' type of search for meaning between 2014 and 2015

5.4.2 Teachers' sense-making

We aimed initially to characterize teachers' sense-making through their types of search for meaning and their experienced sources of uncertainty and ambiguity (see section 5.1). However, when reviewing the teachers' personal frames of reference in more detail, we noticed that teachers with identical types of search for meaning (and experienced sources of ambiguity) still differed from each other. During the analysis of teachers' perceptions of the situational demands (i.e., related to the question *'What do you think of GUTS until now?*'), we noticed that their responses also held information about what they thought the innovation, or differentiated student talent development, *should* be. The question *'What is, according to you, differentiated student talent development?',* was initially aimed at measuring teachers' perceptions of differentiated student talent development. In addition, the answers to this latter question were not always consistent with the answers to the first question. In other words, for some of the teachers their thoughts about what differentiated student development *should* be did not coincide with their perceptions of differentiated student talent development. Julia, for example, explained differentiated student talent development to be exactly what is aimed for in GUTS: "Providing students with a talent for a specific subject an opportunity to further develop their talent, knowledge and practices for that subject further. Students should largely be responsible for the design of their learning process and determining their goals." However, as can also be seen at the end of 5.4.1, she perceives that participating in GUTS should be a reward for performing well in the subject, rather than a place to follow your interest: "The real challenge is not there, because GUTS is obligatory for everyone. All students have to do it, you are not 'special' when you are doing GUTS. (…) it is not a reward for your hard work and/or talent."

Thus, when analyzing the teachers' types of search for meaning, we tried to take teachers' perceptions of differentiated student talent development as well as what they perceived that

differentiated student talent development *should* be into account. Teachers' personal frames of reference were used to understand their sense making into further detail, as depicted in Tables 5.5 and 5.6. This analysis showed that even teachers with identical types of search for meaning and who experienced the same sources of ambiguity and uncertainty, differed in their sense-making (Tables 5.5 and 5.6).

A first glance at Tables 5.5 and 5.6, shows that all teachers, except Mark in 2014 (his personal frame of reference holds convergent teaching and enrichment), saw DI as an important way of stimulating differentiated student talent development. Furthermore, all teachers' personal frameworks held some connection to the criteria for GUTS (autonomy, higher-order learning, enrichment, and DI). However, very few teachers formulated their perception of differentiated student talent development as holding all four criteria for GUTS. In 2014, the two teachers' personal frames of reference that held the most GUTS criteria (three out of four) were Otto's and Gideon's, who were both assigned to *assimilation* as type of search for meaning, without sources of uncertainty and ambiguity. However, in 2015, this similarity with the criteria appeared to be irrelevant to how Gideon made sense of GUTS: he had *accommodation* as type of search for meaning and experienced *conflicting goals*.

Table 5.5 also shows that three teachers viewed differentiated student talent development as something that should focus first and foremost on the student. These teachers explained that as a teacher you should first look at where the student's talents lie and then at how you (the teacher) can adapt your teaching of the subject matter to that talent. This is opposed to the views of most teachers who believe that talent development is situated *within* the subject: thus, that as a teacher you should figure out what the student's talents within the subject are and aim to develop those further. These three teachers, held that perception (regardless of subject) can be found in *assimilation-none* (Otto) and *toleration-conflicting goals* (Quint and Alex). This perception

in theory conflicts with one of the criteria for GUTS and how GUTS is set up, as it is situated *within* subjects. Otto did not see this as a problem, apparently: "I totally love it. I have seen faces light up when I explain that GUTS is theirs and not mine. That they can take the lead in direction, purpose, enjoyment and presentation." In 2015 Quint and Alex moved to searching for meaning through *assimilation-conflicting goals*. For Quint, it seems that although he fitted best in *assimilation* in 2015, he apparently still held perceptions that were somewhat similar to those he held in 2014 regarding GUTS: "Now we have chosen with our subject, to have a measurable end point, we can see whether these lessons really lead to better achievement. Every round, GUTS is getting closer to its goal. It provides us space to experiment with other pedagogical approaches."

Comparing Table 5.6 with Table 5.5, teachers still seem to be scattered across types of search for meaning and sources of uncertainty and ambiguity. Teachers with similar frames of reference made sense of GUTS in different ways, through different types of search for meaning and with different sources of ambiguity. However, in 2015 many teachers (n=5) appear to have added *providing autonomy* to their perceptions of differentiated student talent development. This broadening of their personal frames of reference seems to have occurred especially among teachers who used *assimilation* as type of search for meaning. All these teachers, except Helga, also used *assimilation* as type of search for meaning in the previous year. Julia also added *providing autonomy* to her personal frame of reference and changed in her type of search for meaning; however, this change was from *accommodation* to *toleration*. Another change in Julia's personal frame of reference could be found in her point of view regarding stimulating differentiated student talent development. Although in 2014 Julia thought that differentiated student talent development was situated *within* subjects, in 2015 she perceived it to be a development that should be *regardless of* subject.

In sum, it is clear that teachers with similar personal frames of reference make sense of GUTS in different ways: for example, some through *assimilation* with no sources of ambiguity, others through *accommodation* with *limited resources* and *conflicting goals* as sources of ambiguity. In 2015 most teachers seemed to have changed in their process of sense-making. Most teachers used *assimilation* as type of search for meaning, though their sources of ambiguity still differed.

5.5 Conclusion and discussion

In this study, we aimed to answer the following questions: *How do teachers make sense of an innovation to differentiate instruction in terms of type of search for meaning and sources of ambiguity and uncertainty? How does this sense-making process change over two school years?* After exploring 15 teachers' personal frames of reference and their attitudes towards the innovation GUTS in two school years, we found that teachers make sense of this minimally structured innovation in very different ways. This is in line with Schmidt and Datnow's (2005) conclusion that teachers' sense-making shows greater diversity in less structured reforms than in more structured reforms. Also, it adds to the literature stating that educational innovations often have a variety of outcomes when a clear theory of improvement is lacking (Van Veen et al., 2010; Wayne et al., 2008). GUTS did not have a distinct theory of improvement: several criteria were described which, if implemented by the teachers, were supposed to help students develop their talents, but what specifically had to change in teachers' practice was not made explicit (Van Veen et al., 2010; Wayne et al., 2008).

Teachers' sense-making in the current study was defined using types of search for meaning (Luttenberg, Van Veen, et al., 2013), which were further specified through the sources of ambiguity and uncertainty (Allen & Penuel, 2015) they experienced and their personal frames of reference. In order to come to these classifications, teachers'

personal frames of reference with regard to differentiated student talent development (perceptions and self-reported practices) were combined with their perceptions of the situational demands (attitudes towards GUTS). In this study, like in previous studies, it appeared that teachers' sense-making is a complex process (Luttenberg, Van Veen, et al., 2013; März & Kelchtermans, 2013). The complexity of this process became especially apparent during the analysis of the teachers' perceptions of the situational demands. These perceptions appeared to also hold perceptions of what the teachers thought differentiated talent development *should* be. For some teachers, these perceptions differed from what we found in their personal frames of reference, when we explicitly asked for their perception of differentiated student talent development. Thus, when we analyzed the teachers' types of search for meaning, we found that the teachers' personal frames of reference could be context-dependent: when teachers are explicitly questioned about their personal frames of reference they might answer from their idea of how regular, everyday classroom practice looks, but when they were asked about their experiences with an innovation, they seemed to perceive the concept central to that innovation differently (Spillane et al., 2002). We would therefore argue that when exploring the teachers' types of search for meaning it should be taken into account that teachers might hold more than one personal frame of reference at the same time, which might depend on the question asked: what their perceptions are, or what their experiences are.

We therefore conclude that in the context of an innovation that is added to the regular curriculum, teachers' sense-making cannot be defined by merely categorizing their types of search for meaning. In the current study we saw that teachers' sense-making could change over time and that a number of variables, like the context from which teachers reasoned, seemed to be involved in influencing their sense-making processes (Spillane et al., 2002).

5.5.1 Sense-making as a dynamic process through type of search for meaning

Considering the diversity of teachers' sense-making of GUTS, it appeared in the current study that their sense-making became more similar as time passed and the innovation changed. Some changes to the innovation were also made to make sure there was a better fit between GUTS and what the teachers said they would prefer to do in GUTS. This adds to the literature explaining teachers' sense-making as a dynamic process (März & Kelchtermans, 2013). Specifically, in the second year of data collection most teachers were similar in their sense-making, which was typified as *assimilation*. According to Spillane et al. (2002) it is possible that this greater similarity in the sense-making of teachers shows an advance in the level of implementation of GUTS is advancing. That the number of teachers grouped under *toleration* also decreased seems to be in accordance with Luttenberg, Van Veen, et al.'s (2013) conclusion. They stated that coherence between the different aspects of teachers' work is achieved as they participate in the process of an innovation, rather than a given at the start of the innovation. It should be noted however, that even though more similarity was observed regarding type of search for meaning, the teachers still experienced different sources of ambiguity. Teachers thus made sense of GUTS in their own, unique, ways.

5.5.2 Sense-making through sources of ambiguity

GUTS appeared to be an interesting context for exploring teachers' sense-making. In the GUTS lessons teachers had space to take risks and innovate in ways they often feel they are not able to, because teaching in the regular curriculum restricts them to certain routines (Allen & Penuel, 2015). But, this freedom in the specific design of a GUTS lesson might have left some teachers confused, because they felt that not enough structure was provided (Schmidt & Datnow, 2005). The teachers who experienced *limited resources* as the source of their ambiguity mentioned a high workload, or not being properly

equipped. Thus, for some teachers, additional guidance and support to learn how to participate in such a lightly structured innovation might be helpful (Schmidt & Datnow, 2005). An example of such support is that from a school leader who is supportive of changes towards more DI (Hertberg-Davis & Brighton, 2006; Ketelaar et al., 2012). The school leader could also support collaboration between teachers, possibly in the form of professional learning communities or mentoring (De Neve et al., 2015; Ketelaar et al., 2012).

5.5.3 Teachers' personal frames of reference

Teachers' need for guidance within GUTS may also explain the discrepancies we found between the teachers' personal frames of reference when we explicitly asked them about their perceptions of differentiated student talent development and their frames of reference we found in their attitudes to GUTS (their context-dependent frames of reference). The teachers' personal frames of reference regarding talent development could be called narrow, as they often contained only two of the four GUTS criteria. In addition, especially in 2014, despite the character of GUTS, where students should be challenged to develop their talents, most teachers said to plan for and practice convergent DI. This is similar to findings by Mills et al. (2014), who found that in their context without specific guidelines on how to implement DI, teachers held *narrow* views of DI. However, their context-dependent frames of reference were defined more broadly. This could mean that the space teachers were given within GUTS could indeed help them to see possibilities to innovate and take risks, and think of the best ways to help students develop their individual talents, although guidance is still needed. For that matter, not all teachers in this study considered this space sufficient, especially those with a narrower personal frame of reference. Looking at these subgroups of teachers and their sense-making processes, it appears valid to conclude that other variables apart from the teachers' perceptions, practices, and

attitudes, play a role in teachers' sense-making (Spillane et al., 2002). We would argue that one of these variables is a teachers' starting point in their sense-making process. One group of teachers (*assimilation-none*) seemed to experience GUTS as an opportunity to innovate and was not bothered by the design criteria. Another group (*toleration-both/conflicting goals*) experienced the few criteria there were as conflicting with their own views on talent development. It is possible that this subgroup of teachers would have benefitted from more guidance and support to understand and implement this innovation.

5.5.4 Limitations and future research

In the current study, we were not able to identify causes for the discrepancies within the teachers' personal frames of reference, nor was it our intention to do so as we did not expect to find these discrepancies. Neither did we study what this meant for the teachers. This would be an interesting subject for future research. In the literature, teachers' personal frames of reference are made up of many different variables (Luttenberg, Van Veen, et al., 2013; Spillane et al., 2002). As mentioned above, the starting point of teachers' sense-making processes might be one of those variables that would be interesting to study further. In addition, it is possibly the interplay of all those different variables that becomes clear when researchers explore a specific concept (differentiated student talent development): teachers may hold one broad frame of reference, but when researchers zoom in they discover other details.

Questionnaires were used to typify teachers' dynamic sense-making processes during GUTS. Using this method it appeared possible to gather information from 15 teachers at two moments in time, with exactly the same questions (Trobia, 2008). In addition, in the current study, we chose to use a questionnaire because it reduced the chances of getting the socially desirable responses teachers might have given in face-to-face interviews (Ballou, 2008). However, using semi-

structured interviews in addition to the questionnaire (at different points in time) may provide extra information on the influence of the changes made to GUTS over time on the teachers' sense-making. In addition, looking at our results, especially the discrepancies, it may be interesting to further elaborate on this topic using retrospective interviews with teachers in which they are shown their sense-making processes and asked whether they indeed feel that way and to elaborate on that. These interviews would also provide a space for teachers to explain their emotions at different points in time (Schmidt & Datnow, 2005), as these also play an important role in teachers' sense-making (Ketelaar et al., 2012).

Finally, what we did find is that teachers' sense-making is a complex and dynamic process. This process needs further attention in research, as stated above, but also in the practice of implementing DI. The current results show that it is important to give teachers space to innovate and take risks, but also guidance and support in the implementation of DI. Guidance and support needs will not be the same for all teachers, as they all have a unique way of sense-making.

Chapter 6

Discussion

Chapter 6
Discussion

6.1 Introduction

In this dissertation, we conducted several studies on the practice of differentiated instruction in the context of GUTS. A teacher perspective was used to gain a better understanding of what influences teachers in their implementation of DI, how teacher knowledge of DI is put into practice, and how they make sense of an innovation that stimulates DI. Our aim with this perspective was to contribute to the literature on DI and teacher knowledge, but also to improve the support given to teachers to implement DI. We conducted a systematic literature review and three empirical studies. In the systematic literature review we elaborated on factors in teachers' working environments that influence the implementation of DI. In two of the three empirical studies, a small number of teachers from the secondary school where GUTS was organized participated in stimulated recall interviews (SRIs) to enable exploration of their interactive cognitions regarding DI. In the fourth empirical study we examined 15 teachers' sense-making processes during GUTS using a questionnaire study.

In this chapter, we first summarize the results and conclusions of the four studies. We then elaborate on some general conclusions that overarch the individual studies in relation to the current literature on DI. We conclude this chapter with limitations, practical implications and suggestions for future research.

6.2 Conclusions per chapter

6.2.1 Chapter 2

In chapter 2, we conducted a systematic literature review to gain an overview of what factors in teachers' working environments have been found to influence their implementation of DI. More specifically, we

aimed to answer the following question: *How do different school, intervention, teacher, and classroom characteristics influence the implementation of differentiated instruction by teachers in primary and secondary education?*

To answer the research question, a selection of 29 articles was made that met four inclusion criteria (published in a peer-reviewed journal; reporting an empirical study; focused on in-service primary/secondary teachers, principals, or schools; and aimed at elaborating on factors influencing teachers' practices of DI). The factors, together with an explanation of how these were found to influence implementation, were summarized and organized using Brühwiler and Blatchford's (2011) supply-use model of student learning.

The results from the literature review showed that many factors in a teachers' working environment influence the implementation of DI: school level, policy, principal, colleagues, tools & resources, intervention, teacher beliefs, teacher learning activities, classroom processes, and classroom context. These factors all influenced the teachers and how they implemented DI. For example, when teachers had colleagues who did not consider DI an important approach to teach all students, there was less collaboration within the school and implementation of DI was less likely to occur. Other examples were a lack of proper tools and resources, and a hindering physical classroom setting (classroom context). These factors made the teachers feel constrained in implementing DI and in those cases DI was not implemented exactly as intended.

To enable implementation, these factors and the way they work on teachers need to be taken into account in deciding the specific DI- or implementation method. In addition, some of the studies provided results on several of the identified factors. It is thus likely that those factors work together in the implementation of DI. Small class sizes, for example, are preferred in implementing DI, but when the physical classroom setting is not adapted to differentiated teaching methods the

teacher can still feel constrained. The main conclusion of this study therefore was that context matters, and each specific school setting requires its own specific way of bringing different factors in the teachers' working environment together.

6.2.2 Chapter 3

In chapter 3, we compared teachers' interactive cognitions of DI in regular and GUTS lessons. Our aim was to answer the following question: *What are teachers' interactive cognitions of differentiated instruction in two different learning environments?*

Four teachers of different subjects participated in two SRIs each: one SRI about a regular lesson and one SRI about a GUTS lesson. In each SRI teachers were shown five video clips of the observed lesson, each containing teacher-student interactions in one of the following categories: (1) providing instruction; (2) offering help; (3) giving assignments; (4) calling on a student; and (5) checking up on a student. After each video clip teachers were asked what they were thinking at that moment. In the transcripts of the interviews, the teacher-student interactions were retraced and coded with the names of the categories. Teachers' considerations during those interactions were characterized as interactive cognitions. In the final step of the analysis, the interactive cognitions were coded for the student characteristics *readiness*, *interest* and/or *learning profile,* or *none* if no student characteristic was considered by the teacher. After coding, the frequencies of the interactive cognition codes were compared between the two contexts and across the two contexts per teacher. In addition, to provide more detail and to examine whether the teachers focused on the whole class, groups of students, or individual students, summaries were made of the lessons.

Overall, the results showed that the frequencies of almost all teacher-student interactions for all teachers were similar for both types of lessons. The summaries of the lessons, however, gave a more

detailed view of the differences between the two types of lessons. The main difference was that for two teachers, in their regular lessons, many student-characteristic codes had to be interpreted as the characteristics of the whole class rather than individual students' characteristics. In the GUTS lessons, these teachers focused more on individual students' characteristics. A third teacher appeared to take more student characteristics into account during the regular lesson than in the GUTS lesson. This teacher explained that she had some difficulties in the GUTS lesson. She only had three students to teach, and if she monitored and interacted with them all the time, they could feel like they were being watched. This made the teacher feel uncomfortable; therefore, she kept some distance.

We concluded from this study that teachers' interactive cognitions nearly always focused on at least one student characteristic when they were deciding how to engage with a group of students or individual students. This led us to argue that teachers are during teacher-student interactions always learner-centered, though it depends on the context whether the teacher focuses on larger groups of students (regular lessons) or smaller groups of or individual students (GUTS lessons).

6.2.3 Chapter 4

Since in chapter 3 we mainly explored differences in teachers' interactive cognitions of DI between the regular and GUTS context, we aimed to focus more on the specific content of teachers' interactive cognitions of DI and how learner-centered teachers' interactive cognitions are in chapter 4. Instead of reporting how often teachers considered student characteristics and summarizing what this looks like in their lessons (chapter 3), we decided to explore what the teachers' interactive cognitions are and on how they consider different student characteristics. Two research questions were formulated: *What*

interactive cognitions of differentiated instruction do teachers have? How do they take learning needs into account in these interactive cognitions?

Four teachers were interviewed in four SRIs spread out over the school year. The teachers viewed six video clips in each SRI. In the observations that preceded the SRIs, the 'Classroom Observation Form for Summative Assessment of Differentiated Instruction' was used to place the teacher-student interactions in one of the following categories: (1) context/goal setting; (2) student assessment; (3) attention to the individual student; (4) instruction and classroom routine; and (5) positive, supportive learning environment. One or two video clips were selected from each category to show the teachers during the SRIs: the teachers were asked to explain what they were thinking during these teacher-student interactions. Their considerations during their actions were characterized as their interactive cognitions. During the analysis, we first brought together, per teacher, the interactive cognitions in one category of interactions that were similar to each other. We then coded these according to who they were aimed at (class, groups of students, students with certain characteristics, individual students) and what student characteristics were taken into account (readiness, interest, learning profile).

From these analyses, we found that the teachers always – with one exception – took student characteristics into account in their interactive cognitions: mostly the students' readiness. However, it appeared to depend on the type of interaction; in the interaction types *instruction and classroom routine* and *positive, supportive learning environment*, teachers often took two learning needs into account. In addition, the learner centeredness of the teachers' interactive cognitions appeared to vary from class-centered to student-centered. The results also showed that teachers' interactive cognitions were mostly focused on convergent DI. Another conclusion from this study was that interactive cognitions differed greatly between the teachers, meaning that interactive cognitions are personal. Other differences were found within the teachers: their interactive cognitions differed

per type of teacher-student interaction, and teachers had multiple interactive cognitions in each type of teacher-student interaction. This means that interactive cognitions also depend on the situation, and on context. By studying the content of the teachers' interactive cognitions, we found differences between and within teachers suggesting the person-, situation-, and context-dependency of interactive cognitions. Teachers thus might have a similar knowledge base regarding DI, but the person-, situation-, and context-dependency of their interactive cognitions means that within the same type of teacher-student interaction differences necessarily exist. Therefore, it is not preferable to confront teachers with a uniform solution to learning to implement DI.

6.2.4 Chapter 5

In the study described in chapter 5 we focused on the dynamic and complex process of teachers' sense-making within the context of GUTS. Our aim was to answer these research questions: *How can teachers' sense-making within an innovation to differentiate instruction be characterized in terms of type of search for meaning and sources of ambiguity and uncertainty? How does this sense-making process change over two school years?*

15 teachers voluntarily completed a questionnaire at two moments in time (in the Fall of the second and third year of GUTS). The questionnaire was aimed at measuring teachers' personal frames of reference regarding differentiated student talent development, and their perceptions of the situational demands of GUTS. Teachers' personal frames of reference were coded to find out how these corresponded with the innovation. In the analysis, the teachers' answers were analyzed for their types of search for meaning (assimilation, adaptation, or toleration), and their experienced sources of uncertainty and ambiguity (limited resources and/or conflicting goals). Then, we characterized teachers' sense-making by aligning the teachers' types of search for meaning, their experienced sources of

uncertainty and ambiguity, and their personal frames of reference. Finally, we compared the results from both school years with each other to see whether the teachers' sense-making had changed.

The results showed that the teachers made sense of GUTS, a minimally structured innovation, in very different ways. Teachers with similar types of search for meaning could hold very different personal frames of reference. It also appeared that when we examined teachers' perceptions of the situational demands, several teachers would explain what they perceived that GUTS *should* be. We valued this as part of the teachers' personal frames of reference, however, these perceptions did not always correspond with the 'actual' personal frames of reference. For example, for several teachers, their personal frames of reference with regard to differentiated student talent development were very similar to the ideas of GUTS. However, with respect to the perceptions of the innovation (the situational demands), they mentioned that students' talents should be stimulated differently from what was aimed for in GUTS. In addition, the comparisons between the school years showed that teachers' sense-making also changed with the changes that were made to the innovation. The dynamic character of teachers' sense-making meant in this study that the fifteen teachers became more similar in the type of search for meaning they used in their sense-making process in the second year of data collection. While in the first year of data collection, teachers had very different types of search for meaning and experienced different sources of uncertainty and ambiguity, in the second year, most of them used assimilation as type of search for meaning, though they still experienced different sources of uncertainty and ambiguity. Finally, the freedom teachers got within GUTS appeared to cause the differences in the teachers' sense-making processes: some teachers experienced this as freedom to experiment with DI, whereas others experienced this as too little guidance in the actual implementation of

the innovation. Thus, freedom appears necessary, but not sufficient, it is important that support and guidance are available for teachers.

6.3 General discussion

6.3.1 Perspectives on differentiated instruction

In this dissertation, we adhered to Tomlinson et al.'s (2003) definition of DI: "Differentiation can be defined as an approach to teaching in which teachers proactively modify curricula, teaching methods, resources, learning activities, and student products to address the diverse needs of individual students and small groups of students to maximize the learning opportunity for each student in a classroom" (p.121). We understood this definition broadly and thus a very broad range of teaching practices and teacher cognitions that indicate how teachers adapt their teaching to students were accepted as examples of DI. Thus, in our understanding of the definition, when teachers interact with students and they take at least one student characteristic into account in that interaction, they are adapting their instruction to the students. In chapters 3 and 4 we concluded that teachers almost always take student characteristics into account during teacher-student interactions. The teachers in these two studies mostly took students' readiness into account. On the one end of the continuum of the size of the student group whose readiness was considered, there was the whole class and on the other end, individual students. It can be argued whether adapting instruction to the whole class' readiness is an example of DI (Denessen, 2017; Tomlinson et al., 2003). However, Corno (2008) mentions that it can also be viewed as a first step where the participating teachers who often used whole-class instruction sought a common ground for the level of their teaching where all students would be addressed. During or after the whole-class instruction, those teachers would then often engage in an interaction with a (group of) student(s) that were considered to have a different

readiness level and teachers would consequently adjust instruction in that interaction to the individual student's needs.

Furthermore, by studying interactive cognitions, we focused more on teachers' reactive DI than on proactive DI. Although proactively planning for DI is one of the hallmarks of effective DI (Tomlinson et al., 2003), during teaching it is very likely that situations arise that need an immediate response (Denessen & Douglas, 2015). Ideally, in this response the teacher takes the student's learning needs into account and thus differentiates reactively. However, especially with reactive DI teachers often seem to adjust their instruction in response to informal assessments of student characteristics, like personality and social skills (Corno, 2008; Denessen, 2017; Denessen & Douglas, 2015; Rubie-Davies, Hattie, & Hamilton, 2006). These types of assessments could increase the possibility of judgement errors (Corno, 2008; Denessen & Douglas, 2015). In their assessments, teachers can, unintentionally, be negatively influenced by students' background characteristics summarized by the student characteristic *learning profile*, like ethnicity, SES, and parents' educational history (Denessen, 2017; Denessen & Douglas, 2015; Rubie-Davies et al., 2006; Severiens, 2014). According to Denessen (2017), teachers often have lower expectations of students whose parents have low education levels, as well as of students who are first- or second-generation Dutch. These expectations change how teachers treat these students. If these practices become systematic behavior from the teacher towards certain groups of students, the teacher might unintentionally reinforce differences between students (Cohen & Lotan, 1995; Denessen 2017; Severiens, 2014; Turner, Christensen, & Meyer, 2009). This can cause students to feel excluded from certain groups in the class or school based on their socio-cultural backgrounds, and in turn their self-esteem might be affected (Cohen & Lotan, 1995; Severiens, 2014). Consequently, not all students may get the opportunity to maximize their learning potential (Cohen & Lotan, 1995; Denessen, 2017;

Denessen & Douglas, 2015; Severiens, 2014; Turner et al., 2009). The teachers studied in chapters 3 and 4 were unintentionally influenced by background characteristics of certain students. Possibly, a perspective on DI from a cultural point of view in addition to academic DI, as proposed by Severiens (2014) could provide a more complete picture on teachers adapting instruction with regard to students' cultural backgrounds. The teachers studied in chapters 3 and 4 did not know all students before they met them during their GUTS lessons, which might cause teachers to only informally assess those students on different characteristics. An example is one teacher in chapter 4, who mentioned trying to challenge a student, because, as she explained it, that student had chosen her subject for GUTS and thus should be able to achieve more. Although the teacher thus tried to adjust her instruction to this student's readiness, she did not yet know what this student could actually accomplish. However, in many of the interactive cognitions in which student *readiness* was taken into account, teachers appeared to adjust the interaction on actual achievement of the students thus also aiming to address students' learning profile.

The potential danger of unequal treatment of students when teachers are differentiating reactively, also leads to the discussion of the difference between convergent and divergent DI and which of these might be more preferable (Bosker & Doolaard, 2009; Corno, 2008; Denessen, 2017; Severiens, 2014; Subban, 2006). In the chapters 3 through 5 we have found that most of the teachers' (proclaimed) DI practices in the context of GUTS correspond to convergent DI. One possible explanation for these findings might be that convergent DI appears easier for teachers, for with divergent DI teachers have to focus on all student characteristics and hold different goals for different (groups of) students (Deunk, Doolaard, Smale-Jacobse, & Bosker, 2015). It is especially having different goals for different students that matches with what we described in section 1.3.1: teachers

experience DI to be an impractical approach to teaching, because they perceive it to be an approach for which they have to develop individual lesson plans for each student (Janssen, Hulshof, & Van Veen, 2016; Janssen, Westbroek, Doyle, & Van Driel, 2013). In recent literature there appears to be a preference for a mixture of both convergent and divergent DI (Denessen, 2017; Severiens, 2014). Based on the findings of the studies reported in this dissertation (chapters 3-5), we argue that teachers' use of convergent DI can provide a base from which they can, with proper and continuous support, further develop their teaching incorporating divergent DI as well (Corno, 2008; Smit & Humpert, 2012). We recognize that this development requires a deep, substantial and complex change to teaching practices, which will not be achieved easily (Janssen et al., 2016; Severiens, 2014; Tomlinson et al., 2003; Tomlinson, Brimijoin, & Narvaez, 2008). In the sections 6.4 and 6.5.2 we elaborate on several suggestions for teaching practices and future research into teachers' developing DI.

6.3.2 The importance of context

Throughout this dissertation, we discussed how different context characteristics can influence teachers' practices, interactive cognitions, and sense-making regarding DI. In the literature review (chapter 2), we found many different factors that influence teachers' implementation practices. The model of Brühwiler and Blatchford (2011) was used to categorize these factors. By also reviewing the ways these factors influence the teachers' implementation practices, we found that it is important to take the school context into account when there is a wish to implement DI. Each school context has its own unique characteristics and within that specific context, alignment of school, intervention, teacher, and classroom characteristics should be strived for (Fullan, 2007; Marsh & Willis, 2007).

The empirical studies reported in this dissertation (chapters 3-5) all took place within the context of one school in the Netherlands

and illustrate how different factors can be aligned. This school's context can be described as an innovative school, which means that change and trying out new ideas within classroom practice is a familiar phenomenon for the teachers. Although several teachers mentioned they had missed specific instruction about (the start of) GUTS in 2013-2014, the implementation of an innovation is something familiar for most teachers in this school.

The characteristics of the intervention GUTS can be described as providing the teachers with a lot of space to experiment with DI because there were only the four criteria (explained in 1.4) the lessons had to adhere to, and no PD trajectories were required for the teachers. In line with the literature, many teachers felt that this little structured context indeed provided them freedom to experiment with DI (De Neve, Devos, & Tuytens, 2015; Schmidt & Datnow, 2005). In line with this, the teachers' interactive cognitions studied in chapter 3 showed that several teachers during the GUTS lessons felt more freedom to focus on individual and small groups of students, than during their regular lessons. Yet, as chapter 5 showed, a small group of teachers would have appreciated more guidance in what was exactly expected of them during the lessons. This latter group experienced limited resources and sometimes even conflicting goals (Allen & Penuel, 2015). Thus, the influence of the school and intervention characteristics on the teachers in this dissertation became apparent through these results from chapters 3 and 5. Support and guidance, combined with freedom to experiment are important for teachers when implementing DI.

However, even when school and intervention characteristics are considered in the implementation of DI, many differences in teacher and classroom characteristics can be found, and it will be difficult to attend to each unique characteristic. In chapter 4, we found that teachers' interactive cognitions differed not only between teachers as a result of individual teacher characteristics, but also within teachers. It appeared that classroom characteristics like time of day and

specific composition of the class influenced the interactions teachers had with their students. This adds to the classroom characteristics we found in the reviewed literature (chapter 2), like physical classroom setting and the type of community that is created within the classroom (Brimijoin, 2005; Roiha, 2014).

Putting these results together in the supply-use model (Brühwiler & Blatchford, 2011), we see that school, intervention, and classroom characteristics indeed influence teacher characteristics, like the model suggests. Looking at the results from chapters 3 through 5, combined with important factors influencing teachers' implementation of DI that were found in the literature (chapter 2), we argue that merely focusing on teachers' knowledge and practices of DI in isolation from those other influencing factors does not do justice to the complex reality of classroom practice (Janssen, 2017; Janssen, Westbroek, Doyle et al., 2013; Meijer, Verloop, & Beijaard, 2002). Consequently, this dissertation has provided the insight that in trying to implement DI – the definition of which states that a one-size-fits-all approach to student learning is not desirable – neither a one-size-fits-all approach for teachers in their implementation of DI should be desired.

6.4 Practical implications

6.4.1 Support for teachers to experiment with innovative ideas

The three empirical studies described in this dissertation took place in the context of GUTS, which was aimed at fostering differentiated student talent development. One of the underlying assumptions in studying DI in this context, was that GUTS provided teachers some freedom to experiment with implementing DI (De Neve et al., 2015). The results described in chapter 3 endorse this assumption. The teachers' interactive cognitions investigated after the GUTS lessons tended more towards effective DI since they were more focused on small groups and individual students, than the interactive cognitions

measured after regular lessons, which focused more on the whole class. In addition, we found in the study reported in chapter 5 that some, not all, teachers experienced freedom to experiment with DI, as illustrated by a quote from one teacher: "It provides us space to experiment with other pedagogical approaches."

What might have helped teachers in GUTS is that the lessons did not have to fit within the regular curriculum. Many teachers feel that one of the things holding them back in experimenting with DI, is the regular curriculum (De Neve et al., 2015; McTighe & Brown, 2005). Teachers feel that the obligation to meet the goals of the regular curriculum makes it impossible to divert too much from the pedagogical methods of their regular lessons (McTighe & Brown, 2005). For example, the comparison of teachers' interactive cognitions in regular and GUTS lessons described in chapter 3, showed that teachers who were used to giving whole class instruction, felt more freedom during the GUTS lessons to teach individual students and small groups of students. Our conclusion that teachers might feel more freedom to experiment due to the separation from the regular curriculum was also acknowledged by the school management when we reported back to them on the most important findings of this dissertation. In addition to providing teachers with an innovation in which they can experiment with DI, this innovation should be embedded within the schedule. From the point of view of practicality, an innovation that is embedded within the regular school schedule is more congruent with teachers' regular practice and thus may help teachers with the transfer of practices from one context to another (Janssen, Westbroek, Doyle et al., 2013).

We thus suggest that it might be beneficial to provide teachers with a context to experiment, an environment in which they feel it is safe to change (Hertberg-Davis & Brighton, 2006). However, merely providing this context is insufficient: teachers also need support and guidance (e.g. Puzio et al., 2015; Schmidt & Datnow, 2005; Tomlinson

et al., 2008). The findings reported in chapters 3, 4, and 5 all show that there are many differences between teachers; chapter 5 specifically shows that teachers differ in how they make sense of a new context that is presented within an innovation. In addition, teachers' sense-making also changes during the course of an innovation. To give all teachers the support and guidance they need, and to support them in their sense-making, it is therefore important that the school management maintains an ongoing conversation with the teachers (Allen & Penuel, 2015; Fullan, 2007; Marsh & Willis, 2007; Schmidt & Datnow, 2005). The school could, for example ask several teachers how they wish to be supported when experimenting with DI, and what they think themselves is realistic and practical (Janssen, Westbroek, Doyle et al., 2013). Teachers who already have more experience with DI could be appointed as teacher leaders (Smit & Humpert, 2012). On the one hand, these teacher leaders could be available to provide support to other teachers, and on the other hand, they could talk to the school management about what teachers need and what goals would be realistic to set for the school regarding change towards implementing DI. By emphasizing ongoing communication with the teachers, it becomes clear what in the innovation helps teachers and what constrains them, and adaptations can be made. Other ideas for support and guidance to implement DI in a context like GUTS, but also within a regular context, are described in the next section.

6.4.2 Taking differences between teachers into account

All four studies described in this dissertation provided results that indicate that teachers are engaging in DI on different levels or at least thinking about ways to implement it. Also, variety in teachers' interactive cognitions and sense-making processes was found. This adds to the literature that argues that teachers say they know what DI is and how to practice it, but that little DI is observed in teachers' classroom practice (e.g., Graham et al., 2008; Dutch Inspectorate of

Education, 2016; Roiha, 2014). It also demonstrates possibilities for growth towards more (effective) DI. For this growth, teachers need to receive help in discovering the possibilities for implementing DI in their teaching practice (Janssen et al., 2013). To help teachers see DI as a more practical approach, they need to be supported with methods that stay close to their practice, depart from what they already do, and take their own learning needs into account (Corno, 2008; Janssen, Westbroek, Doyle et al., 2013; Smit & Humpert, 2012; Van Veen et al., 2010).

The SRI method, used in the studies reported in chapters 3 and 4, can also be implemented as a tool for personalized learning. Together with a researcher, colleague, or coach, teachers can observe their teaching practice to examine their own interactive cognitions. In engaging in SRIs with coaches, teachers have to explicate their thinking about DI and the coaches can invite them to also reflect on those explicated interactive cognitions (Van Veen & Janssen, 2016). Teachers can also engage in SRIs with other teachers, colleagues or teacher leaders, as suggested in 6.4.1. The support of colleagues is important in the implementation of DI (Bianchini & Brenner, 2010; Puzio et al., 2015); by engaging in SRIs with supporting colleagues, not only do teachers experience mutual trust and openness, and the benefits of explicating and reflecting on interactive cognitions, but they can also learn from each other. This collaboration with colleagues using SRIs could also be further expanded in to professional learning communities, which have shown positive results on teacher learning (e.g. De Neve et al., 2015; Puzio et al., 2015).

Teachers can further be supported while keeping close to their practice by combining SRIs with laddering interviews (Van Veen & Janssen, 2016). In laddering interviews teachers explain what they do during a 'typical' lesson and what goals they aim to achieve with those practices. Thus, in contrast to SRIs which focus on situation specific interactive cognitions that are interpreted by researchers, teachers

themselves relate more typical practices to the goals they aim for during a typical lesson. The result of such an interview is typically an elaborate goal system hierarchy (Janssen, Westbroek, & van Driel, 2013; Van Veen & Janssen, 2016). Such a goal hierarchy can then be used to develop an (individual) PD trajectory that takes the teachers' learning needs into account. The SRIs can provide support to this trajectory by having teachers explicate situation specific interactive cognitions (Van Veen & Janssen, 2016).

Combining SRIs and laddering interviews might also help teachers to become aware of possible mistakes in their assessments of students or provide them with the guidance they need in the implementation of DI (Denessen & Douglas, 2015; Schmidt & Datnow, 2005). For example, making teachers aware of the actions they undertake to achieve certain goals might also make them become more aware of the assessments they make and how they respond to those assessments. It is important, therefore, that teachers are properly supported in changing towards DI based on appropriate student assessments.

6.5 Limitations and future research

6.5.1 Limitations

The findings of this dissertation have provided greater insight into the teacher perspective in DI. However, a small number of teachers was studied. In addition, the research was conducted in one school at which a specific innovation, GUTS, was taking place. GUTS has not taken place at other schools; therefore, the results of this dissertation are not generalizable. However, as mentioned above, the new context GUTS provided, did allow us to come to several interesting conclusions, which we would not have found in a regular context.

In the studies reported in chapters 3 and 4, we used the SRI method to study teachers' interactive cognitions. For these SRIs, we, the researchers, selected video clips from lesson observations to show

to the teachers. Because we made these selections ourselves and showed only these selections to the teachers, bias was possible. Sometimes it is difficult for a teacher to recall every action in detail (Meijer, 1999; Verloop, 1989). Presenting teachers with video clips might confront them with actions for which they cannot immediately recall their thoughts, thus it might seem that teachers are reconstructing rather than recalling their thoughts. However, research has shown that, teachers constantly make conscious and unconscious decisions during teaching (Verloop et al., 2001). This suggests that even though teachers, on their first viewing of a preselected video clip, might not immediately recall their thinking, it is likely that upon a second showing or talking about what is happening in the video clip, as in the studies in chapters 3 and 4, they will recall rather than reconstruct their thoughts. It should be noted though that there is still a possibility that some of the interactive cognitions were more reconstructed instead of recalled thoughts. In addition, in the results reported in chapter 4, we related the teachers' interactive cognitions during specific teacher-student interactions to, among other things, their goals for those interactions. However, these relations were our interpretations of what the teachers said during the interviews. In our analyses, we remained as close as possible to what the teachers explicitly said during the interviews. To ensure the relationship between teachers' interactions with students and their goals for those specific interactions, laddering interviews could provide more information.

The use of SRIs in chapters 3 and 4 also means that we mainly focused on teachers' adaptations in the process of their instruction (Tomlinson et al., 2003). Teachers' differentiation in content and product of their instruction might thus be underexposed in this dissertation since we argue these adaptations to mainly take place in the planning of their instruction.

6.5.2 Future research

In this dissertation, we focused on a small group of teachers in a specific context to focus on the teacher perspective. To delve even deeper into this perspective in future endeavors, it would be interesting to study a group of teachers for an extended period with multiple moments of data collection and in different contexts. Following the teachers over a longer period in different contexts would make it possible to find out whether the interactive cognitions of teachers change over time (towards more DI) and how the context influences those changes. For, with DI, experience and repeated practice with DI is important to build further (e.g., Subban, 2006; Tomlinson et al., 2003). Such a prolonged research study, would allow teachers to engage in deliberate practice: teachers' DI practices could develop further as a result of repeated practice and feedback from researchers (and colleagues), among others, while students' learning outcomes could increase as a consequence (Bronkhorst, 2013; Marsh & Willis, 2007). In addition, teachers' interactive cognitions gain shape through experience, which means that development is possible through reflection (e.g. Meijer, 1999).

Our aim in taking the teacher perspective in this dissertation was to provide a deeper view on the complex practice of DI. We did this by examining what in a teachers' working environment influences teachers' implementation of DI and how (chapter 2); connecting teacher knowledge of DI to teachers' DI practices by examining that knowledge in practice (chapters 3 and 4); and studying how teachers make sense of a context in which they were stimulated to implement DI and how that sense-making changes (chapter 5). The idea was that this would provide a more detailed view on the complex approach that DI is. In future studies, it would be relevant to ask teachers to explicate their choices regarding the specific interactions and the students with whom the interactions took place. The combination of laddering interview and SRIs, as mentioned in section 6.4.2 would then serve not

only as a method in the professional development of teachers regarding DI, but also as a research method. Teachers' interactive cognitions of DI could then be explored in the light of the goals of their practices (Van Veen & Janssen, 2016).

Finally, it is important in future research to also consider other perspectives. In the current dissertation, we deemed it important to focus on the teacher perspective, since it is the teacher who, in the end, has to implement DI (Marsh & Willis, 2007). However, the supply-use model of student learning outcomes of Brühwiler & Blatchford (2011), our use of it in the study reported in chapter 2, and the discussion in section 6.3.2, show that all stakeholders, like school administration, students, and even students' parents, are connected. All stakeholders need to be supportive of new practices, because their support influences implementation (Marsh & Willis, 2007; Tomlinson et al., 2008). Especially students make an important group of stakeholders that require attention together with the teachers, since the students are the ones that should benefit from DI. In the PhD research project that took place parallel to the research reported on in the current dissertation, for example, students' perspectives on the GUTS lessons and the development of their motivation and achievement as a result of the innovation were studied (Wijsman, 2018). In a future undertaking, changes in students' achievement and motivation, but also their perceptions of teachers' DI practices can be studied alongside the teachers' interactive cognitions and practice of DI. Such research, preferably set up in a longitudinal study, can help to reveal what DI practices students perceive they need and whether the teachers' practices are in accordance with this. Studies like this can help to get a complete picture of how innovations stimulating DI practices influence classroom practice.

References

Akkerman, S., Admiraal, W., Brekelmans, M., & Oost, H. (2008). Auditing quality of research in social sciences. *Quality & Quantity*, *42*, 257–274.

Allen, C. D., & Penuel, W. R. (2015). Studying teachers' sensemaking to investigate teachers' responses to professional development focused on new standards. *Journal of Teacher Education*, *66*, 136–149.

Anderson, K. M. (2007). Differentiating instruction to include all students. *Preventing School Failure*, *51*, 49–54.

Ballou, J. (2008). Survey. In P. J. Lavrakas (Ed.), *Encyclopedia of Survey Research Methods* (p. 861). Thousand Oaks: Sage Publications, Inc.

Beecher, M., & Sweeny, S. M. (2008). Closing the achievement gap with curriculum enrichment and differentiation: One school's story. *Journal of Advanced Academics*, *19*, 502–530.

Bianchini, J. A., & Brenner, M. E. (2010). The role of induction in learning to teach toward equity: A study of beginning science and mathematics teachers. *Science Education*, *94*, 164–195.

Bosker, R. J., & Doolaard, S. (2009). De pedagogische kwaliteit van differentiatie in het onderwijs [The didactical quality of differentiation in education]. (H. Amsing, H. I. Spelberg, A. Minnaert, & S. Greveling, Eds.), *Het Pedagogisch Quotiënt* [The Didactical Quotation]. Houten: Bohn Stafleu van Loghum.

Boudah, D. J., Lenz, B. K., Schumaker, J. B., & Deshler, D. D. (2008). Teaching in the face of academic diversity: Unit planning and instruction by secondary teachers to enhance learning in inclusive classes. *Journal of Curriculum and Instruction*, *2*, 74–91.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn. Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Brighton, C. M. (2003). The effects of middle school teacers' beliefs on classroom practices. *Journal for the Education of the Gifted*, *27*, 177–206.

Brimijoin, K. (2005). Differentiation and high-stakes testing: An oxymoron? *Theory Into Practice*, *44*, 254–261.

Bronkhorst, L. (2013). *Research-based teacher education. Interactions between research and teaching* (Doctoral dissertation). Utrecht University, Utrecht, The Netherlands.

Brühwiler, C., & Blatchford, P. (2011). Effects of class size and adaptive teaching competency on classroom processes and academic outcome. *Learning and Instruction*, *21*, 95–108.

Butcher, K. R., Leary, H., Foster, J., & Devaul, H. (2014). Facilitating teachers' thinking about pedagogy and technology with an online curriculum planning tool. *Journal of Technology and Teacher Education*, *22*, 423–447.

Cha, H. J., & Ahn, M. L. (2014). Development of design guidelines for tools to promote differentiated instruction in classroom teaching. *Asia Pacific Education Review*, *15*, 511–523.

Ciampa, K., & Gallagher, T. L. (2013). Getting in touch: Use of mobile devices in the elementary classroom. *Computers in the Schools*, *30*, 309–328.

Cohen, E. G., & Lotan, R. A. (1995). Producing equal status interaction in the heterogeneous classroom. *American Educational Research Journal*, *32*, 99–120.

Cordray, D., Pion, G., Brandt, C., Molefe, A., & Toby, M. (2013). The impact of the Measures of Academic Progress (MAP) Program on student reading achievement. Washington, DC: National Center for Education Evaluation and Regional Assistance.

Corno, L. (2008). On teaching adaptively. *Educational Psychologist*, *43*, 161–173.

De Jager, T. (2013). Guidelines to assist the implementation of differentiated learning activities in South African secondary schools. *International Journal of Inclusive Education*, *17*, 80–94.

De Neve, D., Devos, G., & Tuytens, M. (2015). The importance of job resources and self-efficacy for beginning teachers' professional learning in differentiated instruction. *Teaching and Teacher Education*, *47*, 30–41.

Dekker, S. (2013). Ruim baan voor toptalent in het funderend onderwijs [Make way for exceptional talent in founding education]. Den Haag: Ministerie van Onderwijs, Cultuur en Wetenschap.

Denessen, E. (2017). Verantwoord omgaan met verschillen: sociaal-culturele achtergronden en differentiatie in het onderwijs [Dealing responsibly with differences: socio-cultural backgrounds and differentiation in education] (Inaugural address). Leiden University, Leiden, The Netherlands.

Denessen, E., & Douglas, A. S. (2015). Teacher expectations and within-classroom differentiation. In C. M. Rubie-Davies, J. M. Stephens, & P. Watson (Eds.), *Routledge International Handbook of Social Psychology of the Classroom* (pp. 296–303). Florence, KY: Routledge.

Deunk, M., Doolaard, S., Smale-Jacobse, A., & Bosker, R. J. (2015). *Differentiation within and across classrooms: A systematic review of studies into the cognitive effects of differentiation practices*. Groningen: GION, Groningen Institute for Educational Research.

Dixon, F. A., Yssel, N., McConnell, J. M., & Hardin, T. (2014). Differentiated instruction, professional development, and teacher efficacy. *Journal for the Education of the GIfted*, *37*, 111–127.

Dutch Inspectorate of Education (2016). De staat van het onderwijs: Onderwijsverslag 2014/2015 [The State of Education in the Netherlands 2014/2015]. Utrecht: Dutch Ministry of Education.

Fullan, M. (2007). *The new meaning of educational change (4th ed)*. New York: Teachers College Press.

Gholami, K., & Husu, J. (2010). How do teachers reason about their practice? Representing the epistemic nature of teachers' practical knowledge. *Teaching and Teacher Education*, *26*, 1520–1529.

Goddard, Y. L., Neumerski, C. M., Goddard, R. D., Salloum, S. J., & Berebitsky, D. (2010). A multilevel exploratory study of the relationship between teachers' perceptions of principals' instructional support and group norms for instruction in elementary schools. *Elementary School Journal*, *111*, 336–357.

Graham, S., Harris, K. R., Fink-Chorzempa, B., & MacArthur, C. (2003). Primary grade teachers' instructional adaptations for struggling writers: A national survey. *Journal of Educational Psychology*, *95*, 279–292.

Graham, S., Morphy, P., Harris, K. R., Fink-Chorzempa, B., Saddler, B., Moran, S., & Mason, L. (2008). Teaching spelling in the primary grades: A national survey of instructional practices and adaptations. *American Educational Research Journal*, *45*, 796–825.

Hertberg-Davis, H., & Brighton, C. M. (2006). Support and sabotage: Principals' influence on middle school teachers' responses to differentiation. *The Journal of Secondary Gifted Education*, *17*, 90–102.

Janssen, F. (2017). Grip krijgen op complexiteit. Onderwijs voor het "moeras" [Understanding complexity. Education for the "swamp"] (Inaugural address). Leiden University, Leiden, The Netherlands.

Janssen, F., Hulshof, H., & Van Veen, K. (2016). *Uitdagend gedifferentieerd vakonderwijs: Praktische gereedschap om je onderwijsrepertoire te blijven uitbreiden* [Challenging differentiated subject matter education. Practical tools to keep expanding your educational repertoire]. Leiden/Groningen: ICLON, Leiden University Graduate School of Teaching/GION, Groningen Institute for Educational Research.

Janssen, F. J. J. M., Westbroek, H. B., & van Driel, J. H. (2013). How to make guided discovery learning practical for student teachers. *Instructional Science*, *42*, 67–90.

Janssen, F., Westbroek, H., Doyle, W., & Van Driel, J. (2013). How to make innovations practical. *Teachers College Record*, *115*, 1–42.

Ketelaar, E., Beijaard, D., Boshuizen, H. P. A., & Den Brok, P. J. (2012). Teachers' positioning towards an educational innovation in the light of ownership, sense-making and agency. *Teaching and Teacher Education*, *28*, 273–282.

Levy, H. M. (2008). Meeting the needs of all students through differentiated instruction: Helping every child reach and exceed standards. *The Clearing House*, *81*, 161–164.

Luttenberg, J., Imants, J., & Van Veen, K. (2013). Reform as ongoing positioning process: The positioning of a teacher in the context of reform. *Teachers and Teaching*, *19*, 293–310.

Luttenberg, J., Van Veen, K., & Imants, J. (2013). Looking for cohesion: The role of search for meaning in the interaction between teacher and reform. *Research Papers in Education*, *28*, 289–308.

Maeng, J. L., & Bell, R. L. (2015). Differentiating Science Instruction: Secondary science teachers' practices. *International Journal of Science Education*, *37*, 2065–2090.

Marsh, C. J., & Willis, G. (2007). *Curriculum: Alternative approaches, Ongoing issues*. Upper Saddle River, New Jersey: Pearson Education, Inc.

März, V., & Kelchtermans, G. (2013). Sense-making and structure in teachers' reception of educational reform. A case study on statistics in the mathematics curriculum. *Teaching and Teacher Education*, *29*, 13–24.

Mastropieri, M. A., Scruggs, T. E., Norland, J. J., Berkeley, S., McDuffie, K., Halloran Tornquist, E., & Connors, N. (2006). Differentiated curriculum enhancement in inclusive middle school science: Effects on classroom and high-stakes tests. *The Journal of Special Education*, *40*, 130–137.

McAlpine, L., Weston, C., Berthiaume, D., & Fairbank-Roch, G. (2006). How do instructors explain their thinking when planning and teaching? *Higher Education*, *51*, 125–155.

McTighe, J., & Brown, J. L. (2005). Differentiated instruction and educational standards: Is détente possible? *Theory into Practice*, *44*, 234–244.

Meijer, P. (1999). *Teachers' practical knowledge: Teaching reading comprehension in secondary education* (Doctoral dissertation). Leiden University, Leiden, The Netherlands.

Meijer, P., Verloop, N., & Beijaard, D. (2002). Multi-method triangulation in a qualitative study on teachers' practical knowledge: An attempt to increase internal validity. *Quality & Quantity*, *35*, 145–167.

Miles, M. B., & Huberman, M. (1994). *Qualitative data analysis : an expanded sourcebook (2nd ed.)*. Thousand Oaks: SAGE Publications, Inc.

Mills, M., Monk, S., Keddie, A., Renshaw, P., Christie, P., Geelan, D., & Gowlett, C. (2014). Differentiated learning: from policy to classroom. *Oxford Review of Education*, *40*, 331–348.

Munby, H., Russell, T., & Martin, A. K. (2001). Teachers' knowledge and how it develops. In V. Richardson (Ed.), *Handbook on Research in Teaching* (pp. 877–904). Washington, DC: American Educational Research Association.

Nguyen, N. T., McFadden, A., Tangen, D., & Beutel, D. (2013). *Video-stimulated recall interviews in qualitative research.* Paper presented at the meeting of the Australian Association for Research in Education, Adelaide, Australia.

Pajares, M. F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, *62*, 307–332.

Puzio, K., Newcomer, S. N., & Goff, P. (2015). Supporting literacy differentiation: The principal's role in a community of practice. *Literacy Research and Instruction*, *54*, 135–162.

Richards, M. R. E., & Omdal, S. N. (2007). Effects of tiered instruction on academic performance in a secondary science course. *Journal of Advanced Academics*, *18*, 424–453.

Roiha, A. S. (2014). Teachers' views on differentiation in Content and Language Integrated Learning (CLIL): Perceptions, practices and challenges. *Language and Education*, *28*, 1–18.

Roulston, K. J. (2008). Open-ended question. In L. M. Given (Ed.), *The SAGE Encyclopedia of Qualitative Research Methods* (pp. 582–583). Thousand Oaks: SAGE Publications, Inc.

Roy, A., Guay, F., & Valois, P. (2013). Teaching to address diverse learning needs: development and validation of a Differentiated Instruction Scale. *International Journal of Inclusive Education*, *17*, 1186–1204.

Rubenstein, L. D., Gilson, C. M., Bruce-Davis, M. N., & Gubbins, E. J. (2015). Teachers' reactions to pre-differentiated and enriched mathematics curricula. *Journal for the Education of the Gifted*, *38*, 141–168.

Rubie-Davies, C., Hattie, J., & Hamilton, R. (2006). Expecting the best for students: Teacher expectations and academic outcomes. *British Journal of Educational Psychology*, *76*, 429–444.

Santamaria, L. J. (2009). Culturally responsive differentiated instruction; narrowing gaps between best pedagogical pratices benefiting all learners. *Teachers College Record*, *111*, 214–247.

Schmidt, M., & Datnow, A. (2005). Teachers' sense-making about comprehensive school reform: The influence of emotions. *Teaching and Teacher Education*, *21*, 949–965.

Severiens, S. (2014). Professionele capaciteit in de superdiverse school [Professional capacity in a super diverse school] (Inaugural address). University of Amsterdam, Amsterdam, The Netherlands.

Smit, R., & Humpert, W. (2012). Differentiated instruction in small schools. *Teaching and Teacher Education*, *28*, 1152–1162.

Sornson, B. (2015). The effects of using the Essential Skills Inventory on teacher perception of high-quality classroom instruction. *Preventing School Failure: Alternative Education for Children and Youth*, *59*, 161–167.

Spillane, J. P., Reiser, B. J., & Reimer, T. (2002). Policy implementation and cognition: Reframing and refocusing implementation research. *Review of Educational Research*, *72*, 387–431.

Subban, P. (2006). Differentiated instruction: A research basis. *International Education Journal*, *7*, 935–947.

Tobin, R., & Tippett, C. D. (2014). Possibilities and potential barriers: Learning to plan for differentiated instruction in elementary science. *International Journal of Science and Mathematics Education*, *12*, 423–443.

Tomlinson, C. (2005). This issue: Differentiated instruction. *Theory into Practice*, *44*, 183–184.

Tomlinson, C. A. (2015). Teaching for excellence in academically diverse classrooms. *Society*, *52*, 203–209.

Tomlinson, C. A., Brighton, C., Hertberg, H., Callahan, C. M., Moon, T. M., Brimijoin, K., … Reynolds, T. (2003). Differentiating instruction in response to student readiness, interest and learning profile in academically diverse classrooms: A review of literature. *Journal for the Education of the Gifted*, *27*, 119–145.

Tomlinson, C. A., Brimijoin, K., & Narvaez, L. (2008). *The differentiated school: Making revolutionary changes in teaching and learning*. Alexandria, Virginia: ASCD.

Tricarico, K., & Yendol-Hoppey, D. (2012). Teacher learning through self-regulation: An exploratory study of alternatively prepared teachers' ability to plan differentiated instruction in an urban elementary school. *Teacher Education Quarterly*, *39*, 139–158.

Trobia, A. (2008). Questionnaire. In P. J. Lavrakas (Ed.), *Encyclopedia of Survey Research Methods* (pp. 653–655). Thousand Oaks: SAGE Publications, Inc.

Turner, J. C., Christensen, A., & Meyer, D. K. (2009). Teachers' beliefs about student learning and motivation. In Saha, L.J. & Dworking, A.G. (Eds.), *International Handbook of Research on Teachers and Teaching* (pp.361-371). New York: Springer.

Valli, L., & Buese, D. (2007). The changing roles of teachers in an era of high-stakes accountability. *American Educational Research Journal*, *44*, 519–558.

Van Veen, K., & Janssen, F. (2016). Praktijkkennis van leraren [Teachers' practical knowledge]. In D. Beijaard (Ed.), *Weten wat werkt* [Knowing what works] (pp. 26–36). Meppel: Ten Brinke.

Van Veen, K., & Lasky, S. (2005). Emotions as a lens to explore teacher identity and change: Different theoretical approaches. *Teaching and Teacher Education*, *21*, 895–898.

Van Veen, K., Zwart, R., Meirink, J., & Verloop, N. (2010). *Professionele ontwikkeling van leraren; Een reviewstudie naar effectieve kenmerken* [Teachers' professional development: A review study into effective characteristics]. Leiden: ICLON, Leiden University Graduate School of Teaching/Expertisecentrum Leren van Docenten, Center of Expertise for Teacher Learning.

VanTassel-Baska, J., Feng, A. X., Brown, E., Bracken, B., Stambaugh, T., French, H., … Bai, W. Y. (2008). A study of differentiated instructional change over 3 years. *Gifted Child Quarterly*, *52*, 297–312.

Verloop, N. (1989). *Interactive cognitions of student teachers: An intervention study* (Doctoral dissertation). Cito, Arnhem, The Netherlands.

Verloop, N., Van Driel, J. H., & Meijer, P. (2001). Teacher knowledge and the knowledge base of teaching. *International Journal of Educational Research*, *35*, 411–461.

Voltz, D. L. (2006). Inclusion in an Era of Accountability: A framework for differentiating instruction in urban standards-based classrooms. *Journal of Urban Learning, Teaching, and Research*, *2*, 104–115.

Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

Walpole, S., McKenna, M. C., & Morrill, J. K. (2011). Building and rebuilding a statewide support system for literacy coaches. *Reading & Writing Quarterly*, *27*, 261–280.

Wayne, A. J., Yoon, K. S., Zhu, P., Cronen, S., & Garet, M. S. (2008). Experimenting with teacher professional development: Motives and methods. *Educational Researcher*, *37*, 469–479.

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization Science*, *16*, 409–421.

Westenberg, P. M. (2011). Een zesjescultuur? Leve de zeven! [A culture of sixes? Long live the seven!] In Dutch Ministry of Education (Ed.) Essaybundel: CU@School [Bundled essays: CU@School] (pp. 29-40). Den Haag: Dutch Ministry of Education.

Westenberg, P. M., & Van Driel, J. H. (2012). In iedere scholier schuilt een acht of een negen: Voorstel pilot in het kader van "Omgaan met verschillen", directoraat Leraren. [In every student an eight or nine is hiding: Proposal pilot regarding "dealing with differences", directorate Teachers]. Leiden: Leiden University.

Wijsman, L.A. (2018). *Enhancing performance and motivation in lower secondary education* (Doctoral dissertation). Leiden University, Leiden, The Netherlands.

Woolfolk, A. E., Rosoff, B., & Hoy, W. K. (1990). Teachers' sense of efficacy and their beliefs about managing students. *Teaching and Teacher Education*, *6*, 137–148.

Nederlandse samenvatting

Zowel in het onderwijsonderzoek als de onderwijspraktijk is differentiatie een concept dat al vele jaren aandacht krijgt. Hoewel uit onderzoek is gebleken dat wanneer docenten in hun lessen rekening houden met individuele leerlingkenmerken de prestaties en motivatie van leerlingen (zowel in het primair als secundair onderwijs) kunnen toenemen, blijkt uit observaties dat differentiatie nog maar weinig wordt toegepast. Differentiatie is voor veel docenten een complexe didactische aanpak, waarvan zij kennis hebben en die zij ook proberen toe te passen in hun lessen. De complexiteit lijkt voornamelijk betrekking te hebben op de belemmeringen die docenten in de reguliere context ervaren bij de implementatie van differentiatie. Zo brengen de 25 tot 30 leerlingen in een klas ieder heel verschillende eigenschappen met zich mee waar rekening mee dient te worden gehouden en hebben docenten maar weinig tijd om lessen uitgebreid voor te bereiden, laat staan in de vorm van een apart lesplan voor iedere individuele leerling.

Om recht te doen aan wat docenten reeds doen wanneer zij rekening houden met hun leerlingen, is er in dit proefschrift voor gekozen om door middel van een docentperspectief differentiatie in de praktijk te onderzoeken. De specifieke praktijk waarin dit werd onderzocht was een innovatie, genaamd GUTS (Gedifferentieerd Uitdagen van Talent op School). Deze innovatie is in samenwerking met de universiteit op een school voor tweetalig voortgezet onderwijs in Nederland uitgevoerd met als doel de talentontwikkeling van leerlingen in de onderbouw te stimuleren tijdens zogenaamde GUTS-lessen. Leerlingen konden per semester een voorkeur voor drie vakken uitspreken en vervolgens zouden zij in een van die vakken acht GUTS-lessen volgen. In de GUTS-lessen werd docenten expliciet gevraagd te differentiëren. Wij zagen GUTS daarom als een goede context om de implementatie van differentiatie door docenten te onderzoeken. Meer

specifiek werd in dit proefschrift onderzocht welke factoren in de dagelijkse praktijk van docenten hun implementatie van differentiatie beïnvloeden, wat hun interactieve cognities van differentiatie waren en hoe zij betekenis gaven aan de innovatie GUTS.

In **hoofdstuk 1** worden de centrale concepten uiteengezet. Het hoofdstuk geeft overzicht van het onderzoek naar differentiatie, de implementatie ervan, interactieve cognities en betekenisgeving door docenten in innovaties en de problemen die ermee in de praktijk worden ervaren.

De hier gebruikte definitie van differentiatie is afkomstig uit een review van Tomlinson et al. (2003). In deze review wordt differentiatie omschreven als een didactische aanpak waarbij docenten proactief rekening houden met verschillen tussen individuele leerlingen in het proces, product en de inhoud van het onderwijs. Deze definitie van differentiatie is ook als cognitieve differentiatie te omschrijven (Severiens, 2014). Naast cognitieve differentiatie kan ook culturele differentiatie worden onderscheiden, waarbij de culturele diversiteit in de klas als uitgangspunt wordt genomen voor het aanpassen van de instructie. In dit proefschrift wordt uitgegaan van de definitie van Tomlinson et al. (2003), aangezien leerlingen in GUTS uitgedaagd werden hun cognitieve talenten verder te ontwikkelen. Bij effectief gedifferentieerd lesgeven worden docenten echter voor vele keuzes en dilemma's gesteld die deze didactische aanpak zeer complex voor hen maken, bijvoorbeeld: (a) docenten moeten in hun lesvoorbereiding rekening houden met verschillen tussen leerlingen (*proactieve differentiatie*), maar ook tijdens het lesgeven inspelen op verschillen die dan zichtbaar worden (*reactieve differentiatie*) (Douglas & Denessen, 2015; Tomlinson et al., 2003); (b) docenten moeten rekening houden met de verschillende leerlingkenmerken *gereedheid, interesse* en *leerprofiel* (Tomlinson et al., 2003); en (c) docenten moeten afwegen wanneer *convergente differentiatie* (minimumdoelen die voor

alle leerlingen gelden en hen daarnaartoe begeleiden) of *divergente differentiatie* (iedere leerling begeleiden om zichzelf te laten overstijgen) het meest geschikt is (Bosker & Doolaard, 2009; Severiens, 2014).

Om docenten te ondersteunen, zijn wereldwijd diverse professionaliseringstrajecten uitgevoerd (Deunk et al., 2015). Deze trajecten hebben echter verschillende uitkomsten, mede doordat differentiatie een volledige medewerking van de gehele school vereist en iedere schoolcontext weer anders is (bijv. Bianchini & Brenner, 2010). De invloed van de schoolcontext is onder andere te zien in het gegeven dat voor succesvolle en blijvende implementatie docenten dicht bij hun praktijk worden ondersteund (Janssen, Westbroek, Doyle, & Van Driel, 2013), voldoende steun, tijd en middelen vanuit school krijgen (Bianchini & Brenner, 2010; Roiha, 2014), maar ook dat zij zich niet te veel belemmerd voelen door de vereisten van het reguliere curriculum (McTighe & Brown, 2005). Om meer zicht te krijgen op hoe docenten praktijknabij kunnen worden ondersteund in de implementatie van differentiatie, welke factoren in die praktijk van invloed zijn en hoe docenten betekenis geven aan een nieuwe praktijksituatie, zijn de volgende vier onderzoeksvragen beantwoord:

1. Hoe beïnvloeden verschillende kenmerken op school-, interventie-, docent- en klasniveau de implementatie van differentiatie door docenten in het primair en secundair onderwijs? (Hoofdstuk 2)
2. Welke interactieve cognities van differentiatie hebben docenten in twee verschillende leeromgevingen? (Hoofdstuk 3)
3. Welke interactieve cognities van differentiatie hebben docenten tijdens het lesgeven? Hoe houden zij rekening met verschillende leerlingkenmerken in deze interactieve cognities? (Hoofdstuk 4)
4. Hoe kan de betekenisgeving van docenten aan een innovatie ter bevordering van differentiatie worden getypeerd door typen *search for meaning* en bronnen van ambiguïteit en

onzekerheid? Hoe verandert deze betekenisgeving gedurende twee schooljaren? (Hoofdstuk 5)

In de hoofdstukken 3 en 4 staat het concept *interactieve cognities* centraal. Dit concept is te definiëren als de cognities die docenten hebben tijdens hun lesgeven (Meijer, 1999). In dit onderzoek verwijst het naar de kennis van differentiatie die docenten gebruiken en toepassen in hun lesgeven wanneer zij met leerlingen interacteren en op wie zij hun instructie proberen af te stemmen. De focus op interactieve cognities van differentiatie heeft als doel het verbinden van wat al bekend is met betrekking tot de kennis en percepties van docenten op het gebied van differentiatie enerzijds, en de observeerbare praktijk van differentiatie anderzijds. Deze focus zou kunnen resulteren in het bieden van handreikingen voor het meer praktijknabij ondersteunen van docenten bij de implementatie van differentiatie.

In hoofdstuk 5 wordt vervolgens gekeken naar de betekenisgeving van docenten aan de innovatie GUTS. Hierbij is gebruikt gemaakt van typen *search for meaning* (Luttenberg, Van Veen, & Imants, 2013) en bronnen van ambiguïteit en onzekerheid (Allen & Penuel, 2015) die de docenten ervaren. De typen *search for meaning* betreffen: (1) *assimilatie* waarbij er een match is tussen het persoonlijk referentiekader van de docent en de manier waarop de docent de innovatie ervaart en vervolgens handelt vanuit het persoonlijk referentiekader; (2) *accommodatie* waarbij er een match is tussen het persoonlijk referentiekader van de docent en de manier waarop de docent de innovatie ervaart en vervolgens handelt vanuit de vereisten van de innovatie; (3) *tolerantie* waarbij er een mismatch is tussen het persoonlijk referentiekader en de manier waarop de docent de innovatie ervaart, maar waarbij de docent handelt vanuit de vereisten van de innovatie met instandhouding van het eigen referentiekader; en (4) *distantie* waarbij er een mismatch is tussen het persoonlijk referentiekader en de manier waarop de docent de innovatie ervaart,

deze verwerpt en blijft handelen vanuit het eigen referentiekader. De bronnen van ambiguïteit en onzekerheid die docenten kunnen ervaren zijn in hoofdstuk 5 verder gespecificeerd in: (1) *conflicterende doelen*; en (2) *beperkte middelen*.

In **hoofdstuk 2** zijn verschillende factoren in de werkomgeving van docenten die de implementatie van differentiatie kunnen beïnvloeden in kaart gebracht via een systematische literatuurreview. Uit 29 artikelen zijn die factoren samen met een beschrijving hoe die factoren de implementatie door docenten beïnvloedden, samengevat met behulp van het *supply-use model of student learning* van Brühwiler en Blatchford (2011). De volgende factoren werden onderscheiden: niveau van de school, beleid, schoolleider, collega's, instrumenten en middelen, interventie, overtuigingen van docenten, leeractiviteiten van docenten, klassenproces en klassencontext. Deze factoren beïnvloedden de implementatie van differentiatie op verschillende wijze afhankelijk van de specifieke schoolcontext. Tevens bleek in verschillende studies dat een aantal van de factoren invloed op elkaar uitoefenen. De studie van Bianchini en Brenner (2010) liet bijvoorbeeld zien dat een inductieprogramma gericht op het ondersteunen van beginnende docenten bij de implementatie van differentiatie positieve effecten kan hebben. Een van de onderzochte docenten gaf echter les op een school waar de collega's de noodzaak van differentiatie niet inzagen. Deze docent ervoer minder ondersteuning vanuit de school hetgeen de implementatie van gedifferentieerd lesgeven in haar praktijk belemmerde. Op basis van deze literatuurreview kon geconcludeerd worden dat de (school)context van groot belang is in de implementatie van differentiatie en dat er binnen iedere school een uniek samenspel is van verschillende beïnvloedende factoren waarmee rekening gehouden moet worden.

In **hoofdstuk 3** zijn de interactieve cognities met betrekking tot differentiatie van vier docenten in kaart gebracht in schooljaar 2013-2014 tijdens twee leeromgevingen, te weten, reguliere en GUTS-lessen. Het doel was om te onderzoeken welke interactieve cognities de docenten hadden en of er verschillen waren tussen deze cognities in beide leeromgevingen. Hiertoe zijn *stimulated recall interviews* (SRIs) (Meijer, 1999; Verloop, 1989) gebruikt. De vier docenten werden gedurende één reguliere en één GUTS-les geobserveerd en kort na iedere observatie geïnterviewd. Tijdens de observaties werden video-opnamen gemaakt die bij het interview gebruikt werden om de docenten bepaalde momenten en de bijbehorende gedachten uit hun lessen te laten herbeleven. Ten behoeve van het interview selecteerde de onderzoeker fragmenten uit de video-opnamen. De gekozen fragmenten betroffen diverse typen docent-leerling interacties, één uit ieder van de volgende categorieën: (1) instructie geven; (2) hulp bieden; (3) opdrachten geven; (4) de beurt geven; (5) voortgang controleren. Na ieder fragment werd de docenten gevraagd wat ze tijdens de betreffende interactie dachten. De overwegingen die de docenten vervolgens benoemden werden gecodeerd als interactieve cognitie. De interactieve cognities werden vervolgens gecodeerd voor het rekening houden met de leerlingkenmerken *gereedheid, interesse* en *leerprofiel*. De resultaten lieten zien dat de docenten in hun interactieve cognities bijna altijd leerlingkenmerken in overweging namen. Voor twee van de vier docenten hadden de leerlingkenmerken die tijdens hun reguliere lessen gecodeerd waren, voornamelijk betrekking op de hele klas. Tijdens de GUTS-lessen richtten deze twee docenten zich meer op kleine groepen en individuele leerlingen. De conclusie uit deze studie was dat de vier onderzochte docenten bijna altijd specifieke kenmerken van hun leerlingen betrekken tijdens docent-leerling interacties, maar dat het afhankelijk is van de specifieke leeromgeving of de docent zich voornamelijk richt op grote groepen

leerlingen (reguliere lessen) of op kleine groepen en individuele leerlingen (GUTS-lessen).

Nadat in hoofdstuk 3 voornamelijk is onderzocht hoe de interactieve cognities op het gebied van differentiatie afhankelijk waren van de context van de lessen, wordt in **hoofdstuk 4** nader ingegaan op de interactieve cognities van de docenten tijdens de GUTS-lessen. In deze studie zijn in een volgend schooljaar (2014-2015) wederom vier docenten (deels dezelfde als in hoofdstuk 3) via SRIs onderzocht. Het doel was de verschillen in interactieve cognities van docenten met betrekking tot differentiatie meer gedetailleerd in kaart te brengen: de verschillen en overeenkomsten in de mate van leerling-gecentreerdheid waren hierbij het uitgangspunt. De docenten werden gedurende één schooljaar tijdens ieder semester twee keer geobserveerd met behulp van een observatieformulier (een aangepaste versie van het *Classroom Observation Form for Summative Assessment of Differentiated Instruction* van Tomlinson, Brimijoin, en Narvaez, 2008). Kort na iedere observatie werden ze wederom geïnterviewd aan de hand van videofragmenten. Net als in hoofdstuk 3 werden de overwegingen van de docenten die tijdens de SRIs werden geuit gecodeerd als interactieve cognitie. In deze interactieve cognities werd vervolgens gekeken op wie de docent gericht was (de klas, groepen leerlingen, leerlingen met bepaalde kenmerken, of individuele leerlingen) en met welke leerlingkenmerken rekening werd gehouden (*gereedheid, interesse* en *leerprofiel*). Uit de analyse bleek dat in iedere interactieve cognitie – behalve één – rekening werd gehouden met minstens één leerlingkenmerk (voornamelijk gereedheid), maar ook dat dit grotendeels afhankelijk was van het type docent-leerling interactie. Tijdens de interacties *instructie en klasroutine* en *positieve, ondersteunende leeromgeving* werd bijvoorbeeld veelal rekening gehouden met twee leerlingkenmerken. De gevonden variatie in de interactieve cognities had zowel betrekking op variatie tussen

docenten (binnen één type docent-leerling interactie) als binnen docenten (tussen en binnen verschillende typen docent-leerling interacties). De conclusie uit deze studie was dat docenten interactieve cognities hebben die op enigerlei wijze rekening hielden met verschillen tussen leerlingen, maar dat de inhoud van deze cognities afhankelijk waren van de persoon (docent), situatie en context. Het is dus aannemelijk dat met betrekking tot differentiatie docenten wel uitgaan van eenzelfde kennisbasis, maar dat de persoon, situatie en context voor verschillen zorgen in de verdere vormgeving en toepassing van die kennis in de praktijk. Bij de ondersteuning van docenten in het verder vormgeven van een gedifferentieerde lespraktijk zou hiermee rekening gehouden moeten worden.

In **hoofdstuk 5** staat de vraag centraal hoe de docenten betekenis gaven aan de innovatie GUTS. Aangezien de docenten binnen GUTS veel vrijheid kregen, er werden namelijk maar weinig eisen aan de specifieke vormgeving van de GUTS-lessen gesteld, werd verwacht dat docenten in deze context de nodige ruimte zouden ervaren om te experimenteren met een didactische aanpak als differentiatie.

Bij 15 docenten zijn twee vragenlijsten afgenomen (schooljaren 2014-2015 en 2015-2016) om zowel persoonlijke referentiekaders als percepties van de innovatie in kaart te brengen. De verzamelde data werden geanalyseerd aan de hand van typen *search for meaning* (*assimilatie, adaptatie* of *tolerantie*) en bronnen van ambiguïteit en onzekerheid (*conflicterende doelen* en/of *beperkte middelen*) die zij ervoeren. Uit de analyse bleek dat de betekenisgeving van de 15 docenten zeer varieerde. Tevens bleek dat docenten met gelijke typen *search for meaning* vaak heel verschillende persoonlijke referentiekaders hadden, ondanks dat deze referentiekaders zijn gebruikt in de analyse om te komen tot de typen *search for meaning*. In de vragenlijst die is afgenomen beoogden twee vragen het persoonlijk referentiekader van de docenten te meten, de antwoorden op deze

vragen zijn dan ook gebruikt in het bepalen van de typen *search for meaning*. In de antwoorden op de vragen die de percepties van de innovatie echter beoogden te meten refereerden de docenten vaak aan wat volgens hen een betere invulling van de innovatie zou zijn. Hierbij refereerden zij aan hun persoonlijk referentiekader. Deze referenties kwamen echter niet altijd overeen met wat in de eerdere fase van de analyse reeds was getypeerd als het persoonlijke referentiekader van de docenten. Naast de gevonden verschillen tussen docenten, bleken de docenten gedurende de twee schooljaren te veranderen in de manier waarop zij betekenis gaven aan GUTS. In de manier waarop docenten betekenis gaven aan GUTS waren in het tweede schooljaar meer overeenkomsten te zien dan in het eerste schooljaar: de meeste docenten gaven op meer positieve wijze, voornamelijk door *assimilatie,* betekenis aan GUTS. Deze verandering kan deels worden verklaard door de aanpassingen die door de school- of projectleiding aan de innovatie zijn gemaakt, soms in reactie op de manier waarop docenten GUTS eerder ervoeren. De verschillen tussen docenten bleken veelal voort te komen uit de ervaren vrijheid. Enerzijds maakte de vrijheid het mogelijk voor docenten om meer te experimenteren met differentiatie, anderzijds werd vrijheid negatief door docenten ervaren, omdat sommigen het zagen als een gebrek aan structuur en ondersteuning. Vrijheid om te experimenteren met didactische aanpakken als differentiatie lijkt daarmee nodig voor docenten, maar ondersteuning en structuur is ook nodig voor hen die daar behoefte aan hebben.

In **hoofdstuk 6** zijn de belangrijkste resultaten en conclusies van de deelonderzoeken samengevat aan de hand van een discussie van en reflectie op de literatuur.

In dit onderzoek is uitgegaan van een brede opvatting van differentiatie. Vanuit dat perspectief was het mogelijk om in de hoofdstukken 3 en 4 te concluderen dat er grote overeenkomsten

tussen docenten zijn in hun interactieve cognities met betrekking tot differentiatie. Dit betekent dat docenten veelal rekening houden met verschillen tussen leerlingen en dat ze daarin voornamelijk uitgaan van het leerlingkenmerk *gereedheid*. De wijze waarop docenten veelal rekening houden met verschillen tussen leerlingen was te typeren als *convergente* differentiatie. Dit is een goede basis voor een verdere ontwikkeling. Het is namelijk het meest wenselijk voor de vooruitgang en eerlijke behandeling van leerlingen dat docenten bewust afwegingen maken per situatie welke leerlingkenmerken worden meegenomen en welk type differentiatie wordt toegepast.

Daarnaast was het mogelijk conclusies te trekken met betrekking tot de invloed die context heeft op de implementatie van differentiatie. Uit de literatuurreview bleek (hoofdstuk 2) dat er in een (school)context veel verschillende factoren zijn die ieder op hun eigen manier invloed uitoefenen op de implementatie van differentiatie. In hoofdstuk 3 vonden we vervolgens dat de opzet van GUTS docenten meer in staat stelde om met kleine groepen en individuele leerlingen interacties aan te gaan en vervolgens rekening te houden met individuele leerlingkenmerken. Dit werd ondersteund door de resultaten van hoofdstuk 5, waaruit duidelijk werd dat de vrijheid die docenten kregen in GUTS hen in staat stelde te experimenteren met didactische aanpakken als differentiatie. Er werd echter wel de kanttekening bij geplaatst dat dit niet voor alle docenten afdoende was, omdat zij graag meer ondersteuning en structuur wilden. Het bieden van een context als GUTS kan dus positief werken voor de implementatie van differentiatie. Desondanks zal het bieden van zo'n context niet afdoende zijn en zal er rekening moeten worden gehouden met andere factoren binnen school die de docent beïnvloeden, zoals ook is geconcludeerd in hoofdstuk 2. Zo bleek bijvoorbeeld uit een van de studies genoemd in hoofdstuk 2, dat een innovatieve context minder positieve uitkomsten heeft wanneer de schoolleider niet voldoende ondersteuning aan de docenten biedt. Uit hoofdstuk 4 bleek

tevens dat binnen die innovatieve context docenten van elkaar kunnen verschillen in toepassing van differentiatie en dat per docent de toepassing ook weer kan verschillen afhankelijk van de specifieke lessituatie. Deze combinatie van conclusies impliceren dat niet alleen per school, maar ook per docent een uniforme vorm van ondersteuning bij de implementatie van differentiatie niet wenselijk is. Met andere woorden, de implementatie van differentiatie zal door middel van *gedifferentieerde professionaliseringstrajecten* moeten worden ondersteund.

Beperkingen

Er zijn enkele beperkingen die in ogenschouw genomen moeten worden bij het wegen van de conclusies. Het onderzoek vond plaats in de context van GUTS. Deze context maakte het mogelijk om differentiatie in een omgeving te onderzoeken waar docenten minder hinder zouden ondervinden van het reguliere curriculum en dus meer ruimte zouden krijgen om te experimenteren met differentiatie. Aangezien het onderzoek in deze context is uitgevoerd, zijn de resultaten niet zonder meer te generaliseren naar de reguliere onderwijspraktijk.

Tevens is het nodig op te merken dat in dit proefschrift is uitgegaan van de definitie van differentiatie die Tomlinson et al. (2003) geven. Binnen deze definitie ligt, vanwege de indeling van leerlingkenmerken in *gereedheid*, *interesse* en *leerprofiel*, relatief meer nadruk op cognitieve verschillen dan op culturele verschillen tussen leerlingen. Hierdoor is in dit proefschrift de impact die de culturele achtergrond van leerlingen kan hebben op hun leren mogelijk onderbelicht gebleven.

Daarnaast is er in de toepassing van de SRIs voor gekozen om zelf fragmenten te kiezen om aan de docenten te laten zien, in tegenstelling tot docenten zelf de gehele les te laten zien en hen te laten pauzeren wanneer zij zelf een interactieve cognitie herinnerden. Deze keuze is vanwege praktische overwegingen gemaakt, maar kan ervoor

hebben gezorgd dat de docenten meer moeite moesten doen bij een aantal van die fragmenten om hun overwegingen te herinneren. Dit brengt het risico met zich mee dat docenten meer aan het reflecteren zijn geweest (op een bepaalde lessituatie), dan dat zij die situatie daadwerkelijk herbeleefden. Tevens zorgt het gebruik van SRIs ervoor dat de interactieve cognities in combinatie met de handelingen tijdens de observaties door de onderzoekers nog geïnterpreteerd moesten worden. Verschillende keren is daarom door de onderzoekers aangegeven dat uit de interactieve cognities doelen van de docenten naar voren kwamen die zij met de betreffende handelingen hadden (hoofdstuk 4). In de SRIs hebben de docenten echter die interactieve cognities niet letterlijk bestempeld als doelen.

Praktische implicaties en vervolgonderzoek

In de praktijk betekenen de resultaten dat docenten ruimte nodig hebben om te kunnen experimenteren. Ze lijken zich namelijk gehinderd te voelen door het reguliere curriculum en de reguliere klassituatie. Daarbij kunnen docenten ondersteund worden vanuit school door ten eerste te zorgen voor een veilige omgeving waarin docenten durven te experimenteren en ten tweede door bijvoorbeeld 'expert'-docenten aan te stellen die in de klas docenten kunnen helpen bij de implementatie of juist met de school in gesprek kunnen gaan over de vraag welke ondersteuning geboden kan worden (Smit & Humpert, 2012).

Deze expert-docenten, coaches of onderzoekers kunnen tevens de docenten door middel van de hier gehanteerde methode van SRIs verder ondersteunen. Deze SRIs kunnen gecombineerd worden met de methode van *laddering interviews* (Van Veen & Janssen, 2016). In *laddering interviews* bespreken docenten met de interviewer wat ze doen tijdens een typische les en welke doelen ze daarmee hebben. Zo'n interview levert uiteindelijk een doel-middel hiërarchie op aan de hand waarvan een gepersonaliseerd ontwikkelingstraject voor de docenten kan worden opgesteld. Vooral in combinatie met de SRIs is

er dan op systematische wijze een overzicht verkregen van wat de docenten in kwestie weten en doen op het gebied van differentiatie en waar nog hulp nodig is voor verdere implementatie van differentiatie.

De combinatie van *laddering interviews* met SRIs kan ook bruikbaar zijn voor vervolgonderzoek, voornamelijk met betrekking tot een van de hierboven genoemde beperkingen. Doordat in *laddering interviews* de docenten zelf hun doelen en handelingen aan elkaar verbinden, hoeven de onderzoekers interactieve cognities niet als zodanig te interpreteren. Vervolgens kunnen de interactieve cognities van docenten dan worden verkend aan de hand van de doelen die zij zelf zeggen te hebben met hun handelingen. Daarnaast is het relevant om de implementatie van differentiatie door docenten gedurende langere tijd te volgen om te onderzoeken hoe deze zich ontwikkelt. Als laatste kan het interessant zijn om andere perspectieven bij het onderzoek naar differentiatie te betrekken. In dit onderzoek is uitgegaan van een docentperspectief om aan te tonen hoe docenten in de praktijk hun kennis van differentiatie inzetten. Zoals echter ook uit de literatuurreview is gebleken, zijn er vele andere stakeholders, zoals ouders, schoolleiders en leerlingen, die invloed kunnen uitoefenen op de onderwijspraktijk en de handelingen van docenten. Parallel aan het onderzoek dat in dit proefschrift is beschreven heeft een promotieonderzoek plaatsgevonden naar de percepties van leerlingen van de GUTS-lessen en de ontwikkeling van hun motivatie en prestaties ten gevolge van de innovatie. Het zou interessant zijn in de toekomst de bevindingen uit deze beide onderzoeken aan elkaar te koppelen en daarna vervolgonderzoek te richten op hoe docent en leerling in de praktijk van differentiatie invloed op elkaar uitoefenen. Het doel van dergelijk onderzoek is dat zowel de implementatie van differentiatie door de docent beter verloopt, als dat dit voor de leerlingen een positieve invloed heeft op hun leeruitkomsten.

Appendix A – Observation form

Teacher-student interaction	**Observed Y/N**	**Extent (not at all, moderate, great)**	**Time**	**Description**
I. Context/goal setting				
1. Set clear learning goals (knowledge, understanding, skills)				
2. Linked new knowledge to prior knowledge and/or experience				
3. Offered headings or other aids to help the students to focus on the goals				
4. Most students seemed to be aware of and understand the learning goals				
5. Concluded the lesson with a focus on the learning goals/purpose of the lesson				
II. Student assessment				
1. Implemented and used results of the pre-assessment to adapt the lesson				
2. Checked the students' understanding during the lesson				
3. Paid attention to students' questions/comments during the lesson				
4. Checked what the students had learned at the end of the lesson				

III. Attention for the individual				
1. Interacted with students when they entered/left the classroom				
2. Paid attention to individual students during the lesson				
3. Helped students to become aware of their own strengths/contributions				
4. Involved students in sharing/planning/evaluating				
IV. Instruction and classroom routine				
1. Varied the grouping of students: individuals, pairs, small groups				
2. Used different instruction methods, with a focus on active learning				
3. Made flexible use of the classroom space, time and materials				
4. Gave clear instructions for different tasks				
5. Gave effective instruction that supported individual needs				
V. Positive, supportive learning environment				
1. Acknowledged/celebrated the students' strengths/successes				
2. Encouraged active participation by a broad spectrum of students				
3. Made students feel comfortable to ask questions/ask for help				
4. Emphasized the students' own talents				

Publications and presentations

Scientific publications

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (submitted). The influence of school, intervention, teacher, and classroom characteristics on the successful implementation of differentiated instruction: A review of empirical findings.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (under review). Teachers' interactive cognitions of differentiated instruction: An exploration in regular and talent development lessons.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (under review). Teachers' interactive cognitions of differentiated instruction in a context of student talent development.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (submitted). Teachers' sense-making processes during two years of an innovation aimed to differentiate instruction.

Paper presentations and symposia

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (2017, July). *Changes in teacher knowledge of differentiated instruction in a context of talent development lessons*. Paper presented at the Biannual Conference on Teachers and Teaching of the International Study Association on Teachers and Teaching (ISATT), 3-7 July, Salamanca, Spain.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M. & Van Driel, J.H. (2017, June). *Praktijkkennis van docenten van differentiatie in een context van talentontwikkelingslessen: een exploratie*. [Teachers' practical knowledge of differentiated instruction in a context of talent development lessons: An exploration]. Paper presented at the Onderwijs Research Dagen (ORD), 28-30 June, Antwerp, Belgium.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (2017, April). *De invloed van beleid, school context en docent kenmerken op de implementatie van differentiatie: een literatuurreview.* [The influence of policy, school context, and teacher characteristics on the implementation of differentiated instruction: a literature review]. Paper presented at the Ontmoetingsdag Binnenklasdifferentiatie, 28 April, Antwerp, Belgium.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (2016, May). Bevorderende en belemmerende factoren bij de implementatie van differentiatie: Een systematische literatuurreview. [Stimulating and hindering factors in the implementation of differentiated instruction: A systematic literature review]. In D. Dolmans (Chair). *Implementatie van differentiatie in het primair en voortgezet onderwijs*. [Implementation of differentiation in primary and secondary education]. Symposium at the Onderwijs Research Dagen (ORD), 25-27 May, Rotterdam, The Netherlands.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (2015, June). Ondersteuning van talent(ontwikkeling) en motivatie: verschillen in docentkennis van differentiatie tijdens reguliere en talentlessen. [Support of talent (development) and motivation: differences in teacher knowledge of differentiated instruction during regular and talent development lessons]. In N. Saab (Chair). *Stimuleren van Talent(ontwikkeling) en Motivatie: autonomie-ondersteuning en differentiatie*. [Stimulating talent (development) and motivation: Autonomy support and differentiated instruction]. Symposium at the Onderwijs Research Dagen (ORD), 17-20 June, Leiden, The Netherlands.

Stollman, S.H.M., Meirink, J.A., & Van Driel, J.H. (2014, November). *Teachers stimulating differentiated student talent development: differences in teachers' practices and practical knowledge concerning differentiated instruction during regular and 'talent' lessons*. Paper presented at the ICO International Fall School, 10-14 November, Blankenberge, Belgium.

Round tables and poster presentations

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M. & Van Driel, J.H. (2016, June). *Teachers differentiating instruction: changes in teacher knowledge and practices*. Poster presented at the meeting of the European Association for Research on Learning and Instruction Special Interest Group Teaching and Teacher Education (EARLI SIG 11), 20-22 June, Zurich, Switzerland.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (2015, August). *Differences in teachers' knowledge of differentiated instruction during regular and talent lessons*. Poster presented at the meeting of the European Association for Research on Learning and Instruction (EARLI), 25-29 August, Limassol, Cyprus.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (2015, August). *Development of teacher knowledge of and practices concerning differentiated instruction in a project focused on student talent development*. Round table session held at the meeting of the Junior Researchers at the European Association for Research on learning and Instruction (EARLI), 22-24 August, Limassol, Cyprus.

Stollman, S.H.M., Meirink, J.A., Westenberg, P.M., & Van Driel, J.H. (2014, June). *De ontwikkeling van docenten in het voortgezet onderwijs tijdens een professionaliseringstraject gericht op een praktisch haalbare invulling van gedifferentieerde instructie*. Poster presented at the Onderwijs Research Dagen (ORD), 11-13 June, Groningen, The Netherlands.

Curriculum vitae

Saskia Stollman was born on April 20th 1990 in Brunssum, the Netherlands. She grew up in Heerlen, where she also attended secondary education at Grotius College from which she graduated in 2008. Afterwards she obtained her Bachelor degree in Pedagogical Science at the Radboud University in Nijmegen in 2011 and her Master degree in Educational Science in 2012, also at the Radboud University. Her master thesis was a case study of the classroom practice of a German language secondary school teacher and how this practice related to the concepts of scaffolding and differentiated instruction.

In 2013 Saskia started as a PhD candidate at ICLON Leiden University Graduate School of Teaching. The research project was part of a larger project aimed at stimulating lower secondary students' talent development. Within this larger project (named GUTS) two PhD research projects (one focused on students, the other on teachers) took place. Saskia's research project focused on what GUTS meant for teachers' differentiated instruction practices. During her PhD trajectory, Saskia attended courses and master classes relevant for her research topic provided by ICO, the Dutch Interuniversity Center for Educational Research. In 2015 she received a 6-week visiting student scholarship to the Berkeley Graduate School of Education (CA, USA). Furthermore, she presented at national (ORD) and international conferences (EARLI, ISATT).

Currently Saskia is employed as a researcher at the Eindhoven School of Education at Eindhoven University of Technology. Here she works within two research projects: one about teacher professionalization in inquiry based learning and the other about learning analytics and the development of MOOCs.

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