Differentiated instruction in practice: do teachers walk the talk?

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Abstract

Differentiated instruction (DI) is put forward as a pedagogical approach to create an inclusive classroom and is considered both a teaching philosophy and a teaching praxis. DI requires that teachers adapt their teaching to students' interests, readiness and learning profiles by adopting differentiated practices such as flexible grouping and ongoing assessment. However, several studies report implementation challenges for DI practices. Using mixed methods, this study explores to what degree differentiated practices are implemented by primary school teachers in Flanders (Belgium). Data were gathered by means of three different methods, which are compared: teachers' self-reported questionnaires (N=513), observed classroom practices and recall interviews with 14 teachers. The results reveal that there is not always congruence between the observed and self-reported practices. Moreover, the study seeks to understand what encourages or discourages teachers to implement DI practices. It turns out that concerns about the impact on students and school policy are referred to by teachers as impediments when it comes to adopting differentiated practices in classrooms.

Keywords: differentiated instruction; primary education; mixed method; DI-Quest instrument

1 Introduction

Students differ in a variety of aspects, such as social backgrounds, learning preferences, interests, previous experiences, languages, social and communication skills, physical abilities, personality, etcetera. Moreover, students' differences in learning are inherent to education (Van Avermaet, 2013). Recognition of these differences enables better alignment between curriculum and teaching, which enhances learning opportunities (Paine, 1995; van Vuuren, van der Westhuizen, & van der Walt, 2012). Differentiated instruction (DI) has been proposed to consider individual learning differences in order to maximize students' learning opportunities (Tomlinson, 2014). Differentiated instruction is defined in multiple ways. The best-known definition states that DI centralizes maximum learning opportunities for all students within the class by proactively modifying teaching methods and resources. In more recent work, Tomlinson (2017) describes DI as a philosophy, a way of thinking as well as a teaching strategy. This study follows Tomlinson's argument (2014) and considers DI as both a teaching practice and a teaching philosophy to understand and align with learning differences between students. Although several empirical studies have confirmed the impact of DI on student learning in terms of students' academic achievements and students' attitudes to learning (e.g. Beecher & Sweeny, 2008; Endal, Padmadewi, & Ratminingsih, 2013; Mastropieri, Scruggs, Norland, Berkeley, McDuffie, Tornquist, & Connors, 2006; Reis, McCoach, Little, Muller, & Kaniskan, 2011; Valiandes, 2015), teachers experience difficulties in acting accordingly and being able to 'walk the talk'. Hootstein (1998) reports that, although teachers utilize various strategies to address students' academic differences, DI occurs rarely in the classroom. When teachers use differentiated strategies, they apply this in a single lesson and not as part of the daily teaching. The research of Suprayogi, Valcke and Godwin (2017) showed that teachers with constructivist beliefs and high self-efficacy tend to

implement DI more than their colleagues, and that the higher the number of students in the classroom, the more teachers feel the need to implement DI. In addition, another study showed that a high pedagogical team culture is beneficial for implementing DI (Smit & Humpert, 2012). Moreover, in the qualitative study of Reis, McCoach, Little, Muller and Kaniskan (2004) it was observed that differentiation is often not frequently or meaningfully implemented. In short, research on teachers' implementation of DI shows that DI is often limited implemented. Moreover, studies often focus on one specific differentiated strategy (e.g. ability grouping, tiering,…) while theories advocate to approach DI more as a general approach to teaching (Tomlinson, 2014). This study adopts DI as a teaching approach, being a pedagogical model that is both a teaching philosophy and a teaching practice, and investigates the implementation of this concept by primary school teachers.

The first goal of this study is to explore to what extent differentiated practices are adopted by teachers. The practices and actions of teachers are influenced by the teachers' thoughts, ideas, perspectives and beliefs (Schatzki, 1996). According to Warde (2005), practices are performances that represents the nexus between what someone does and what someone says (Warde, 2005). Haney and colleagues (2002) found a relationship between what teachers report that they do and what they actually do in the classroom (Haney, Lumpe, Czerniak, & Egan, 2002). However, to know what is generally true in surveys, triangulation is necessary (Olsen, 2004). Therefore, to get an in-depth understanding of which differentiated practices are implemented by teachers, this study will investigate the congruence between teachers' self-reported, observed and recalled practices (Olsen, 2004). Second, since previous studies report that implementation of these practices is often limited (e.g. Hootstein, 1998; Reis et al., 2011), this study seeks to understand what encourages and hinders teachers in their implementation of these practices.

2 Differentiated instruction (DI)

The theoretical framework of this study digs into the concept of DI. More specifically, the study starts by emphasizing the importance of both teachers' philosophies and teachers' practices when implementing DI. The most important philosophies for implementing DI and most common differentiated practices are discussed. Subsequently, facilitating conditions and barriers for implementing DI from the perspective of teachers are synthesized. The focus in this study is on the individual teacher embedded in a specific school. As school elements might facilitate or obstruct implementation the role of the school is also briefly discussed.

2.1 Differentiated instruction: a philosophy and a practice

According to Tomlinson (2017), a teacher's response to students' needs by means of DI does not only include a practice of teaching but also a philosophy. The practice of teaching refers to the proactive adjustments of the curricula, teaching methods, resources, learning activities and students' products according to students' readiness, personal interests or learning profiles (Tomlinson et al., 2003). These differentiated practices are based on flexible principles such as ongoing assessment, adaptations and grouping strategies (Tomlinson, 2001). An effective application of these differentiated practices relies on a pedagogical philosophy that recognizes inherent learning differences and learning potential among all students in the classroom (Latz & Adams, 2011; Tomlinson, 2005). The interpretation of DI as both a practice and a philosophy is also confirmed in the recently developed 'DI-Quest model' (Figure 1). This model is based on a previous validity study that aimed to pinpoint diverse factors that explain differences in the adoption of differentiated instruction (Coubergs, Struyven, Vanthournout, & Engels, 2017). In this study an instrument was developed to measure teachers' perceptions and practices of differentiated instruction on the one hand, resulting in the validation of a model that predicts the adoption of Differentiated

Instruction in classrooms (DI-QUEST-model), on the other hand. The DI-Quest model distinguishes teachers in terms of the extent to which they implement DI. Studies on the development of this model have shown that DI is an approach that includes both philosophical components (growth mindset and ethical compass) and practical components (output = input and flexible grouping). These components lead to the adaptation of teaching to students' interests, readiness and learning profiles. Moreover, the four factors in this model explain the differences in the frequency with which teachers adapt their teaching to students' interests, readiness and learning profiles (Coubergs et al., 2017).

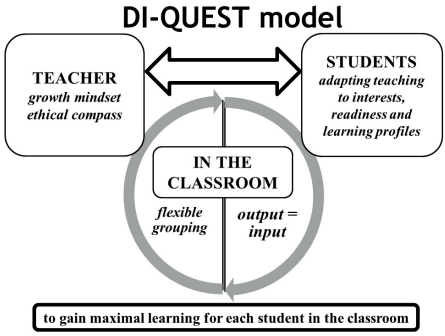


Figure 1: The DI-Quest model (based on Coubergs, Struyven, Vanthournout, & Engels, 2017)

On the right of Figure 1 we see the essence of DI, which lies in adapting teaching to students' differences in learning interests, readiness and profiles (Tomlinson et al., 2003). Differentiated teaching practices adapted to students' interests mainly help to develop students' motivation, joy and perseverance in learning (Tomlinson 2001, Vansteenkiste, et al., 2007). This can occur in the classroom, for example by integrating lessons and assignments with elements from students' fields of interest. Further, differentiated practices adapted to readiness focus on increased academic achievements for each student (Tomlinson & McTighe, 2006). For example, Valiandes (2015) conducted a quasi-experimental study to investigate the effectiveness of differentiation in mixed-ability classrooms on students' attainment in literacy and comprehension. The results indicated a positive effect of DI on students' comprehension. Moreover, Valiandes underlined that although students' achievement was also influenced by prior knowledge and social factors, DI had a clear positive effect on student's learning in a mixed-ability classroom. Furthermore, differentiated practices adapted to learning profiles often lead to increased learning efficiency (Tomlinson & McTighe, 2006). Differences in learning profiles are described by Tomlinson and colleagues (2003, p. 129) as "a student's preferred mode of learning that can be affected by a number of factors, including learning style, intelligence preference and culture." Applying different learning profiles helps to increase learning efficiency and thus positively influences the effectiveness of learning. Hence, differentiating at the level of learning profiles encompasses the provision of a variation in learning activities and takes into account differences in learning profiles so that they perform certain tasks in a more efficient way (Coubergs et al., 2017). For example, the study of Alavinia and Farhady (2012) confirmed the benefits of DI for students' performance when teachers consider learning styles in DI implementation.

The factors 'growth mindset' and 'ethical compass' are displayed on the left of Figure 1 and contain the philosophical components of DI. The growth mindset refers to a positive mindset of the teacher that affects the successful implementation of DI (Dweck, 2006). Tomlinson and Sousa (2011) addressed the concept of mindset in her DI model by stating that a teacher's mindset can affect the successful implementation of differentiated instruction (Sousa & Tomlinson, 2011). Teachers with a growth mindset believe that if students are provided with commitment and engagement they can learn more than was initially thought (Dweck, 2006). The ethical compass envisions the influence of curricula, textbooks, school leaders and parents on teaching, versus the observation of the student as a guide for teaching. In other words, the ethical compass refers to how flexible the

teacher is in dealing with the curriculum when considering students' learning differences (Coubergs et al., 2017). Previous studies have shown, for example, that teachers' philosophy has a great influence on their differentiation for talented students in reading in their classes (Reis et al., 2011). An ethical compass that focuses on the student embodies the development of meaningful learning outcomes, devises assessments in line with these, and creates engaging lesson plans designed to enhance students' proficiency in achieving their learning goals (Tomlinson & Imbeau, 2010). An overly rigid adherence to a curriculum that does not take students' needs into account negatively predicts the use of adaptive teaching based on differences in learning (Coubergs et al., 2017).

Finally, the factors 'flexible grouping' and 'output = input' include DI practices in the classroom. Flexible grouping refers to cooperative learning and alternately switching between working in heterogeneous or homogenous groups, in duo or individually (Whitburn, 2001). Variation in working in groups helps students to progress based on their abilities (when in homogeneous groups) and facilitates learning through interaction (when in heterogeneous groups) (Whitburn, 2001). The positive effect of flexible grouping as a practice of DI was described in a study by Aliakbari and Haghighi (2014). Their results showed that students enjoyed flexible grouping, one-to-one instruction, being able to freely choose topics of interest, and presenting these in their preferred way (Aliakbari & Haghighi, 2014). However, a study of Vaughn and colleagues (1998) revealed that teachers mainly use whole-group instruction for relatively large groups of students and that instruction or materials are differentiated to a very limited extent. Finally, the factor output = input represents the importance of using the output of students, such as information from evaluations, observations, conversations, etcetera, as a source of information, both for the students in terms of learning by providing them with feedback and also for the teacher in terms of adapting his or her teaching. This continuous process of using the output as input ideally takes place during each lesson, each task and each exercise (Coubergs et al., 2017; Hattie, 2009).

2.2 Challenges to implement DI

Several studies report that teachers experience difficulties when implementing DI. These difficulties make it hard for teachers to implement DI according to DI theory; in other words, teachers do not 'walk the talk'. Hawkins (2009) theoretically discussed three teacher-related obstacles to implementing DI: a lack of confidence, a lack of teacher efficacy and a lack of personal perseverance. Findings of empirical studies affiliate with these theoretical obstacles of Hawkins (2009). Lack of confidence is also mentioned in the study of Tobin and Tippett (2014). Their pilot study investigated teachers' perceptions regarding planning and implementing DI in science. The results of this qualitative study indicated that, from the perspectives of teachers, DI was beneficial in terms of student engagement, motivation and approaches to learning. However, teachers also expressed fear and insecurities related to teaching ability and performance (Tobin & Tippett, 2014). The second obstacle, a lack of teacher efficacy, is related to teachers' implementation of instructional practices, innovations, classroom management, and positive and realistic expectations (Ashton, 1984; Hoy, 2000). Hawkins (2009) connects these to the planning or execution of differentiated lessons. To adopt differentiated practices, the teacher must consider DI as important and positive for students (Hawkins, 2009). The last obstacle for successful DI implementation that Hawkins describes is personal perseverance. He relates this to the importance of professional development. However, studies about professional development and DI reveal other challenges besides those described by Hawkins (2009). For example Brighton, Hertberg, Moon, Tomlinson and Callahan (2005) examined the impact of a staff development programme related to DI on teachers and students in heterogeneous classrooms. The outcomes of this study proved that DI and assessment

requires a great deal of time and effort from teachers. Nonetheless, the biggest challenge reported is the contradiction between DI philosophy and general society's beliefs about school. The philosophy behind DI made teachers questions their prior beliefs about teaching and learning. These prior beliefs are often shared by the community (e.g. colleagues and parents) and include a more traditional philosophy on teaching. The study concluded that the complexity of DI together with the traditional beliefs of the teachers, the school and even society are hindrances to the implementation of DI in practice (Brighton et al., 2005). Hootstein (1998) carried out a large-scale mixed-method study to examine how instructional methods were used to satisfy different academic needs of students. One of the research questions focused on the activities utilized to address students' academic differences. Results revealed that the most used strategies were modelling, lecture with question and answer and variety of materials. Whereas other differentiated practices such as tiered assignments or experiments were used the least. From these findings Hootstein (1998) highlights that the implementation of DI as well as professional development for DI should take into account teachers' perceptions of how to teach their content and the practices they already use.

The above obstacles relate foremost to the individual teacher but, as can be deduced from the aforementioned studies, several implementation challenges, such as common beliefs or a staff development plan, go beyond the individual teacher level. A common vision within the school enhances implementation (Adami, 2004). Beecher and Sweeny (2008) found that beliefs about teaching and learning are radically different among various actors involved in a school. Within a school teachers have often different a teaching philosophy and thus a different approach to DI in their individual classrooms, while a shared philosophy among teachers enhances DI implementation. The school leader plays a crucial role in developing a shared vision (Beecher & Sweeney, 2008; Fullan, 2007). Adami's study (2004) illustrates that having a specific development plan facilitates DI implementation for the school and is beneficial for the individual teachers. A school development plan and support from the management of the school encourages individual teachers to move in the same direction, which is essential to successfully implementing DI (Adami, 2004). Finally, several studies also report practical limitations when implementing DI. Practical obstacles include large class size, lack of planning time, lack of administrative support, limited resources, curricular restrictions and limited accommodation (Brighton et al., 2005; Hootstein, 1998; Joseph, 2013).

2.3 Theoretical studies versus practical studies

Recent theories agree that DI is both a teaching philosophy and a practice of teaching (Coubergs et al., 2017; Tomlinson, 2017). In these theories DI is perceived in a holistic way as pedagogical model, as the DI-Quest model demonstrates. However, empirical studies on DI are often limited to one aspect of DI, e.g. ability grouping, tiering, heterogenous grouping, individualized instruction or another specific operationalization of DI (Smale-Jacobse et al., 2019), while theories claim that DI is more than just a set of individual teaching practices (Tomlinson, 2017). Implementation studies on DI report that (some) teachers are familiar with (some) differentiated practices and strategies and investigations into the effectiveness and efficiency of adopting DI demonstrates the importance of utilizing DI (Brighton et al., 2005; Hootstein, 1998; Joseph, 2013). However, the difficulty lies in the focus on the concept of DI. This is not a roadmap that can be predefined and followed by an individual teacher using a step-by-step procedure with a guarantee of arriving at the desired destination. DI is instead both a philosophy and a way of teaching that respects the different learning needs of students and expects all students to experience success as learners (Tomlinson, 2001) and ideally should be implemented as such. This study therefore adopts the DI-Quest model to approach DI holistically as being both a

Table 1: Participating schools in the study

	SCHOOL A	SCHOOL B	SCHOOL C
Urban or rural school	Urban	Urban	Urban
Total number of teachers in the school	33	64	45
Total number of students in the school	403	630	337
% of students with non-Belgian nationality	12.9 % (N=52)	11.75% (N=74)	25.22% (N=85)
% of students with a different mother tongue	26.05% (N=105)	50% (N=315)	56.67% (N=191)
% of students with a low SES	17.12% (N=69)	28.89% (N=182)	42.73% (N=144)

philosophy of teaching as a practice of teaching and investigates the implementation of DI as such.

3 Research aim

Although the positive effectiveness of DI in terms of student wellbeing and progress has been confirmed in several studies (e.g. Beecher & Sweeny, 2008; Reis et al., 2011; Valiandes, 2015), other studies show that implementing differentiated practices comes with several challenges (e.g. Hawkins, 2009; Smit & Humpert, 2012; Suprayogi, Valcke, & Godwin, 2017). Moreover, practice and accompanying actions are connected to teachers' thoughts, ideas, perspectives and beliefs (Schatzki, 1996; Warde, 2005). This study investigates teachers' implementation of DI. The first research question is: which differentiated practices are self-reported in questionnaires, observed in classrooms and recalled during interviews, and what is the congruence between these? The second research question is: what encourages and discourages teachers to implement these differentiated practices?

4 Research context

This study was conducted in primary education in Flanders, Belgium. This study focuses on primary education, which is organized for children from six to twelve years old and includes six year groups. A child usually starts primary education at the age of six after finishing kindergarten. Unlike kindergarten, primary education is compulsory for Flemish children. Usually, there is one responsible teacher who teaches all subjects, with the exception of physical education, which is generally taught by a subject-specific teacher.

5 Methodology

5.1 Sample

This study is part of the 'POTENTIAL – Power to teach all' project. Within this research project, 32 Flemish primary schools were selected during 2016–2017 through a stratified sample, based on an equal representation of each geographical region within Flanders (Belgium) and school denomination, and a proportional representation of rural versus urban schools. In total, 32 primary schools agreed to participate in the study. After agreement to participate in the main project, the following academic year all teachers within the schools were invited by e-mail to complete a survey related to the project. There was an additional call to the 32 participating schools to cooperate in qualitative research, more specific in classroom observations and interviews. Three primary schools agreed, which are all urban schools with a diverse student population. Table 1 shows the background information of the participating schools: the number of students and teachers, the diversity within these schools regarding students with a different non-Belgian nationality or mother tongue than the instruction language (Dutch), and the percentage of students with a low socioeconomic status. The latter number is displayed because schools receive additional resources based on this percentage. The criteria for a low socioeconomic status are determined by the Flemish Government.

Five teachers from each school were selected based on their willingness to agree to

Table 2: Participating teachers in the study

Pseudonym	School	Gender	Age*	Experience*
Andres	A	M	20–30	1–5 years
Anna	A	F	30–40	5–10 years
Alice	A	F	30–40	5–10 years
Alexandra	A	F	30–40	10–15 years
Annabeth	A	F	20–30	1–5 years
Boris	B	M	30–40	5–10 years
Bob	B	M	30–40	5–10 years
Barbara	B	F	30–40	5–10 years
Beatrice	B	F	30–40	5–10 years
Belle	B	F	30–40	5–10 years
Cristina	C	F	30–40	15–20 years
Chelsey	C	F	30–40	15–20 years
Carmen	C	F	50–60	35–40 years
Chiara	C	F	50–60	35–40 years

*to protect the privacy of the respondents, age and years of experience are presented in categories

Table 3: The DI-Quest instrument

Scale	Example from the items	Alpha
Growth mindset	Classroom experiences of success can influence the intellectual capacities of students.	.858
Ethical compass	The curriculum does not provide any flexibility to cope with an individual student.	.856
Flexible grouping	I differentiate by switching between working with heterogeneous and homogeneous groups.	.791
Output = Input	I use assessment to gain insight into the learning processes of my students.	.632
Adaptive teaching	Knowing my students, I select the learning content, materials and teaching methods.	.827

classroom observations and being filmed and interviewed (Table 2). Teachers were given pseudonyms to protect their privacy according to their school. Teachers from school A were given names starting with 'A' and so on. One teacher from school C dropped out of the project due to maternity leave. This led to our final sample of 14 teachers participating in this study.

5.2 Data collection and analysis

To investigate teachers' perceptions and practices of DI, different sources and types of information were used. This approach is more persuasive since triangulation of information allows the researcher to include multiple perspectives (Creswell, 2013). These multiple perspectives are crucial if we want to investigate whether teachers 'walk the talk'. Both quantitative and qualitative methods were applied to collect three types of data: (1) the DI-Quest instrument as a quantitative survey to measure self-reported practices; (2) classroom observations to study teachers' practices; and (3) short semi-structured interviews to study both teachers' practices and teachers' conditions for or hindrances to implement DI.

5.3 Quantitative data

The DI-Quest is a validated self-report instrument that includes 31 items organized in five scales and measures teachers' philosophies and teaching practices of DI (Coubergs et al., 2017). The 18 items from the scales growth mindset, ethical compass and flexible grouping were answered through statements on 7-point Likert scales ranging from 'I totally disagree' to 'I totally agree'. The remaining 12 items from the scales output = input and adaptive teaching were measured through a 7-point Likert scale

Table 4: Descriptive results of the DI-Quest

	Growth mindset	Ethical compass	Flexible grouping	Output = input	Adaptive teaching
Andres	4.75	2.50	4.50	3.75	2.88
Anna	4.50	2.17	4.63	3.25	2.88
Alice	4.25	2.50	5.00	4.75	4.13
Alexandra	4.50	3.50	5.88	4.25	2.00
Annabeth	4.50	2.00	5.38	4.25	4.13
Boris	4.00	2.83	3.38	4.75	2.19
Bob	4.50	3.00	4.75	2.50	1.88
Barbara	3.25	4.33	5.25	4.00	3.13
Beatrice	4.75	2.00	5.00	3.75	3.25
Belle	4.60	2.00	4.88	3.00	2.50
Cristina	5.00	3.33	4.50	3,50	1.63
Chelsey	3.25	4.33	4.38	3.50	2.50
Carmen	5.00	4.50	6.00	5.50	4.25
Chiara	4.00	3.30	5.00	3.00	2.75
Mean score (n=513)	4.19	3.14	4.99	3.50	3.27
Standard deviation (n=513)	1.15	1.16	.57	1.06	.99

ranging from ‘never’ to ‘always’ in order to achieve a frequency measure (Table 3).

After agreeing to participate in the project, all teachers were invited by e-mail to complete the survey. The survey was answered through an online platform designed for the project that teachers could access with a personal login. The data derived from the survey was statistically analysed with IBM SPSS Statistics 25. Descriptive analyses of the data were based on the five scales (summed scores) from the DI-Quest instrument. Table 4 shows the results of the scales for each participating teacher in this study (from three schools) and the mean score of the larger group of teachers based on the full dataset (32 schools, N=513) to illustrate that the teachers in our small sample score average in the DI-Quest, compared to a larger representative sample.

5.4 Qualitative data

After getting the permission of each teacher, video observations of lessons were conducted. No specific instructions were given to the teachers, except to teach like they normally do. One researcher was present in the classroom to install the camera and make field notes. The camera was installed at the back of the classroom and was orientated towards the teacher. All the observations took the same amount of time in every classroom, totalling about 90 minutes actual teaching. In every observation the same subjects math and language (Dutch) occur. These two topics cover the majority of the observation and are complemented by an additional course, for example history, biology or geography. There were no interferences from the researcher.

The teachers were asked to answer some questions after the observations. Specifically, teachers were asked to give more examples of DI practices they recalled from other lessons and courses of how they adapt their teaching to students’ interests, readiness and learning profiles, how they adopt flexible grouping strategies and how they use students’ output as input. Subsequently they were asked what would facilitate further implementation of DI and which pitfalls they come across when implementing DI. The interviews were transcribed for analysis.

The observations and interviews were analysed using NVivo 12. All video observations and accompanying field notes were collected and converted into transcriptions and a script that in detail describes what happens in the classroom. For the interviews, the coding process was based on the transcriptions. For the video observations the coding process was based on both the transcriptions/scripts and the video footage. To answer our first research question, a two-step qualitative data analysis procedure of interpretation was applied to both the observations and interview transcriptions (Miles & Huberman, 1994). First, a deductive analysis was conducted based on our theoretical framework of DI (Tomlinson, 2017; Coubergs et al., 2017). Thereafter interrater reliability was applied by using Cohen's Kappa statistic to determine consistency among raters and identify imprecise code definitions. To ensure coding reliability, replicability and scientifically valid results, 30% of the data or three observations and four interviews were coded by a co-author (MacPhail, Khoza, Abler, & Ranganathan, 2015). The interrater reliability had an acceptable agreement for all coding; the reliability scores for the interviews and the observations were between Kappa=.47, $p < .001$ and Kappa=.68, $p < .001$. Therefore the coding of the main researcher was considered reliable and used for further analyses. Subsequently, a phase of open inductive coding and thematic analysis was conducted. This way additional codes were developed and added to the data. To answer our second research question, open inductive coding was applied on the data from the interviews. Finally, a discussion between the researchers was held to refine the codebook for both research questions. The complete codebook can be found in Appendix A. The coding is based on the frequency of the observed differentiated practice during the observations and the recalled practices and given examples during the interviews.

6 Results

In the results we focus only on the 14 participating teachers who completed in all data collection methods: survey, observations and interviews.

6.1 RQ 1: Which differentiated practices are reported, observed and recalled by teachers?

Before answering this research question, we would like to make clear that the results have to be carefully interpreted. The questionnaire, the observations and the interviews all

Table 5: Rank order of teachers' self-reported practices

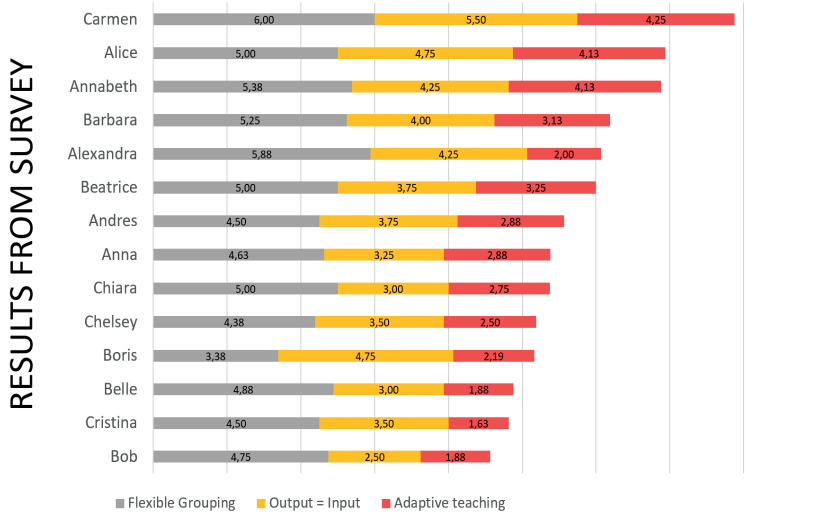
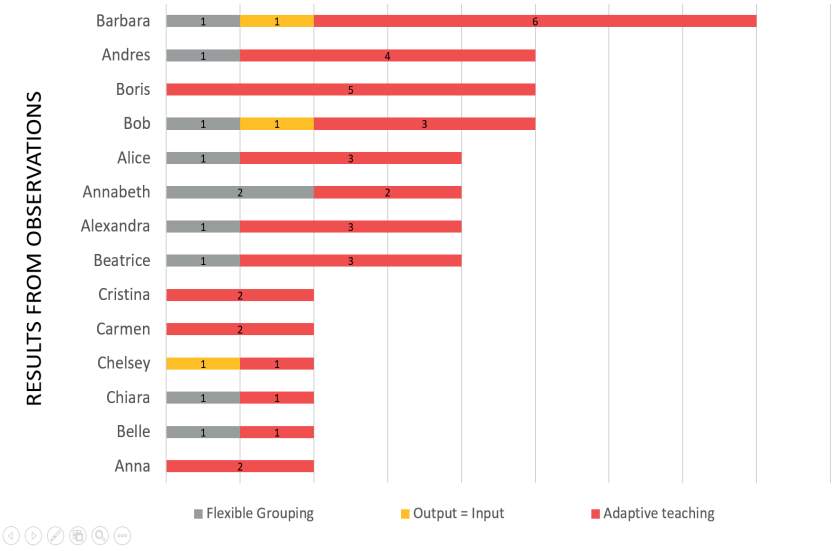


Table 6: Rank order of teachers' observed practices



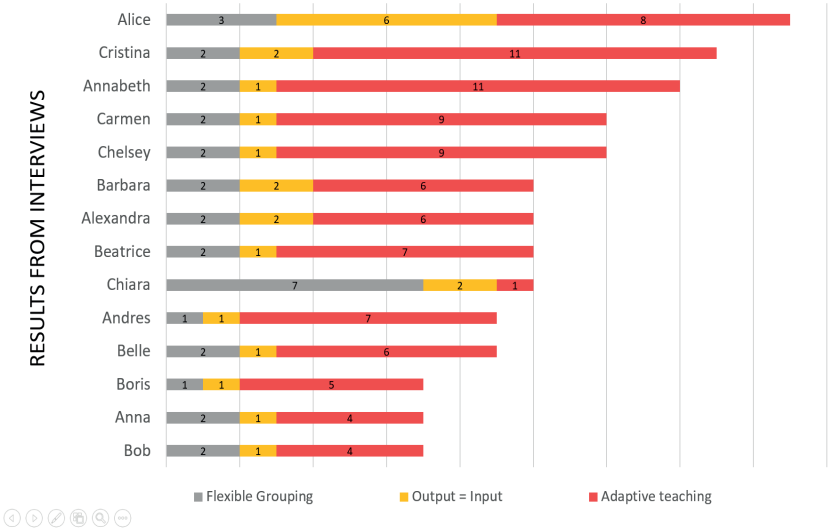
examined which differentiated practices, based on the framework of the DI-Quest model, occur most in classrooms. In the next part we compare the results of these three different methods. However, some cautiousness is necessary because these three different methods have a different measurement unit. To give interpretation to the data, rank orders are made for the teachers based on their scores in the survey (scales of the DI-Quest), on the number of observed practices (number of codes) and on the number of recalled practices during the interviews (number of codes).

First, based on the scales of the DI-Quest survey, a rank order was made (Table 5) of the participating teachers. Overall, in the results of the survey, teachers report that they implement flexible grouping practices often and adapt their teaching to students' interests, readiness and learning profiles least frequently.

We made a second rank order based on the number of codes of the differentiated practices that were observed during the lessons (Table 6). During the observations, adaptive teaching practices were observed in every classroom. In particular, it was noticeable that every teacher adapts his/her teaching to students' readiness during the observed lessons. For example, students received extra individual attention from the teachers during the completion of an assignment (observed in the classrooms of Andres and Carmen). Also, the consideration of students' interests was observed in some of the classes. For example, in one lesson, a video of dinosaurs was used to introduce a maths lesson about big numbers. Students needed to calculate the weight and height to order different types of dinosaur (observed in the classroom of Alexandra). There were no observations of teachers adapting teaching to students' learning profiles. Flexible grouping strategies were also documented during the observations. Although it seemed from the survey that teachers implement these strategies often, they occurred less frequently in the observations than reported in the survey. Moreover, when flexible grouping strategies were observed they were either homogenous groupings based on students' readiness or random grouping, not intentionally dealing with students' differences (e.g. working together with a fellow student who is seated close by for practical reasons). The output = input factor was almost invisible during the observations.

When asked in the interviews to give more examples of this practice, observing the behaviour of students while they are executing an assignment was often mentioned. The

Table 7: Rank order of teachers' recalled practices



majority of the teachers claimed that they help students during an assignment when they see them struggle. This way they use the output of the students as input to help. However, feedback was rarely observed or mentioned. When the teachers were asked about DI and evaluation, a minority of the teachers claimed that they adopt differentiated strategies (e.g. using a help tool) during a test. The other teachers are stricter when it comes to evaluation.

Finally, this process was repeated a last time and a rank order was made based on the recalled practices and examples from the interviews (Table 7). Similar to the observations, teachers recalled adapting teaching to students' readiness within in the classroom. Each teacher gave examples of adapting practices to students' readiness, such as giving students who need extra help additional individual instruction from the teacher, using remedial measures for weak students or deepening the topic for the strongest students. Furthermore, the use of smartgames for students who finish an assignment early was recalled by almost all teachers. In addition, the interviews showed that every teacher in this study engages in co-teaching to meet differences in readiness between students. Teachers also gave examples of adapting teaching to differences in interests. The most common adaptive practice to students' interests is triggering students at the start and/or during the lesson by using examples that intrigue them. Other common observed adaptations to students' interests are letting the students talk about their own experience, giving options they can choose from or using social media. It seems that adapting teaching to learning profiles is rather uncommon in the classrooms.

A minority of teachers use different visualizations to reach different learning profiles. However, all three teachers in the upper grade of primary education (students aged 11–12 years) recalled that they adapt their teaching to learning profiles by presenting the students with different ways to study and give exercises using these study methods. For example mindmaps, rubrics, schemes and other ways to summarize and study a topic are presented to the students (observed in the classroom of Annabeth, school A). Many teachers reported in the interviews that implementing flexible grouping strategies can be difficult because of lack of planning time, or limited materials or infrastructure and gave this as an explanation as to why it does not occur as frequently as they intend. Finally, using students' output as input for learning and teaching is mainly applied during evaluation moments. Most

Table 8: Comparing rank orders

Teacher	Ranking survey	Ranking observations	Ranking interviews	Congruence?
Carmen	1	9–14	4–5	No
Alice	2	5–8	1	Semi
Annabeth	3	5–8	3	Semi
Barbara	4	1	6–9	Semi
Alexandra	5	5–8	6–9	Yes
Beatrice	6	5–8	6–9	Yes
Andres	7	2–4	10–11	No
Anna	8	9–14	12–14	Semi
Chiara	9	9–14	6–9	Semi
Chelsey	10	9–14	4–5	No
Boris	11	2–4	12–14	No
Belle	12	9–14	10–11	Yes
Cristina	13	5–8	2	No
Bob	**14**	**2–4**	**12–14**	**No**

Note: green = top of the ranking, orange = middle of the ranking, blue = bottom of the ranking

teachers claim that they give students help when they are struggling during a test or that students are allowed to use a help tool if they have a (learning) disability. Some teachers try to implement using the output of students in their daily classroom; for example, Chiara describes: "I observe all my students carefully and try to address them individually at least once a day."

This leads to three different rank orders (Tables 5, 6 and 7). For each rank order different teachers are at the top and the bottom. Since the numbering of each rank order is different (due to small numbers in the coding, we have some ex aequos and thus tied scores in the ranking of the observations and interviews) colour codes were added to compare them (Table 8). The first teachers of each rank order are in green, the middle teachers are in orange and the teachers at the bottom of the rank are in blue. This is based on the four highest teachers in the rank order, the five middle teachers and the five lowest teachers in the rank order. If teachers are in the same category for each rank, they are congruent in their reporting of differentiated practices and their observed classroom actions. This is the case for Alexandra, Beatrice and Belle. These teachers are conscious about their differentiated actions, they report and recall similar practices as were observed. If teachers are in the first and second category or in the second and third category, then they are considered semi-congruent. Alice, Annabeth, Barbara, Anna and Chiara report some differences compared to the observations and interviews. There are small differences but overall their reported and observed practices match. If teachers are in three different categories or if they have a mix of the first and third category, they are considered not congruent in their self-reported practices, observed practices and recalled practices. Andres and Cristina are situated in three different categories. Andres is a novice teacher, but Cristina has over 15 years of experience as a teacher. Chelsey, Boris, Cristina and Bob score low on the self-reported practices, but do better in the observed and recalled practices. Carmen reports adopting differentiated practices frequently both in the survey and in the interviews, but during the observations only two practices to adapt teaching were observed. Chelsey reports limited implementation of differentiated practices in the survey and only one example of output = input and adaptive teaching was observed, but during the interview she was able to give many examples. Strikingly, of the six teachers that are least congruent, three are from school C. Also noteworthy is that, for the

observations, all the teachers from school C are situated low on the ranking, whilst in the other two rank orders the teachers from the three different schools are mixed.

In addition, we draw some overall conclusions on the reported, observed and recalled practices. In the survey, flexible grouping strategies were the most reported, followed by students' output = input for learning and teaching. Adaptive teaching practices were reported least frequently, whilst adaptive teaching strategies were most observed and recalled in the interviews. Flexible grouping strategies and output = input for learning and teaching were limitedly observed. It is noteworthy that the number of observed practices and the recalled practices from the interview match with each other, but the main differences are situated between the self-reported practices in the survey on the one hand and the additional qualitative data on the other.

6.2 RQ 2: What encourages and discourages teachers to implement differentiated practices?

During the interview, teachers were asked to describe what facilitates and discourages them in their attempts to implement DI. Although, the question was orientated towards both enhancements and discouragements, all teachers took this moment to express their concerns about what hinders them in implementing DI practices (Table 9). A first wave of concerns is about the impact they (do not) have on students, e.g. the cultural differences are huge or the teacher does not have enough information about the home situation of the student to reach them: "Some students do not even have a table at home for their homework and have to do it on the ground, it is so difficult for us teachers if we do not know what is happening at home" (Chelsey). Or teachers feel that, despite their efforts, they cannot handle all the differences in learning: "I make all these efforts to involve all of my students, and then I'm still unable to reach all of them" (Bob). A second wave of concerns was orientated towards school policy. The lack of a common school policy relating to DI was mentioned by several teachers and in each school. This is a particular issue in schools A and B, where three teachers out of five reported it as a hindrance, whereas in school C only one teacher addressed this. For example, differentiated measures such as using a help tool during a test depends on the individual teacher, which results in students who are allowed to use a help tool in the second grade, not in the third grade and then again in the fourth grade (example from school A). Surprisingly, the three teachers from school C scored lowest overall on being congruent in their self-reported, observed and recalled practices. A third wave concerns colleagues; some teachers feel pressured or overruled because colleagues teach in a totally different way. There is limited collaboration with colleagues. Last, two teachers expressed a feeling of powerlessness towards their own competences and doubt about whether their efforts are good enough: "That's actually the biggest question, are my efforts enough? It's very difficult to actually find an answer to that question" (Alice).

After the reporting of these concerns, we looked in depth at the concerns of the six teachers who are least congruent in their self-reported, observed and recalled practices (teachers with an asterisk in Table 8). Our initial assumption was that the teachers who are most different in their self-reported, observed and recalled practices would also have reported more concerns. However, this cannot be concluded from the results, since other teachers also report several challenges. Looking for possible explanations based on the concerns mentioned by these teachers, it is remarkable that four teachers stated that school policy or, as they put it, the lack of a school policy hinders them in their implementation of DI. Another possible explanation might be the years of teaching experience, but this is also different for each of these six teachers (ranging between one and 40 years of experience). Four out of six teachers reported concerns about school policy. They might be confused between their individual beliefs and (the lack of) school policy. Also striking is that three teachers who are incongruent in their self-reported,

Table 9: Teachers' concerns about implementing DI

Teacher	Teachers' own competences	Students and their background	School policy	Collaboration with colleagues
Andres*			X	
Anna		X		
Alice	X		X	X
Alexandra		X		
Annabeth		X	X	
Boris*		X	X	X
Bob*		X	X	
Barbara		X		
Beatrice		X	X	
Belle		X		
Cristina*		X	X	X
Chelsey*		X		
Carmen*		X		
Chiara	X	X		

*these teachers are least congruent in their self-reported, observed and recalled DI practices

observed and recalled practices are from the same school. Although school-specific explanations did not specifically jump out during the interviews, we assume that there might be some explanatory factors at school level. However, we do not have enough information to establish this and thus must be careful with jumping to conclusions. In addition to the above mentioned concerns, Cristina was the only teacher that expressed concern about whether implementing DI really benefits the students, stating: "Eventually students need to be independent in later life and they have to do it themselves. If I help them too much, they will get used to it and I wonder if this is such a good thing."

7 Discussion

The demand for inclusive classrooms is growing and teachers are challenged to implement teaching approaches to meet this demand. Differentiated instruction (DI) has been proposed to address students' differences in learning and create maximized learning opportunities for every student (Tomlinson, 2013). Although favoured in theory and recommended by educational scientists, DI practices are often integrated into classrooms to only a limited extent (e.g. Reis et al., 2011). This study aimed to get an overview of which differentiated practices are implemented by teachers. Because of possible differences between what teachers think they do and their actual classroom actions, this study explicitly explored the congruence between teachers' self-reported, observed and recalled differentiated practices. Furthermore, the present study investigated what encourages and hinders teachers in their implementation of these practices.

The first focus of this study was to map the differentiated practices that are implemented by teachers in today's classrooms. The survey data provides us with self-reported practices, which are a good indicator for actual classroom behaviour (Haney et al., 2002). However, what someone says and thinks he/she does in a survey or interview can be deepened with additional data for better understanding. To get a more complete image of the actual differentiated practices of teachers, this study adopted a profound form of triangulation by combining survey data with observations and interviews (Olsen, 2004). More specifically, the survey mapped self-reported practices, the observations looked at classroom actions, and during the interviews teachers recalled additional examples of differentiated practices. The combination of these three methods provide us with new perspectives on teachers' implementation of DI. However,

results also have to be carefully interpreted because each method has a different measurement unit and by comparing these results we are treading on thin ice. It was therefore decided to make rank orders of the 14 participating teachers, based on the results for each method. This approach might not be ideal but this way we aim to give interpretation to the data and to provide insight in teachers' implementation of DI. Some conclusions can be drawn if the results from the survey, observations and interviews are put next to each other. Adaptive teaching practices were most frequently observed and recalled in the interviews, but least reported by the teachers in the survey. The observations and interviews gave more in-depth information from which we can conclude that most common DI practices in primary schools are orientated towards adapting teaching to students' readiness, even though studies advocate to also consider students' interests and learning profiles (Alavinia & Farhady, 2012; Tomlinson, 2001; Vansteenkiste et al., 2007). The survey also made it seem as if teachers implement flexible grouping strategies often, while the observations and interviews suggest that this might occur less frequently. Teachers agree that flexible grouping strategies can be applied as a DI practice to deal with students' differences, but in the classroom they usually implement this randomly for practical reasons (e.g. turn your chair and work with the person close to you). This is consistent with conclusions of previous studies, which show that practical obstacles limit implementation of differentiated practices (Hootstein, 1998; Brighton et al., 2005). Moreover, in the interviews teachers stated that flexible grouping strategies are often used to deal with students' readiness. Similar results to flexible grouping are found for output = input. This factor represents the importance of continuous evaluation, feedback and using information from students as input for learning and teaching (Coubergs et al., 2017; Hattie, 2009). Again here, from the examples given during the interviews, the main focus lies on adapting practices during evaluation with the main focus being on students' differences in readiness. For example struggling students are allowed to use help tools or advanced students are allowed to play smart games if they finish earlier. Summarizing the results of the first research question, recent studies show the importance of other factors related to education besides academic achievement. From the survey it seems that teachers agree with this in theory. However, from the observations and interviews it became clear that academic performance is still the top priority of teachers in practice. Considering other differences in learning, besides students' differences in readiness, is rather uncommon. Furthermore, an additional question that rises from the observations and interviews is whether the differentiated practices that teachers implement to meet students' differences in readiness really foster their academic performance as well. For example, the most common practice for advanced students to challenge them, is playing smart games. This is a solution that keeps the students focused and quiet, but the question is of this really fosters their learning needs. Moreover, are these kind of differentiated practices meaningfully implemented?

The second focus of this research was on the hindrances that teachers report to implement DI. Most concerns mentioned by teachers as limiting them in their DI implementation are orientated towards not having an impact on the students. Some teachers attribute the cause for not being able to implement DI to the students, e.g. despite their efforts the students do not respond. Other teachers seem rather insecure and express a feeling of powerlessness towards themselves and doubt about whether their efforts are good enough. This is consistent with the theory of Hawkins (2009) that a lack of confidence hinders DI implementation (Hawkins, 2009). Other concerns were orientated towards the school. A development plan can facilitate DI implementation within the school (Adami, 2004). Many teachers in this study reported that this is currently missing in their school. Moreover, when beliefs about teaching and learning are different among various actors involved in a school, this can limit DI implementation

(Beecher & Sweeny, 2008). There was one teacher that reported not being convinced of the benefits of DI. To implement DI successfully the teacher must consider DI to be important and positive for students (Hawkins, 2009); a teacher who doubts whether DI really benefits the students cannot implement DI to the fullest extent. Overall, results of this research question provide us with more insight why (some) DI practices are limited implemented. The question was asked to teachers what encourages or discourages them to implement DI. None of the teachers mentioned an encouragement why they would implement DI, while they all mentioned hindrances why not to implement DI. In other words, they do not experience positive inducement to implement DI, but are convinced of several reasons why not to implement DI. We know for several decades that practices and actions of teachers are influenced by the teachers' thoughts, ideas, perspectives and beliefs (Schatzki, 1996). Our assumption is that teachers do not succeed in implementing DI to the fullest because their philosophy of DI is not as advanced as their abilities about certain single differentiated practices, which are often part of the curriculum or textbook. On the one hand teachers nowadays are trained in teacher education programmes to use differentiated strategies and DI is included in the curriculum and course materials. On the other hand teachers are only trained in teaching individual practices and not in DI as a pedagogical approach to teaching. This leads to partial implementation of DI.

This study aimed to investigate teachers' implementation of DI as a holistic pedagogical model. While previous studies often focus on a single differentiated practice, this study tried to overcome this shortcoming by adopting the DI-Quest model that considers DI as both a teaching philosophy and a practice of teaching. However, results demonstrated that DI is often implemented fragmented by teachers. This leads for example to teachers only focusing on considering differences in students' readiness when implementing DI or teachers adopting certain differentiated measures without this being an informed choice that will really benefit students' learning. The cause for this limited implementation of DI lies probably in the teachers' philosophy. From a previous study we know that that both the philosophical components in the DI-Quest model (growth mindset and ethical compass) are determining for the extent to which a teachers adapts his teaching to students' differences (Gheyssens, Griful-Freixenet, & Struyven, 2020). Hence, having a growth mindset and an ethical compass on the part of the teacher determines the extent to which that teacher adopts differentiated practices. In the present study, teachers' perceptions and behaviour were examined together and although there was some congruence in the majority of the cases between teachers' perceptions and their behaviour, differences in the perceptions of their actions, and their actual classrooms actions, were revealed. This shows how fragile and how complex the relationship are between teachers' philosophies and actions are when it comes to DI.

8 Recommendations for practice

Our first recommendation is for schools and teachers who currently focus mainly on differences in readiness between students when they implement differentiated strategies. Students differ in more ways than readiness; consideration of differences in interests and learning profiles should also lead to higher levels of motivation (Tomlinson, 2001) and higher learning efficiency of students (Tomlinson & McTighe 2006). Another recommendation is for teachers to adopt flexible grouping practices more consciously and proactively with a specific goal in mind (e.g. working in pairs because a student with a learning disability could use help) and not randomly (e.g. turn your chair and work with the person next to you). A final recommendation is orientated towards the schools. Many studies have shown the importance of a positive and coherent school culture in benefitting DI implementation (Adami, 2004; Beecher & Sweeney, 2008; Fullan, 2007) and this study appears to

confirm this importance. Teaching has for too long been an individual activity. If schools focus more on collaboration and consensus between teachers in terms of DI philosophy, this would benefit the consistency of DI adoption throughout all the years of primary education.

9 Limitations and suggestions for future research

The combination of research methods used to investigate DI implementation in this study provided us with detailed information about teachers' classroom actions. Triangulation by combining survey data with observations and interviews demonstrated whether teachers act according to DI theory, in other words, if they walked like they talked. Therefore triangulation methods are valuable, not only for validation arguments but also for deepening and widening the research questions (Olsen, 2004). Qualitative methods demand a lot of time investment and this is not always an option. Therefore surveys can function as an indicator. The DI-Quest is a validated instrument to measure teachers' perceptions of their differentiated philosophy and practices. However, additional qualitative data demonstrates that this survey has some shortcomings. Moreover, the results showed that the quantitative and qualitative data were not always congruent. Hence, to get an in-depth understanding and more detailed overview, we recommend mixed methods in future research to study the implementation of complex teaching practices such as DI. A downside of qualitative research is often the small sample size, which limits the transferability of the results. Interrater reliability was applied to strengthen the coding process and give more reliable results. However, the results of this research only apply to the 14 participating teachers and without additional research in other contexts it cannot be generalized to other teachers. In addition we had to be careful comparing the data from three different methods in a rank order. However despite the small sample and the method of creating rank orders to present interpretation of the data, some promising information has arisen for future research. In the results, more than half the respondents are congruent in terms of the extent to which they reported implementing DI practices and the practices observed and recalled, meaning that these methods are complementary, which is promising for future research. Educational researchers agree that DI is a complex approach to teaching. It is therefore utopic for researchers to investigate such complex concept, that is considered both a philosophy and a practice and is influenced by several other aspects (efficacy, beliefs, prior knowledge etcetera) with one ideal method. Thus, we recommend that future research also applies triangulation methods. To get a better understanding of why teachers are different in their self-reported, observed and recalled practices, additional methods can be applied. For example, video-stimulated recall interviews could be useful to get more understanding of the process of implementing certain classroom actions (Schmid, 2011). Moreover, this method may help teachers to gain more insight into their own practice (Tripp & Rich, 2012), which leads to interesting possibilities for professional development as well.

Acknowledgements

The authors of this study gratefully acknowledge the support of the POTENTIAL research and valorisation project (www.potentialproject.be), funded by the Flanders Innovation & Entrepreneurship (VLAIO). We would also like to thank the participating teachers for allowing us into their classrooms.

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Samenvatting

Binnenklasdifferentiatie in de praktijk: leerkrachten hun denken en handelen

Binnenklasdifferentiatie (BKD) wordt voorgesteld als een pedagogische benadering om inclusief onderwijs te creëren en wordt beschouwd als zowel een onderwijsfilosofie als een onderwijspraktijk. BKD vereist dat leerkrachten hun onderwijs aanpassen aan de interesses, leerstatus en leerprofielen van de leerlingen door gedifferentieerde praktijken zoals samenwerkingsvormen en formatieve evaluatie toe te passen. Verschillende studies rapporteren echter uitdagingen wanneer leerkrachten differentiërende praktijken implementeren. Aan de hand van verschillende methoden onderzoekt deze studie in welke mate gedifferentieerde praktijken worden toegepast door leerkrachten in het basisonderwijs in Vlaanderen (België). De gegevens werden verzameld aan de hand van drie dataverzamelingsmethoden die onderling vergeleken worden: zelf gerapporteerde vragenlijsten van leerkrachten (N=513), geobserveerde klaspraktijken en interviews met 14 leerkrachten. De resultaten tonen aan dat er niet altijd congruentie is tussen de geobserveerde en de zelf gerapporteerde praktijken. Bovendien brengt deze studie in kaart wat leerkrachten aanmoedigt of ontmoedigt om gedifferentieerde praktijken toe te passen. Onder andere bezorgdheid over de impact op leerlingen en het schoolbeleid worden door de leerkrachten aangeduid als een belemmering voor het toepassen van gedifferentieerde praktijken in de klaslokalen.

Kernwoorden: binnenklasdifferentiatie; basisonderwijs; mixed method onderzoek

Appendix A: Codebook qualitative analyses (based on the framework of the DI-Quest model)

Name	Description	ART
PART 1: **DI-QUEST MODEL**		
Adaptive Teaching	**Teaching strategies for adapting teaching to students' interests, readiness and learning profiles**	
Adapting teaching to INTERESTS	**Adapting teaching strategies to consider students' interests**	
Letting the students choose	The students are given the opportunity to choose what to work on themselves	"They can choose a song, even in another language, that they want to work on" (Belle, during the interview)
Responding to students' living environments	The teacher includes examples from students' living environment during the lesson to trigger them	"Watching a show for children called 'Karrewiet'"(observed in the class of Alice)
Students getting to talk about their own experiences	The teacher gives students the opportunity to talk about themselves and share information with their peers	"Every Monday morning we start with a group conversation about how the weekend went" (Belle, during the interview)
Triggering students at the start of the lesson	At the start of the lesson the teachers triggers students with an example to introduce a new topic	"Watching an introduction video" (observed in the class of Barbara)
Triggering students during the lesson	During the lesson the teachers triggers students by using examples from their living environment, going back to their own experiences, etc.	"The students rebuilt a scale model of the school with Lego during the maths lesson" (observed in the class of Anna)
Using social media	The teacher uses social media to trigger students	"Learning about the history and use of smartphones by using social media" (Annabeth, during the interview)
Playing a short game between assignments	Between assignments the teacher plays a little game with the students	"Students perform a short dance that represents the cycle of water, from the ocean to the clouds" (observed in the class of Barbara)
Adapting teaching to LEARNING PROFILE	**Adapting teaching strategies to consider students' learning profiles**	
Considering learning pace	The teacher considers the learning pace of students	"They work at their own pace" (Alice, during the interview)
Different visualizations	The teacher provides various different visualizations	"During reading assignments, I provide also pictures and schematics" (Chelsey, during the interview)
Practising different study methods	The teacher presents different study methods to the students and lets them practice these different methods	"I teach them different methods to summarize a text" (Bob, during the interview)
Students choosing the execution of an assignment	Students get to choose how they execute an assignment	"I let them choose the way they want to present their assignment to the group" (Alexandra, during the interview)
Adapting teaching to READINESS	**Adapting teaching strategies to consider students' readiness**	
Classroom configurations	The classroom is adapted to the needs of students based on their readiness, for example students who need extra help are seated closer to the teachers	"I always put the weak students in the front of the classroom" (Alice, during the interview)
Contractwork	Students get to work on contractwork that is personalized and has options for remediation and/or deepening exercises based on the student's readiness	"They all have personal contractwork they can work on when they are ready" (Andres, during the interview)

Name	Description	ART
Co-teaching	A second teacher is present in the classroom to assist the main teacher and give support to students who need extra instruction and help	"During reading lesson, a second teacher comes to help with the different reading groups" (observed in the class of Boris)
Deepening of the topic	Deepening of the topic for advanced students	"I always provide additional exercises for the advanced students" (Chelsey, during the interview)
Extra help during break	During the break students get the opportunity to work on their assignments and get extra help from the teacher	"During lunch break, they are allowed to come to the classroom for extra instruction from me" (Alexandra, during the interview)
Extra instruction from the teacher	The teacher helps individual students who need extra instruction	"I often work one-to-one for students who struggle" (observed in the class of Alice)
Help tools during the lesson	Students are allowed to use a help tool during their assignments	"I designed spelling card that students who struggle are allowed to use as a help tool" (Carmen, during the interview)
Peer tutoring	More advanced students get to tutor their peers	"They are allowed to coach each other" (Alice, during the interview)
Remedial measures	Remedial exercises for students with a low readiness	"I provide repetitive exercises" (Chelsey, during the interview)
Smartgames	Students who finish their assignments earlier than the other students are allowed to play some smartgames, for example: crossword puzzles, sudoku, brainteasers, etc.	"I always provide smartgames such as puzzles and sudokus for students who finish early" (Chiara, during the interview)
Individual trajectory for a specific course	Because the readiness of a single student is completely different for a specific course, this student follows an individual trajectory	"There is a new student from a different school and he struggles with maths, he is behind; we organized that he follows the maths lesson of two grades lower to catch up" (Beatrice, during the interview)
Strong students can go to the next topic when comfortable with the previous topic	Students who are more advanced are allowed to continue with the next chapter or topic when they are comfortable with the previous topic	"I provide instruction for the next lesson so when an advanced student is ready, he can go to the next topic" (Bob, during the interview)
Flexible grouping	**Flexible grouping strategies**	
Heterogenous GROUP	The teacher consciously creates heterogenous groups	"For the language lesson today, I've put deliberately weak and strong students together and in a way they really helped each other" (observed in the class of Beatrice)
Homogenous GROUP	The teacher consciously creates homogenous groups	"For reading, we really use different methods so they are put in groups based on their readiness" (observed in the class of Chelsey)
Switching GROUP	The teacher often switches between heterogenous and homogenous groups	"I find it important to not always put the strongest or weakest students together, so I often switch" (Annabeth, during the interview)
Working in heterogenous PAIRS	The teacher let the students work in pairs; the pairs are consciously heterogenous and put together by the teacher	"I put an advanced student together with a student who struggles to work in pairs" (Alexandra, during the interview)
Working in random PAIRS	The teacher let students work together in random pairs	"I let them choose a partner they can work with but tell them to take a different one than their previous assignment" (Belle, during the interview)
Working as INDIVIDUALS	The teacher lets the students work independently	"I prefer to let the students work independently and then give feedback after with the whole class group" (observed in the class of Carmen)
Output = input	**Importance of observing the output of students (behaviour, assessment and evaluation) and using this as input for both the students (in terms of learning) and the teacher (in terms of teaching)**	

Name	Description	ART
Different reading tests based on their readiness	The teacher provides a different reading test based on the readiness of the student; this is communicated with the student and parents	"I provide level A texts, level B texts and level C texts. They are evaluated both on the level and the progress they make" (Chiara, during the interview)
Frequent testing	The teacher tests frequently to gather more output from students' learning	"For spelling, I test frequently so I have more information about their learning process" (Alice, during the interview)
Help tool during test	Students are allowed to use help tools, including during tests	"They can use a help tool during the evaluation if they need to, but it is also reported to the parents" (observed in the class of Alexandra)
Observing classroom behaviour of students	The teacher observes the behaviour of the students' output so he/she can use this as input to adapt his/her teaching	"I observe all my students carefully and try to address them all individually at least once a day" (Chiara, during the interview)
Teacher helps students during a test	If the teacher notices that students are struggling during a test, he/she will come by and give the student(s) a hint or provide some support	"When it is a test and they are struggling, I jump in and help them a little" (Boris, during the interview)
Feedback	The teacher provides the students with immediate feedback	"After the presentation of each group, I provide them with immediate feedback" (Barbara, during the interview)
Using help tools during a test only when a student has special permission	Students are allowed to use a help tool during a test, but only if this student has special permission because of a (learning) disability	"When they have special permission and a certification that they have a learning disability, they are allowed to use a help tool" (Belle, during the interview)
Ethical compass	**Prioritizing the students' needs over curriculum, text books and other influences**	
Input for this variable could not be extracted from the observations and interviews		
Growth mindset	**The teacher has a growth mindset towards the students**	
Input for this variable could not be extracted from the observations and interviews		
PART 2: TEACHERS' CONCERNS ABOUT IMPLEMENTING DI (for this part only the interviews were used)		
Concerns with regard to colleagues	**Teachers feel that they can't implement DI to the fullest extent because of their colleagues**	
Colleagues are doing things totally different	The teacher has the impression that he/she is the only one implementing DI	"When I hear colleagues talk, sometimes they do things the same but often they do things totally different" (Bob, during the interview)
Concerns with regard to the school	**Teachers feel that they can't implement DI to the fullest extent because of the school**	
Lack of a common school vision	The lack of a common vision in the school with regard to differentiated practices makes it more difficult to implement them	"That is something I really miss at the school, a common vision or a common policy in how to deal with these things" (Alice, during the interview)
Concerns with regard to themselves and/or the students	**Teachers feel that they can't implement DI to the fullest extent because of the students**	
Difficult to reach all the students	Despite the effort of the teacher, he/she feels that he/she does not succeed in reaching all the students	"Despite the efforts to involve all of them, and then you're still short" (Bob, during the interview)
Holding students' attention in the classroom	It is very difficult to keep the attention of all students	"It is not only getting their attention; it is holding on to it" (Alice)

Name	Description	ART
Home situation of students	The teacher has little information about the home situation of the students	“Some students do not even have a table at home for their homework and have to do it on the ground; we do not have a sight on their home situation” (Chelsey, during the interview)
Not the desired effect with the students despite the teachers’ effort	The teacher feels that the desired effect with the students is not achieved	“I do all these extra things for a struggling student and then this student still fails, this frustrates me” (Chiara)
Self-doubt: wondering if the actions of the teacher are ever enough	The teacher doubts if his/her efforts are good enough for the students’ learning	“That’s actually the biggest question, are my efforts enough? It’s very difficult to actually find an answer to that question” (Alice)
Wondering whether giving extra support to the students makes them less independent	The teacher worries that if he/she adapts his/her teaching, the student will end up being less independent in later life	“We need to prepare students for the real world out there and I do not know if holding their hand with every step is the right way to prepare them” (Vera)