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A teachers' professional development programme to implement differentiated instruction in secondary education: How far do teachers reach?

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Abstract: This study explores how four teacher teams introduced differentiated instruction into their practice. It draws on Tomlinson's conceptualisation of differentiated instruction to respond to diversity in their classroom. The aim of this study is to document to which extent participating teachers achieved in doing so.
A participatory action research design was set up. First teachers were trained to respond to heterogeneity aided by a tailor-made professional development program. Second an implementing period followed in which the participants worked collaboratively in teacher teams and were coached while implementing differentiated instruction. Field notes and interview transcripts (n = 20) with participants were collected. These were analysed thematically. Results show that teachers succeeded in implementing a range of strategies associated with differentiated instruction. In particularly they use cooperative learning strategies to accommodate heterogeneity. However, as the instructional design was not organized responsively this did not result in a practice of responsive teaching. In this study, the

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PUBLIC INTEREST STATEMENT

One of the main areas of research in the field of education is how to address diversity in general education classrooms. This study explores how four teacher teams introduced differentiated instruction into their practice. The aim of this study is to document to which extent participating teachers achieved in doing so. In a participatory action research design teachers were trained to respond to heterogeneity aided by a tailor-made professional development program. An implementing period followed in which the participants worked collaboratively in teacher teams and were coached while implementing differentiated instruction. Results show that teachers succeeded in implementing a range of strategies associated with differentiated instruction. In particularly they use cooperative learning strategies to accommodate heterogeneity. However, as the instructional design was not organized responsively this did not result in a practice of responsive teaching. We propose to conceptualize the practice of differentiated instruction as a teachers' competence with higher and lower achievement level.

implementation of differentiated instruction is shown to be a complex type of educational change. We propose to conceptualize the practice of differentiated instruction as a teachers' competence with higher and lower achievement level.

Subjects: Inclusion and Special Educational Needs; Multicultural Education; Secondary Education; Teachers & Teacher Education; Classroom Practice; Continuing Professional Development

Keywords: differentiated instruction; in-service teachers' professional development; teacher teams; educational change

1. Introduction

Can we expect teachers to successfully deal with student differences in the classroom? Many teachers find it hard to adapt their practice based on the diversity present in their classroom. Urban areas throughout Europe are increasingly characterized by a superdiverse population (Meissner & Vertovec, 2015). This increased diversity evidently affects educational processes. Spotti (2008) has described classrooms as superdiverse hetero-normative spaces (Gogolin & Duarte, 2013). Schools and teachers face challenges to meet the needs of these new and diverse populations (Severiens et al., 2014). Milner (2015) has stressed the vital role of teachers' instructional adaptions in order to respond to the needs of learners in urban settings. Moreover, the need for a pedagogy of cultural-responsive teaching is argued for by many authors (Gay, 2013; Ladson-Billings, 1994; Tomlinson, 2015; Wlodkowski & Ginsberg, 1995). Gay defines it as 'using the cultural characteristics, experiences and perspectives of ethnically diverse students as conduits for more effective teaching' (Gay, 2002, p. 106).

In Flanders (the Dutch-speaking part of Belgium) educational policy has prompted an increase of diversity in the class. Regulations have facilitated subscription in the school of a students' choice in order to reduce racial and social segregation. This has had a significant impact on the classroom composition in urban schools: students at risk of academic failure are now more dispersed among all urban schools than before (Wouters & Groenez, 2015). In addition to this legislation to stimulate the inclusion of special needs students has increased the urgency for teachers to be able to address the needs of all students in heterogeneous classes (vorming, 2017). Whereas responding to diversity in the past was a point of interest for specific schools in sensitive areas, nearly all urban schools in Flanders are now challenged to rethink their educational processes in order to successfully respond to this reality (Geldof, 2015). It is argued that teachers should provide learning opportunities that "resonate with students" home discourses, as well as their individual interests, social needs, and learning preferences' (Beltramo, 2017, p. 327). Hence, a broad type of teachers' responsivity is needed to accommodate for this diversity. As in many others regions (e.g., Mills et al., 2014; Pilten, 2016) the practice of it remains relatively exceptional in the Flanders region. Present study draws conclusions from a systematic attempt to implement the concept of differentiated instruction at the teacher level, in order to respond to diversity at the classroom level.

1.1. Differentiated instruction: conceptualizing teachers' responses to heterogeneity

Differentiated instruction is a sensitizing concept that is used to circumscribe a variety of strategies for successfully dealing with student diversity in the classroom. Tomlinson (2000) describes it as teachers' response to accommodate the learning process in response to students' interest, readiness level or learning profile. In order to maximize learning opportunities for all students, teachers respond to student characteristics. By consequence, it is typical for DI that focus does not lie on any particular group of interest (gender, social class, ethnicity, special needs). Hence, differentiated instruction is a philosophy and practice of teaching that responds to rather a comprehensive range difference among students', and thus also to cultural differences.

A variety of strategies are proposed to cater for this process of accommodation to students' needs (Tomlinson, 2015). Approaches may be discerned that prompt students to work in collaborative groups or that individualize assignments. The first is aiming at helping students to learning with and from each other. The latter set-up different learning paths that provide tailored instruction and exercise based upon students' characteristics. In addition to this, collaborative case-studies or more advanced types of problem-based learning may also be used to adapt teaching for heterogeneous groups. Differentiated instruction, however, is more than a set of teaching strategies.

In order to be able to design such responsive lessons, teachers must be aware of the diversity among their students. Evidently, teachers' perceptions of the present diversity determine the way they are able to provide differentiated instruction. Attention was drawn to the importance of teachers' perceptions of students capacities (Bruggink et al., 2016a, 2016b). This is why assessment is advocated in order to evaluate students' learning needs. By using formative assessment teachers stay informed on the current and evolving heterogeneity in their class (Andrade & Cizek, 2010; Black & Wiliam, 2009). The cyclical relation between ongoing assessment of student diversity and teachers' subsequent response in the classroom may, therefore, be seen as typical for differentiated instruction (Hall et al., 2006; Tomlinson, 2000). Figure 1 provides a visual representation of this responsive character of differentiated instruction.

The practice of differentiated instruction is supposed to be guided by the teachers' growth mindset and ethical compass (Coubergs et al., 2017). This means that differentiated instruction thrives upon teachers' believes in all of their students' ability to achieve noticeable progress. It also means that instructional design is first of all about responsiveness to the learning needs of students and thus not primarily determined by curriculum or other standards.

In summary, differentiated instruction uses a variety of teaching strategies, it is based on the use of assessment data to respond to diversity, and it relies on attitudes of teachers which aim at maximizing learning for all students. The intertwined relation between these different aspects of differentiated instruction makes it a complex concept to study. Teachers wanting to practice it needs knowledge about instructional strategies (e.g., collaborative learning structures), skills to assess and respond to diversity (e.g., assessment or classroom management, ...) and beliefs to engage in it (e.g., growth mindset, ethical compass). This is why we propose to interpret the practice of differentiated instruction as a teacher competence: an integrated body of knowledge, skills, and attitudes (Korthagen, 2004).

1.2. Theoretical framework and rationale for this study

Although differentiated instruction is advocated by many experts, the introduction of it seems to be a difficult process of change (Louws et al., 2016; Smit & Humpert, 2012). Gaitas and Martins

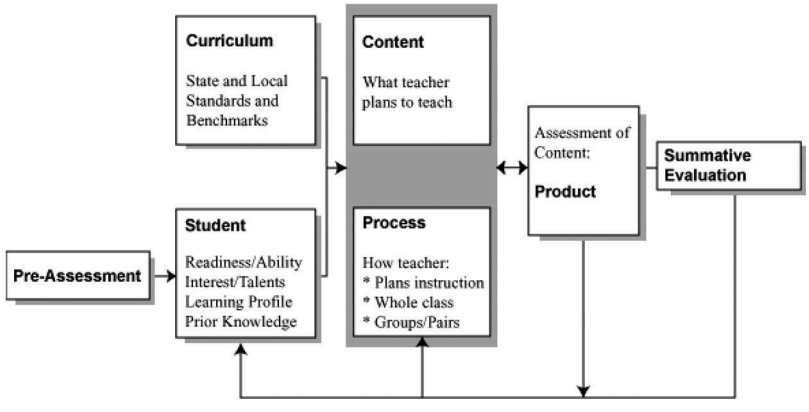


Figure 1. The responsive character of differentiated instruction (Hall **et al.**, 2006**).**

(2017) have specified 5 domains of teachers' perceived difficulties when implementing DI. They are: (1) activities and materials; (2) assessment; (3) management; (4) planning and preparation; and (5) classroom environment. Pilten (2016) referred to teachers' perception of the limited applicability of DI. In-service teacher professional development is advocated in order to foster teaching quality in urban settings (Gaikhorst et al., 2015). Also, specifically for differentiated instruction in-service teacher professional development has been recommended (De Neve & Devos, 2017; Suprayogi et al., 2017). By consequence then the introduction of it could be seen as a process of educational innovation.

The theoretical framework behind such an approach can be found in systems theory. Over three decades of research on educational reform has pinpointed the complexity of introducing educational innovations. Fullan (1993) has described this complexity: "There is an overwhelming amount of evidence that educational change is inherently, endemically, and ineluctably nonlinear. This means that the most systematically sophisticated plan imaginable will unfold in a nonlinear, broken-front, back-and-forth manner. It will be fragmented" (p. 420). It is unclear whether the introduction of DI needs to be a matter of well-planned school policy or rather it would be built on small-scale initiatives at the individual teacher level. Present study, therefore, choses to prompt participants to implement differentiated instruction within the situatedness of their own teaching context (Anderson et al., 1996; Contu & Willmott, 2003).

Much research has been dedicated to stressing the importance of implementing educational innovations as comprehensive school reform. The structural-functional character of it has highlighted the role of teachers as professionals in rational school planning, targeting clear goals within formalized structures. Van den Berg et al. (1999) have added an additional perspective on educational innovation stressing its cultural-individual character. They argue for the role of individual and collective sense-making and of a concerns-based approach (Conway & Clark, 2003). Moreover, they stress the contextual conditions in which each educational innovation needs to be integrated. "The actual implementation of it is always determined by a complex interaction between the innovation content, the local working conditions and the sense-making by the members of the school team" (März & Kelchtermans, 2013, p. 15).

Building on existing literature on school reform and improvement we believe that both the structural-functional perspective on innovations, and the cultural-individual perspective have their rights. Consequently, an ideal context to foster the implementation of differentiated instruction would be one that takes into account both perspectives. Yet, reality appears to be harsher than that. Given the increased diversity in urban classrooms, one would expect much enthusiasm for the introduction of differentiated instruction in schools. However, often school management is reluctant to engage in educational reform to do so. Even when a structural-functional school policy with regard to addressing heterogeneous classes is absent, teachers are confronted with the issue of catering for heterogeneity. Current literature on differentiated instruction largely focusses on actual differentiated instruction practices of teachers (Gaitas & Martins, 2017; Laine & Tirri, 2016; Rytivaara & Vehkakoski, 2015), without the support of teacher professional development. This is why this study focusses on the implementation of differentiated instruction with a focus on teacher teams who intend to learn on this matter. A professional development program was established to train in-service teachers to implement differentiated instruction. It is aimed to find out to which extent engaged teachers can achieve implementing differentiated instruction, without comprehensive school reform. Moreover, we intend to disclose what makes it so difficult for teachers to implement differentiated instruction in their classroom. Therefore, the following research questions were addressed: (1) To which extent teachers in this program managed to introduce differentiated instruction in their practice? (2) What hindrances and concerns did teachers experience when implementing differentiated instruction?

2. Methodology

This study is based on a professional development program with four teams at three secondary schools in a metropolitan area in Belgium (Flanders). It is grounded on an interpretivist research tradition (Lincoln et al., 2011). Through participatory engagement in a community of practitioners, it is aimed to provide insight the dynamics of implementing differentiated instruction, and thus in the complexity of the field of catering for heterogeneity. The freedom for participants in this program to implement differentiated instruction according to the specific conditions of their own school, team and subject guaranteed highly realistic research conditions. In order to tailor the content and design of the training to the needs of participants participatory engagement through regular consultation with the main researcher was prompted. Both during the training and the coaching stage participants were encouraged to develop personal learning targets and to apply a reflective practitioners' attitude (Zwozdiak-Myers, 2012). The quality criteria of trustworthiness and authenticity are based on Guba and Lincoln (1994).

2.1. Participants and research context

Participating schools and teachers were selected within the university college's partner network. Initiative for participation in the program laid initially with the school's principals, yet teachers were all free to participate or not. Teachers' motivation was explicitly checked during the take-in interviews in which teachers engaged to participate in a time-intensive PD program. No schools or teams were refused to participate. Participants formally agreed on the use of the data from this program for scientific research. As their surroundings are seen as decisive for what and how teachers learn (Postholm, 2012), the teachers participating in this professional development program worked as teacher teams within their school (Vangrieken et al., 2013). The choice to work with teacher teams is motivated by Timperley and Alton-Lee (2008) argument about teachers' PD, in which they advocate for collegial interaction combined with external expertise. In each school a teacher team existed of four to six teachers who were willing to engage to introduce differentiated instruction in their classrooms. This voluntary engagement for educational change was the common feature of all teams.

Participants were secondary school teachers, and teams were both interdisciplinary (school A) and disciplinary (schools B and C), such as presented in Table 1. Two different teams participated in school C: one consisted of French-language teachers (grade 8) the other one of history teachers (grades 7–12). The team with the four French teachers is described as C1 and the team of history teachers is C2. The PD design in teacher teams permitted continuous participant interaction, both with each other and the researcher.

The city in which the program took place can be characterized as superdiverse (Blommaert, 2014); however, schools' profiles were largely different. During the intake interviews, schools A and B reported a period of several years during which diversity had increased. School A provides primarily vocational education with a focus on child care professions. Its population is of predominant African origin (Moroccan), also many other nationalities are present. Students'

Table 1. Sample schools and characteristics

School	A	B	C1	C2
Location	Urban	Urban	Urban	Urban
SES %	85,2%	37,3%	15,2%	15,2%
Subject team	Mathematics, French, child care	French	French	History
Schooltype	Vocational	Academic	Academic + small technical department	Academic + small technical department
Participating teachers	5	4	5	6

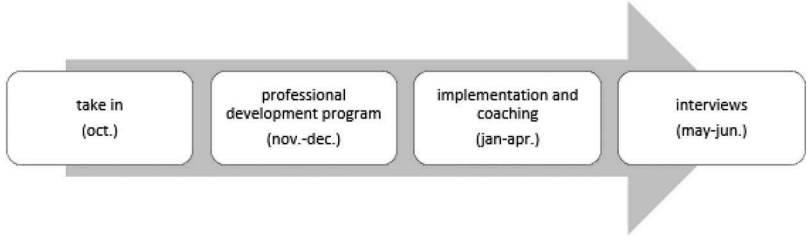
Muslim identity is often an important theme of conflict at school. Teachers at this school are regularly worried about the low motivation of their students. Even compared with other schools in the city, the school has a very high rate of students with low Socio-Economic Status (SES). In Flanders, three parameters are used to determine this SES-level: mother tongue, district of living and graduation level of students' mother. Table 1 provides and overview. Schools' with a larger number of students of low SES-status are considered to be more challenged by superdiversity. According to the participants, the high number of students living in vulnerable condition reflects in all sorts of problems associated with urban education such as truancy, low literacy, etc. During the take-in interview, participating teachers at this school described the tough working conditions in the school. Participating teachers see differentiated instruction as a necessity given the heterogeneity of the school population. School B has a history as an old elitist institute for general education that prepares for academic higher education. The school manager still refers to this history, however its population has changed dramatically over the last two decades. Many teachers at this school still feel traumatized by the turbulences the school has went through. The two main groups of its students are African (sub-Sahara) and Asian (many nations, including Chinese, Nepalese, Indian, ...). Some students have French as a mother tongue, others virtually speak no French, which complicates the work of the participating French-language teachers. These teachers refer to the difficult conditions in which they work, but also claim to believe that differentiated instruction may relieve some of it. School C historically has a similar reputation as school B, it is the cultural and socio-economic composition of its population has nonetheless changed less dramatically. At present, it still has a largely middle class or elite reputation. Cultural diversity is less prominent than at schools A and B. Teachers at this school contend to be triggered by the recent influx of students of a variety of ethnic origins. Although these students still remain a minority in class, teachers feel challenged by the new profiles of their students.

2.2. Program

The professional development consisted of two consecutive phases: first a training based on the aforementioned conceptualization of DI as a teachers' competence, followed by an implementation period in which the participants were coached in team by the first author which a certified teacher educator for both in-service and pre-service teachers. Figure 2 provides an overview of the intervention timeline.

The training was organized in 3 days as presented in Figure 2. All teams gathered at the organizing teacher education institute. An inductive approach was used in which teachers first learnt about practical issues such as teaching strategies and classroom management. Teachers collaboratively prioritized topics. A practice-oriented review study on differentiated instruction was used to introduce practical teaching strategies that are commonly used for differentiated instruction (Coubergs et al., 2013). The most cited options were: cooperative learning, individualized assignments (such as learning contracts or compacting and enrichment strategies), additional instruction (tiered instruction) and naturalistic learning (problem-based learning and case studies). In the second day of the program, the assessment of students was discussed. Theory on and examples of formative assessment (Black & Wiliam, 2009) were introduced in order to familiarize participants with the concept of responsivity in

Figure 2. Intervention timeline.



education. Hall's model for differentiated instruction (Hall et al., 2006), as presented in Figure 1 was used to relate formative assessment to responsivity in a context of differentiated instruction. In the third day of the program the role of teachers' beliefs related to differentiated instruction were discussed. This included discussions on growth mindset, ethical compass and perceptions on student heterogeneity. Attention was given to students' pre-assessment and on the role of formative assessment in differentiated instruction. Participants learned about different strategies to do so, and discussed timing and relevance of such a cyclical approach to learning. Figure 3 provides an overview of the professional development program.

A second phase of the PD consisted of coaching sessions per team in their own school. The teachers were asked to implement DI. Teachers were free to choose the approach they thought the most relevant and realistic for their own context. They all, individually or as a team made a personal selection and interpretation of which elements in the program could be useful for them. During a four-month period, tailored coaching and advice were offered by the researcher in order to prompt participants to use differentiated instruction in their classes. Eventual difficulties and concerns were discussed throughout the period. The main researcher had at least monthly contact with each team. A participatory research-approach was adopted in order to foster an equitable relationship between the teachers and the researcher (Lau & Stille, 2014).

2.3. Data collection

To obtain data about the significance of various circumstances in which the implementation of DI took place, four teaching teams at three different schools were followed. Case studies allowed us to develop thick descriptions and deep understanding of the specific cases and their complexities. Each team of teachers was treated as a case and the whole study was designed as a multiple case study (Yin, 1994). Field notes were collected during the training and coaching sessions. After the intervention, all participants (n = 20) were interviewed about their experiences with the implementation of differentiated instruction. Data were collected through semi-structured interviews conducted by the first author. Each interview lasted for around 30–60 min and was organized individually in order to avoid team pressure and to provide enough time for personal storytelling. The fieldnotes were used to compose a semi-structured topic guide with regard to the implementation of DI (added in Annex 1). As a rule of thumb for the interviews, teachers were always asked to describe specific and concrete practices. Further questions then sought clarification and helped teachers to explain the reasons for their practical choices as well as their beliefs about differentiated instruction.

2.4. Data analysis

Interviews were transcribed and analyzed using Nvivo 10 software. The names of the teachers quoted in this article are pseudonyms, the first letter of the name referring to the teacher team. To

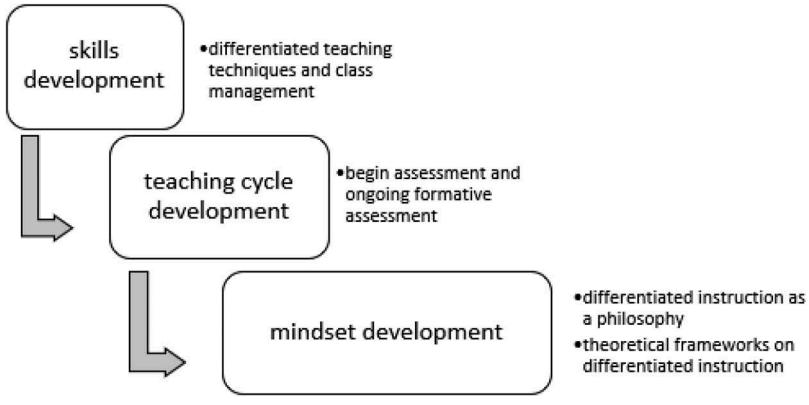


Figure 3. Professional development focused on differentiated instruction.

document the introduction of differentiated instruction interview transcripts were coded inductively. Interpretation was highly essentialist in order to give maximal voice to the teachers (Pinhoa & Andrade, 2015). Emerging themes were analyzed based on the theoretical framework for differentiated instruction that was introduced in the first section. The following thematic clusters were made to analyse the extent to which DI had been implemented: (a) teachers adapt their instructional and classroom management strategies to student diversity. (b) Teachers use assessment to monitor student diversity: pre-assessment, formative and summative assessment are discerned. (c) Teachers enact differentiated instruction with a growth mindset and an ethical compass that is directed to the student. Table 2 presents the coding scheme that was used for this purpose. Table 3 summarizes data of (a) and (b), the third category of data on teachers' beliefs (c) is not summarized by default of sufficient data.

In the results section, it is sought to compare results across cases, and then to detail on specific cases. First, an overview is provided of references across cases to the instructional and assessment strategies used, based on the operationalisation of differentiated instruction. No quantitative data were added, which implies that no distinction was made between participants using a strategy multiple times or only once. In addition to Table 3, thick descriptions were used to provide more insight in the dynamics of implementing differentiated instruction. Participants' quotes were used to illustrate findings. Cross-case similarities and specific dynamics of each case were analysed.

To increase the reliability of the study, the complete data collection and data analysis were regularly discussed in reinterpreted with the second author (which is affiliated with a different institution). This process of reflectivity aimed at giving maximal voice to the participant teachers (Usher & Edwards, 1994). Most noticeable was discussion about the extent to which we could rely on teachers' explicit references to their own teaching beliefs or not. We chose to minimalize interpretations on this matter. Moreover, during the data analysis, the participants were informed of the results. These were shared and discussed with them in order to refine the quality of the statements.

3. Findings

The dynamics of the implementation of differentiated instruction are presented in the following sections. First, cross-case similarities are noted. Then, case-specific findings for each teacher team are elaborated.

Table 2. Implementation of DI coding tree

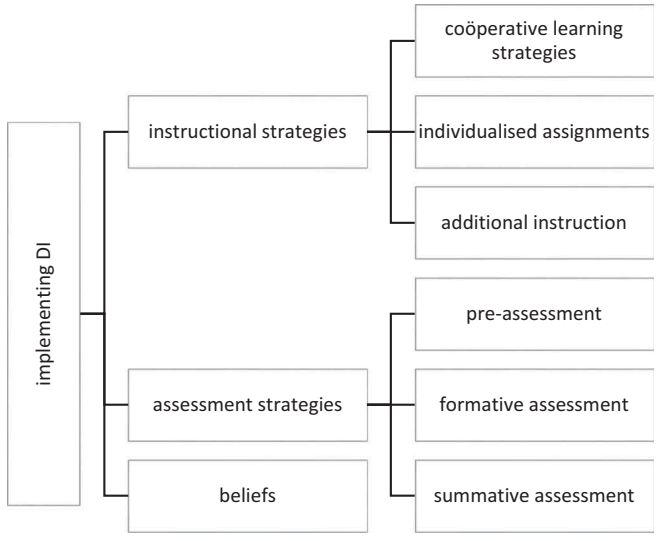


Table 3. Implementation of DI per participant and per team

Identification			Implementation					
participant			assessment strategy			instructional strategy		
pseudonym	team	subject	pre-	formative	summative	cooperative learning	individualized assignments	casestudies & PBL
Anna	A	child care	x	0	0	x	x	x
Amalia	A	child care	x	0	0	x	x	x
Astrid	A	mathematics	x	0	0	x	x	0
Ariana	A	child care	x	0	0	x	x	0
Andy	A	French	x	0	0	x	x	0
Birgit	B	French	x	0	0	x	x	0
Bernard	B	French	x	0	0	x	x	0
Basma	B	French	x	0	0	x	x	0
Barbara	B	French	x	0	0	x	0	0
Fabiola	C1	French	x	0	0	x	x	0
Faizah	C1	French	x	0	0	x	x	0
Farrah	C1	French	x	0	0	x	x	0
Faith	C1	French	x	0	0	x	x	0
Fabienne	C1	French	x	0	0	x	x	0
Cindy	C2	history	0	0	0	0	0	0
Caitlin	C2	history	0	0	0	x	0	0
Calvin	C2	history	0	0	0	x	0	0
Caesar	C2	history	0	0	0	x	0	0
Calista	C2	history	0	0	0	x	0	0
Calgary	C2	history	0	0	0	x	0	0

3.1. Cross-case similarities

Table 3 provides a summary of the most noticeable results of the program per participant and per team. It emerges that teachers were much more focused on adapting their instructional strategies in the classroom, than they were in using assessing to cater for student diversity. Except for one teacher, all participants used cooperative learning strategies in order to respond to student diversity. Moreover, in teacher teams A, B and C1 many participants also used individualized assignments in order to cater for student diversity in their classroom, more specifically they used learning contracts. Some teachers also used additional instruction. Although many teachers expressed practical concerns about the implementation, most of them also reported important successes.

Contrary to this, participants' use of assessment as a basis for differentiated instruction is limited. None of the participants systematically used formative or summative assessment to document the learning outcomes of their practice. They could by consequence only rely on pre-assessment of students' traits to organize DI. Most participants of teams A, B and C1 used pre-assessment, yet none of them did this systematically. The use of pre-assessment as a basis for differentiated instruction was limited to the teachers' intuitive assessment of students characteristics. Although participants were trained for using systematic student pre-assessment, they used rather a intuitive evaluation of students' readiness level. "On the matter of the need to assess every student individually, [...]: that made me think. Actually, I do agree that this is the education of the future, [...]. It's just, very hard to practice this. Certainly here at this school." (Astrid). Many participants stressed that they see the added value of linking assessment to differentiated instruction, yet they often also refer to the need for additional time to be able to do this: "It is really a process of change, that requires lots of time and energy. But it's worthwhile. I would be happy with it." (Birgit) Another teacher said: 'I hear myself saying this so often "no time for that". And actually, I really regret this. But it is a real-life problem".

3.2. Case-specific results

Team A

Teachers of school A showed high enthusiasm to implement what they had learnt during the program. They focused mainly on the implementation of cooperative learning strategies and different individualized assignments. By doing so they intended to provide tailored learning opportunities for students in a highly structured instructional design. Some of the teachers also applied other strategies such as case studies or problem-based learning (PBL) strategies in order to cater for heterogeneity. These teachers were very satisfied with their actions. They expressed multiple times throughout the program that the teaching strategies they had chosen in their perception were helpful with catering for diversity in their multicultural classes. Some teachers in team A were triggered to use formative assessment, or to connect data of prior summative assessment with grouping strategies, however they actually did not succeed in doing it. "I think that as soon as you have this fundamental belief, than you won't allow all students to work at the same assignments. When you would map the learning profile of students, you just have more information, and I believe every bit of information about a student provides an added value" (Ariana). Given this statement it is striking that these teachers did not yet achieve in implementing practices based on these beliefs. Some teachers in school A describe the use of assessment data as a next-level type of differentiation which they seek to implement in the near future: "The most important thing that I remember from the training is how important it is to assess students based on curriculum targets [...]. I really want to improve doing this, [learning to do this] is actually a process that I can't do at once. I want a sort of big chart in which I summarize what all students have achieved and what not" (Astrid).

Team B

Teachers of school B agree on the importance of DI to respond to heterogeneity in their classes. All teachers have to some extent practiced some new teaching strategies such as cooperative

learning strategies. Teachers of lower grades also chose for their students to work on individualized assignments. Some participants have used extended instruction. Several teachers succeeded in implementing several strategies, which were new to them. These teachers shared the perception that this aided them in catering for diversity in their classes. Nonetheless, some of them remained uncertain about the result of it. Sometimes they even doubted whether some of their practices were actually a type of differentiated instruction: "Don't you think that I just did it, last hour? They [the students] received two handouts with extra exercises and corrector keys. They could work at their own pace, and assess their own work. Do you think this is differentiated instruction?" (Basma). Differently stated: some of these teachers' self-efficacy with regard to differentiated instruction could be further developed. Teachers in this school also refer to changes in their own mindset: "Some students would better get started from exercise five, others not [...]. I always wanted to pull anyone with me from one to 10. [...] If they only reach the fifth one, then that's alright for me. I used to pull everybody to 10. I mean, I now focus more on the progress than the absolute results. I think that I focused too strongly on the latter" (Bernard). This quote reveals how the program influenced teachers' beliefs with regard to learning, and hence also the way they now provide learning opportunities for heterogeneous classes.

Team C1

Teachers of team C1 worked intensely together as a team to implement DI. Most of them focused on learning contracts. They appreciated each other's support and reported a need to discuss and evaluate successes and concerns in the team. Some of the participants remained doubtful about the application of it. They regularly referred to practical issues that prevented them from implementing differentiated instruction more regularly, such as a lack of facilities and a need for more time. Many questions about classroom management strategies arose, some of them persistent until the end of the program. "I often found it chaotic. I really find this difficult. I like to be in control, so this letting go [i.e. trust in students' self-regulation] was difficult to me." (Faith). Teachers are convinced about the usefulness of the strategies they practiced, however, they also stress the need for additional future professional development: "I think I need more time to learn on this. We should discuss in our team on how we do it." (Fabiola). It is largely unclear to which extent teachers' self-efficacy had changed throughout the program.

Team C2

Teachers in this team stress how difficult they found it to implement the proposed learning strategies in their practice. Most teachers found it hard to adapt their instructional designs based on suggestions of Tomlinson. The result of this is that some of them did not succeed in implementing them: "I wish that students were addressed at their achievement level, and challenged to their abilities, regardless of the grade that would be the eventual outcome of that, [...]. However, I want to study all this during the summer vacation. During the school year I don't have enough time for this." (Cindy). Others did indeed practice some strategies, but remained doubtful on the outcome of it: "Some people are really pragmatic, and they can just start doing it. I need some more time to reflect on it" (Calvin). Most teachers in this team refer to practical issues such as time and facilities as main hindrances for implementing differentiated instruction. A commonly shared conviction between these teachers is that it would be a very ambitious challenge to implement differentiated instruction based on data-driven decision-making. As history teachers only have a 1- or 2-h course per week per class, they see the idea of building strong relations with classes as largely unachievable. Moreover, the idea of organizing formative assessment as a basis for flexible grouping is also rejected as "impossible" (Caitlin).

4. Discussion

Teachers in urban settings are challenged to be responsive teachers. They need the competence to recognize and address diversity present in their classrooms. The concept of differentiated instruction provides a framework to bring such responsive teaching into practice. In order to be competent to accommodate for heterogeneity among their students teachers need to be acquainted with a variety

of teaching techniques and assessment strategies. Moreover, they also need skills to apply and organize them in practice. Moreover, also teachers' beliefs are vital determinants of the implementation of differentiated instruction. The integration of all this knowledge, skills and beliefs hallmarks teachers implementation of differentiated instruction. This study investigated to which extent teachers, in reality, did practice such an integrated competence after a tailor-made professional development program. In this study, the implementation of differentiated instruction by four motivated teacher teams in three urban schools appears to be a complex type of educational innovation.

Almost all teachers, regardless of the school in which they work, focused their efforts on teaching strategies that are commonly associated with differentiated teaching such as cooperative learning and individualized learning. Although some of them were concerned about students' self-regulation skills or on classroom management strategies in a differentiated classroom, it could be argued that most teachers indeed implemented this aspect of differentiated instruction. Most teachers in teams A, B and C noticed that the practices they implemented indeed were aiding them to cater for diversity in their classes. These findings align with the large body of research that confirms the usefulness of these teaching strategies to foster equitable educational opportunities (e.g., Cohen & Lotan, 1995; Webb et al., 1995).

The teaching competence of differentiated instruction is, however, not solely characterized by an adaption of teaching strategies. Building on the cyclical character of differentiated instruction, an essential feature of the idea is the adaptation of instructional design based on a cyclical process of student assessment (Hall et al., 2006; Tomlinson et al., 2003). Participants' decision-making about instructional design relied on teachers' intuitive pre-assessment of students' needs. More responsive types of formative assessment were not implemented. Comparable contentions have been found in other studies (Gaitas & Martins, 2017; Smit & Humpert, 2012). Although an intensive professional development program was organized, teachers in this study indicate that they still needed more time in order to be able to practice the responsive character of differentiated instruction.

We must buy consequence question to which extent it is achievable for motivated teachers to implement differentiated instruction based on a teachers' professional development program. Present study indicates that the idea of responsive instructional design which is based on an assessment of students learning progress could be described as a more complex or higher type of differentiated teaching. It has been indicated how important it is to strongly relate to groups of students that are seen as "at risk" (Nelson, 2016). Instead of fostering educational equity, we believe the implementation of differentiated instruction without responsive instructional design, potentially even increases the risk of stereotype threat (James, 2012; Steel & Aronson, 1995). Smets (2019) argued that high quality differentiated instruction avoids the one-dimensional characterization of students, and is necessarily based upon high expectations for all students. To guarantee this differentiated instruction by consequence must go further than solely implementing certain teaching strategies which are commonly associated with the concept. Such a data-driven type of implementation of differentiated instruction laid out of the reach of the participants in this study.

The implications of this study for practice are important. The in-service training of teachers in urban settings is a major challenge for teacher professional development (Sleeter, 2001). It cannot be expected that teachers learn to implement differentiated instruction without a well-designed and intensive teacher professional development program (Brown, 2016). Although some scholars are critical about the feasibility of the concept (De Jager, 2017; Pilten, 2016; Wan, 2017), we believe findings in this study illustrate how careful professional development may foster the implementation of differentiated instruction. Most teachers in this study thoughtfully adapted their instructional design in order to better cater for student diversity in their class. Keuning et al. (2017) performed a cognitive task analysis of teachers implementing differentiated instruction. They stress the complexity by discerning five complexity factors: lesson content, group composition, support factors at school or pedagogical level and availability of student data. Present study confirms the complexity of differentiated instruction, and adds the aspect of

responsivity. We believe that to practice differentiated instruction responsively, including its cyclical character, encompasses a higher-order type of differentiated instruction competence. In addition to programs such as the one described in the current study, a more longitudinal is needed. Teacher education institutions, by consequence, must adapt curriculum based on these findings in order to enable teachers to cater for diversity.

Implications for theory-building stretch towards the needed design for studies on differentiated instruction. Reductionism has been a topic of concern for empirical research in the learning sciences (Rogers et al., 2013), and particularly in urban education (e.g., Gordon, 2003; Kozleski & Smith, 2009; Sullivan & Artiles, 2011). Building on the complex nature of teaching in urban settings, it must be discussed to which extent scholarly studies on the topic are genuinely implemented. Moreover, the complexity of implementing differentiated instruction challenges empirical research on differentiated instruction methodologically. Particular studies on the effectivity of differentiated instruction strongly rely on a proper implementation of the concept (e.g., Deunk et al., 2015; Pablico et al., 2017). Current study illustrates the need for a situated approach (Hodkinson et al., 2008; Jacobson et al., 2016) in which local conditions of application and implementation are considered. When statements are grounded on the implementation of differentiated instruction without adequate teacher professional development, it may be doubted to which extent indeed differentiated instruction is indeed assessed.

5. Limitations

Qualitative case study approach was chosen in order to illustrate the dynamics of teacher teams starting to use the concept of differentiated instruction when supported by a PD program. The complexity of the concept prompted us to narrow the focus of the study to teachers in three schools. This permitted us to get insight into the context of the schools. Multiple case-design allowed us to gather a rich dataset on teachers implementation of differentiated instruction. A participative researchers' stance was chosen in which the first author was strongly involved in the actual implementation process. This choice enabled us to build strong mutual relations with participants and allowed us to gather personal insights which often stay hidden for researchers. With regard to participants beliefs, and the role of these beliefs in their instructional practices, we think that future research could improve our insight in this complex process of educational change by clearing out which role these plays in the process of implementing differentiated instruction. In addition to this, a more longitudinal approach would add to our understanding of the long-term implications of teacher professional development programs to cater for student diversity.

6. Conclusions

This study adds to our understanding of the complexity of educational innovations, in particular with regard to differentiated instruction. It draws conclusions based on an in-service teacher professional development program that intended to foster the implementation of differentiated instruction. The implementation of differentiated instruction was based on a strong personal motivation and a tailor-made professional development program. Despite some hindrances, participants did implement a range of teaching strategies associated with differentiated instruction. Most teachers, however, did not implement assessment in order to obtain the responsivity which was aimed at. We suggest to reinterpret the practice of differentiated instruction as a teacher competence and estimate that the responsivity of differentiated instruction is a more complex application of it. Sustained teachers' professional development is needed in order to fosters teachers' responsive teaching skills.

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Author Statement
Both authors are researchers and teacher educators in Belgium. The present study is part of a doctoral thesis of the first author under the supervision of the second author. The general interest that inspires this study is the

ambitious challenge for teachers to respond to diversity in the class. The thesis intends to facilitate teachers to realize the concept of differentiated instruction in their teaching. While intending to practice differentiated instruction, many teachers refer to scientific and non-scientific discourse on learning styles. By systematically and critically analyzing how teacher learns to respond to diversity in the classroom, we aim to bridge the gap between theory and praxis of differentiated instruction.

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Annex 1. Topic guide

Introduction

1. Which moment of the last year has been particularly significant for you? Can you recall it?

Successes

2. Which moment has been the most successful last year? What other moment do you see as successful?
3. What has aided you to practice DI?
4. Which aspects of DI do you regard as achievable and realistic?

Hindrances

5. Which moment has been your worst experience last year?
6. What has hampered you from practicing DI?
7. Are there aspects of differentiated instruction that you did not or not yet practice? What prevented you from practicing it?
8. What do you need to further develop yourself with regard to differentiated instruction?

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