



Chapter 23

Exploring How Teachers' Personal Characteristics, Teaching Behaviors and Contextual Factors Are Related to Differentiated Instruction in the Classroom: A Cross-National Perspective



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Abstract Internationally, differentiated instruction (DI) is suggested as a teaching approach that can help teachers to meet the varying learning needs of students in the classroom. However, not all teachers reach a high level of implementation. Personal characteristics of the teacher as well as teaching quality may affect the degree and quality of DI. In addition, several classroom-, school-, and country characteristics may affect DI practices. In this chapter, literature is reviewed about personal factors, teaching characteristics and contextual factors influencing DI. Findings from the literature are connected to analyses of classroom observation-data collected in six

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countries including Indonesia, the Netherlands, Mongolia, Pakistan, South Korea and Spain. The chapter aims to contribute to insights into factors related to DI and into differences in these associations between the six countries. This chapter concludes by discussing scientific and practical implications.

1 Introduction

Globally, teachers are challenged to meet the learning needs of groups of students with heterogeneous characteristics. Students may, for instance, vary in their readiness, interests and learning preferences (Tomlinson et al., 2003). Heterogeneity in classrooms is becoming larger with increasing inclusion of students with disabilities, different backgrounds and varying experiences into contemporary classrooms around the world (Rock et al., 2008; UNESCO, 2017, 2020a). As suggested in several theoretical frameworks, such as Vygotsky's zone of proximal development (Vygotskii & Cole, 1978), self-determination theory (Deci & Ryan, 1985) and the theory of flow (Csikszentmihályi, 2008), learning occurs best when instruction matches students' needs. Internationally, the question of how to deal with varying learning needs is currently approached by suggesting inclusive educational systems in which differentiated instruction (DI) or other types of adaptive instruction are used to match instruction to students' needs (UNESCO, 2017, 2020a). DI is defined as the adaptation of content, process, product, learning environment or learning time based on information about students' readiness or another relevant student characteristic (such as learning preference or interest) with the goal to better align teaching to students' needs (Smale-Jacobse et al., 2019). Teachers using DI proactively offer different 'routes' in their lessons for students to reach the learning goals. By doing so, the learning can be better adjusted to students' needs. DI has been a much-studied topic across various countries (Sun & Xiao, 2021). Multiple studies

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have shown that DI can lead to better learning outcomes, although more evidence about the effectiveness of different applications of DI is still needed (Deunk et al., 2018; Smale-Jacobse et al., 2019; Steenbergen-Hu et al., 2016).

Although DI seems to entail useful pedagogical-didactical approaches for student-centered teaching, implementation can be challenging. In general, teachers acknowledge the need to address students' varying needs, but they typically show little differentiation in their lessons (Tomlinson et al., 2003). Factors like the knowledge or skills of a teacher may affect the implementation of DI, besides the impact of contextual factors like the school system or cultural beliefs in society (Loreman et al., 2014; UNESCO, 2020a). A recent narrative review of studies from different countries showed that contextual factors like class size, time constraints and density of the curriculum were related to the implementation of DI, as well as personal characteristics of the teacher (Lavania & Nor, 2020). Thus, when aiming to gain insight into how implementation of DI may be improved, we should take into account factors regarding the context in which DI is executed and characteristics of the teacher that may influence implementation. Research into contextual factors that influence the implementation of DI is relatively scarce up to date (Sun & Xiao, 2021). Since factors related to the teacher and the context may vary across educational systems and countries, studying these influences with international data can give valuable insights in similarities and differences across countries.

Helms-Lorenz and Visscher (2021) identified different relevant contextual factors influencing teaching behavior including class size, student performance in the class, school policy, leadership and educational policies of the country. In the same vein, Brühwiler and Blatchford (2011) summarized several factors influencing teachers' adaptive instruction and, eventually, student performance in a theoretical model. At the teacher level, the authors included general characteristics like gender, teaching experience, personal motivation, affect and competency that may influence teaching. Furthermore, variables referring to the context of the classroom like class size and heterogeneity of the classroom are hypothesized to influence adaptive teaching. At a higher level, factors like characteristics of the educational system of the country or region are mentioned. As identified in the dynamic model of teaching (Kyriakides et al., 2009), national and regional educational policy influences school policy, which in turn may affect teaching.

In this chapter, we aim to explore the relationship between the implementation of DI and various personal characteristics, teaching behaviors and contextual factors. We will study this using empirical data from secondary schools in six different countries to explore the relations across a rich set of different contexts. First, let us turn to the literature about the influence of variables included in the study. In line with the model of Brühwiler and Blatchford (2011), we will discuss findings from the literature across different categories: classroom (teaching) processes, teacher characteristics, classroom context, school context and country (educational system).

1.1 Classroom Processes

1.1.1 Differentiated Instruction

Across educational contexts, policy makers and teachers stressed the need to use frequent assessment and to adapt the curriculum towards individual learning needs (OECD, 2012; UNESCO, 2020a; UNESCO, 2017). Yet, observational studies in secondary education found that teachers across different countries in general did not show much DI in their lessons (Maulana et al., 2021; Van der Lans et al., 2017). Nevertheless, teachers' DI can develop in contexts in which DI is explicitly promoted (Bondie et al., 2019; Schipper et al., 2017). In literature on teaching and teaching effectiveness, DI is recognized as one of the key characteristics of effective teaching (Kyriakides et al., 2009; Seidel & Shavelson, 2007; de Grift & Wim, 2014).

1.1.2 Differentiated Instruction and Other Effective Teaching Behaviors

Most models of DI stress the interrelatedness of DI and other teaching behaviors. For instance, in the differentiation model of Tomlinson (2014), DI is said to be influenced by general principles of differentiation like high-quality curriculum, teaching up and continuous assessment. In addition, teaching behaviors like stimulating mutual respect and supporting students to have high expectations of what they can do are important factors that may help set the stage for DI (Tomlinson & Imbeau, 2010). In the description of DI principles by Van Geel et al. (*this book*), general teaching quality indicators like communicating clear lesson goals, introducing the lesson and monitoring students' progress have a central place. The same goes for the model of Smale-Jacobse et al. (2019) in which DI is embedded in a context of continuous assessment, high-quality teaching and curriculum and a supportive learning environment. In that sense, other teaching behaviors are hypothesized to be related to teachers' DI. In some models of teaching quality, differentiation is viewed as a high-quality dimension of general teaching quality indicators like questioning, modeling or assessment (Kyriakides et al., 2009). Observational studies showed that teachers who have highly developed basic teaching skills are typically more likely to differentiate (Van der Lans et al., 2017). DI has often been found to be one of the more complex domains of teaching, clustering together with other complex teaching skills like activating students and teaching learning strategies (Van der Lans et al., 2017). In our study, DI is conceptualized as one of six domains of effective teaching behavior: creating a safe learning climate, efficient classroom management, quality of instruction, activating teaching methods, teaching learning strategies and differentiated instruction (de Grift & Wim, 2014). Interrelatedness between DI and teaching behaviors in other domains was previously found in all of the countries included in the current empirical study (Chun et al., 2020; Maulana et al., 2021).

1.1.3 Other Classroom Processes

Besides the teaching behaviors described above, which were included in our study, there are other classroom processes that may be related to DI. One example is the interpersonal relationship between the teacher and the students. A previous study shows that students rather uniformly perceive teachers who show relatively high-quality DI to be “helpful” or “directing” in their interactions (Van der Lans et al., 2020).

1.2 Teacher Characteristics

1.2.1 Teaching Experience

A personal factor of the teacher that may affect the implementation of DI is teaching experience. Beginning teachers are often still developing basic teaching skills and are generally relatively inflexible in their teaching. Experienced teachers, on the other hand, are generally better at offering challenging curricula, they often have deep representations of the subject matter and are skilled in monitoring and providing feedback (Berliner, 2004). Expert teachers often have a broad pedagogical and didactical repertoire and are typically more able to evaluate students' learning needs (Hayden et al., 2013). This could make it easier for them to flexibly adapt their teaching to students' needs. Fullers' (Fuller, 1969) theory of teacher development posits that teachers typically shift their concern from a focus on themselves to a focus on the task and later on to a focus on the impact of their teaching for students. Secondary school teachers generally experience a shift in focus during their careers, developing from an emphasis on the subject matter to an emphasis on gaining didactical and pedagogical expertise (Beijaard et al., 2000). The latter, more student-centered focus in both theories of teacher development seems to be more in line with the student-centered philosophy of DI.

Teaching experience was found to be positively related to DI in the Netherlands (Van der Pers & Helms-Lorenz, 2019), Indonesia (Suprayogi et al., 2017), and in countries not included in our study like Singapore and the United States (Van Tassel-Baska et al., 2008). However, there are also studies in which less-experienced teachers differentiated better than more-experienced counterparts, for instance in Spain and South Africa (Fernández-García et al., 2019; De Jager et al., 2017). In Spain, the current teacher-training program includes increased attention for pedagogical, didactical and psychological aspects of working with students, which may explain why novice teachers show higher quality DI in this country (Fernández-García et al., 2019). In Mongolia, about half of all teachers have between 1–10 years of experience (Ministry of Education and Science, 2021). In Pakistan, teachers on average have about 7 years of experience with a maximum of around 30 years. In South Korea, teachers in lower secondary education on average have around 16 years of

experience. Since about one third of all teachers are 50 years or older, many new teachers will be starting in the coming years though (OECD, 2019b). Differences in the relations between experience and DI may be caused by variation in the way teachers are prepared for DI in teacher education, in-service professionalization or by differences in educational policy (De Neve & Devos, 2016; De Jager et al., 2017), which stresses the need to take the broader context into account.

1.2.2 Teacher Gender

Teacher gender might be a less obvious influence on DI than experience. However, since there are studies pointing at gender differences in teaching styles, teacher gender is a characteristic worth exploring. In most of the countries included in our sample, there are both female and male teachers in secondary education. In Pakistan and South Korea, there are relatively more female teachers in lower secondary education. In the Netherlands, Spain and Indonesia the proportion of female and male teachers in secondary education is relatively equal (UNESCO, 2021). Alternatively, in Mongolia, more than 80% of all secondary school teachers are female (Ministry of Education and Science, 2021).

When turning to the relations between gender and teaching, there are some studies pointing at advantages for female teachers. For instance, a study using student-ratings found that Spanish female teachers in secondary and vocational education were rated higher than male teachers regarding their implementation of DI and several other domains of teaching (Fernández-García et al., 2019). In the same vein, an observational study executed in the Netherlands found female pre-service teachers to ensure a better learning climate and have better quality of instruction (Maulana & Helms-Lorenz, 2017).

However, there are also studies in which male teachers seemed to have an advantage over female teachers or in which there were little gender effects on teaching quality. In a study in Flanders, for instance, male teachers evaluated themselves more positively on leadership qualities and on helpful/friendly interpersonal behavior (Van Petegem et al., 2005). A study in the Netherlands showed that students evaluated male teachers as more cooperative and friendly than female teachers (Opdenakker et al., 2012). Another study found gender effects in favor of males in teaching learning strategies (Van der Pers & Helms-Lorenz, 2019).

It seems that gender differences in teaching are mixed depending on the context, the measurement instrument and the teaching domains. Findings in favor of males were found regarding classroom management and interpersonal relationships with students. One study executed in Spain reported that females were better in DI (Fernández-García et al., 2019), but other studies did not report on direct relations between gender and DI.

1.2.3 School Subject

There are studies arguing that the way a school subject is perceived by teachers can influence their teaching (Grossman & Stodolsky, 1995). In the countries included in our sample, many different school subjects are taught ranging from about 8–20 core subjects followed by students. Turning to between-subject differences in DI, prior studies did not find evidence for pronounced differences. In a study of Pozas et al. (2020) in which teachers were questioned about their DI, a rather similar response pattern was found for both German and Mathematics. There were slight differences though, with mathematics teachers using (peer)tutoring more and German teachers indicating more use of project-based learning. In a study in which lessons of pre-service teachers in the Netherlands were observed, no significant differences in teaching quality were found across school subjects (Maulana & Helms-Lorenz, 2017).

1.2.4 Other General Characteristics of the Teacher

In addition to the previously mentioned teacher characteristics included in our study, there are other teacher characteristics that could be related to DI. In prior studies, characteristics of teachers like knowledge, growth mindset, beliefs, self-efficacy and professional vision were related to the implementation of DI (Coubergs et al., 2017; Suprayogi et al., 2017; Vantieghem et al., 2020; UNESCO, 2020a; Whitley et al., 2019). There are between-country differences that may affect such teacher characteristics. For instance, in South Korea only top students from high schools can enter teacher-training programs, which makes for highly knowledgeable and skilled teacher-candidates. Conversely, while in countries like Indonesia, Pakistan and Mongolia teaching is a relatively low-paid profession that does not attract many of the top graduates. In addition, the curricula of the teacher training programs and the professionalization initiatives may affect teachers' knowledge, skills and beliefs. There are differences between countries with respect to how well teachers feel prepared for pedagogical and didactical issues in classroom practice. For instance, in Spain and the Netherlands, only about a quarter of all teachers reported to feel prepared to teach in mixed-ability classrooms (OECD, 2019b). In Mongolia, there is increasing attention for teacher training and professionalization, but up to date a wide variety of approaches is used across the country (UNESCO, 2020b). And teacher training programs in Pakistan and Indonesia are not yet up to international standards (United States Agency for International Development, 2006; World Bank, 2015). From the countries included in our sample, teachers are particularly valued and supported in South Korea (OECD, 2016a).

1.3 Classroom Context

1.3.1 Class Size

The majority of studies on class size have reported that within smaller classes, teachers have more care for students' individual needs than in larger classes. Blatchford et al. (2011) found that students in smaller classes received more attention and had more active interactions with the teacher. Another study reported that teachers in smaller classes devoted less time to group instruction and more time to individual instruction, especially in below-average classes (Betts & Shkolnik, 1999). Observational studies in Dutch secondary education showed that, on average, teachers use DI more in smaller classes (Maulana & Helms-Lorenz, 2017; Van der Pers & Helms-Lorenz, 2019). Teachers typically perceive it as a relatively time-demanding and difficult to adapt their instruction to the substantial spread of learning needs in large classes (Roiha, 2014; Wan, 2014). Across OECD countries and economies, teachers who teach larger classes tend to spend less classroom time on actual teaching and learning (OECD, 2019b).

Although overall findings point in the direction of DI being easier for teachers to implement in smaller classrooms, the link between the two is not always clear. For instance, in the study of Suprayogi et al. (2017), Indonesian teachers reported slightly more DI in larger classes. In the study of Brühweiler and Blatchford et al. (2011), class size was not directly related to classroom processes nor student outcomes in secondary education. This illustrates that, although smaller classes may make DI easier, lower class size does not by definition affect teaching nor student outcomes. In fact, teaching quality has been suggested to impact students more than class size (OECD, 2010).

In the countries included in our sample, the average class size differs considerably. In countries like Mongolia, Spain, South Korea and the Netherlands, the average class size is around the OECD average of 21 students (Education policy and data center, 2018; OECD, 2021). In the Netherlands, class size differs substantially between different educational tracks (Van Bergen et al., 2016). In Mongolia, class size differs considerably from around 15 students per teacher in rural areas up to 60 students per teacher in urban areas (UNESCO, 2019). The average class size in Pakistan is typically large, more than 40 students per class is not exceptional. In Indonesia, class size is also relatively large, with estimates of average class size ranging from about 33 to 47 students per teacher (Hendayana et al., 2010; OECD, 2014a).

1.3.2 Other Classroom Context Factors

Besides class size, another factor that may be related to the implementation of DI is the heterogeneity of the classroom. A large spread of learning needs can make it challenging for teachers to cater to individual students (Wan, 2014). On the other hand, external differentiation between classes may impede differentiation practices within the classroom. For instance, in Dutch secondary education students are tracked early on based on (presumed) abilities. Therefore, secondary school

teachers generally feel less need for DI than in primary education (Van Casteren et al., 2017), although there is in fact still large variation in attainment within the tracks (OECD, 2016b). In most countries in our sample, students first follow compulsory lower secondary education in mixed ability classes for 2 to 4 years. This could imply that classes in these countries are relatively more heterogeneous than in Dutch lower secondary education. Nevertheless, about half of all Dutch teachers do report to have more than 10% of students with special needs in their classes, illustrating that there may be other sources of heterogeneity too (OECD, 2019b). In upper secondary education, students are split up across different ability tracks varying from two different levels – an academic track and a vocational/technical track – in Spain, to six different ability tracks in the Netherlands (early tracking). Alternatively, in Mongolia and Indonesia, most students stay in their heterogeneous classes in upper secondary education. However, there are also students that switch to a different institution for vocational/technical education. In Pakistan, students choose between general and technical/vocational education before entering secondary education. After that, students are not split up further based on their abilities either but they do choose between different electives. In South Korea, upper secondary students can enroll in various types of high schools like general high schools, vocational high schools, science high schools or special high schools.

A teacher may additionally let the SES or the cognitive composition of the class influence the way they choose to implement DI, for instance by taking into account that homogeneous grouping could be detrimental for low-achieving students (Deunk et al., 2018). In addition, the cultural composition of a class may drive teachers towards differentiated approaches aimed at culturally responsive teaching (Gay, 2013). In Spain, for instance, an above-average percentage of students is born in another country (OECD, 2016c), which may make classes more culturally diverse.

1.4 School Context

Although the effects of school factors on instructional quality are typically small (Opdenakker & Van Damme, 2007), there are ways that schools can support, or hinder, teachers in their implementation of DI. Several aspects of the school climate may influence teaching and learning. School climate includes school organization, relations in the school community, leadership, available resources and institutional and structural features of the school environment to name a few (Wang & Degol, 2016). In the Netherlands and South Korea, schools have much autonomy over their resources and curriculum, while schools in Spain have somewhat less autonomy (OECD, 2011). In Mongolia, schools have little autonomy in matters of resources or curriculum. Also, in Indonesia and Pakistan, a standardized curriculum determined by the government is followed.

Several studies show that school principals can play an important role in teachers' willingness and ability to differentiate instruction (Goddard et al., 2010; Hertberg-Davis & Brighton, 2006). At the school level, working together with colleagues in a 'pedagogical team culture' may enhance teachers' implementation of

DI (Smit & Humpert, 2012). Additionally, the way schools are set up may influence DI. For instance, schools may vary in flexibility to move between different tracks (Gamoran, 1992). Moreover, school-level practices like providing enough preparation time for teachers may affect DI. Various studies show that teachers often experience lack of time for preparation and implementation of DI (De Jager, 2017; De Jager, 2013; Lavania & Nor, 2020; Roiha, 2014).

1.5 Characteristics of the Country

Based on a large-scale study on teaching quality across European, North-American, Pacific Countries, Canada and Australia, Reynolds et al. (2002) concluded that most factors known from national school- and teacher effectiveness research ‘work’ in different international contexts. However, there are country-specific differences in how teaching behaviors are interpreted and valued. The six countries included in the current study differ in many ways, for instance in the way education is organized, how the teaching profession is set up and valued, and what the classroom context is like. Some specifics of these countries that could affect DI through classroom processes, characteristics of the teachers, and the context of the school have been discussed above. In this paragraph, we will discuss some general country characteristics, policies related to DI and country-specific resources.

International comparisons of student performance show that students from South Korea are among the top performers internationally. Dutch students show above average performance in comparison to other countries and the performance of Spanish students is around the OECD average in the PISA evaluation. Indonesia is positioned among the lowest performing educational systems (Mullis et al., 2020; Mullis et al., 2017; OECD, 2019a). Mongolia and Pakistan are developing countries that are not yet included in international evaluations.

In most of the countries included in our study, countrywide policies aimed at student-centered and inclusive learning have been developed. For instance, in Mongolia, DI and formative assessment have gained a lot of attention through the Mongolia-Cambridge Education Initiative and also, from 2013 on, the “Upright Mongolian child” policies emphasizing equal opportunities and catering to the unique talents of individuals (Government of Mongolia., 2013; Pavlova et al., 2017). In Spain, the government emphasized the need for early diagnosis of problems affecting students’ learning (in the classroom but also regarding access to education) and annual assessment of student performance (Ministerio de Educación y Formación Profesional, 2020). There is also an initiative to provide schools with enough resources for students with specific educational needs. In the Netherlands, knowing how to account for differences between students is part of the standards prospective teachers have to meet before entering the teaching profession, and as such is included in teacher training programs and evaluation criteria for schools (Ministerie van Onderwijs, Cultuur en Wetenschap, 2017). Nevertheless, a lot of Dutch secondary teachers still struggle with fully implementing DI in practice (Van

Casteren et al., 2017). In South Korea, the Master Plan for Educational Welfare with a focus on providing equal opportunities for all students has helped to boost quality of education and to diminish differences in school success caused by students' socio-economic or migrant status (OECD, 2014b). A homeroom teacher functions as a mentor for individual students helping to keep them on track in their development.

Indonesia also has a national policy related to improving teaching quality. However, the country does not have specific policies directed at improving DI or other adaptive teaching practices. Policies directed at improving teaching quality in general have yet to lead to significant improvements (Chang et al., 2014). In Pakistan, there are no specific country-level initiatives aimed at DI either. Studies indicate that Pakistani secondary school teachers rather adopt traditional than students-centred methods of teaching (Andrabi et al., 2013). Whether or not initiatives are employed to boost teaching quality, including DI, teachers in various countries included in our study typically struggle with the implementation of DI (Maulana et al., 2021).

Schools across different countries will probably also vary significantly in the human and material resources they have for accommodating students' learning needs (UNESCO, 2020a). In Indonesia and to a lesser amount in South Korea and Spain, principals reported a shortage of material resources, while shortages in the Netherlands are less pronounced (OECD, 2020). Schools in Mongolia sometimes also experience shortages; for instance, not all schools have access to the internet for pedagogical purposes (UNICEF, 2020). Of the countries in our study, expenditure on education is particularly low in Pakistan and Indonesia (World Bank, 2021). Also, school attendance is a problem in some countries. There are still a lot of children who do not attend secondary education, especially in Pakistan (UNICEF, 2021).

2 Research Questions

In this study, the relationships between personal factors, teaching behaviors and contextual factors and DI are explored across and within different countries. We have different questions guiding this study:

RQ1: Which personal characteristics of the teacher are related to differentiated instruction?

RQ3: Which teaching behavior domains are related to differentiated instruction?

RQ2: To which degree is class size (contextual characteristic) related to differentiated instruction?

RQ4: Are there country-level differences in how characteristics of the teacher, the teaching, and the context are related to differentiated instruction?

Based on the review of the literature, we expect that teaching experience will be positively related to teachers' DI. Since in previous studies other teaching behavior domains were found to be related to DI, we expect to find relations between the other observed teaching behaviors and DI, especially between DI and other relatively

complex teaching behaviors. Class size could be negatively related to teachers' DI, with teachers differentiating more in relatively small classes, although this may not be true for all countries. Since there are large differences in class size across the countries in our sample, the strength of the relation may vary across the different countries. Additionally, there are indications from a Spanish study that females may differentiate more than their male counterparts, but this finding is less clear-cut in the literature. At the school level, some variance may be explained, for instance, because of leadership, practical facilitation of DI and working together with colleagues. At the country level, multiple characteristics may affect how DI is executed and perceived. Policies attempted to stimulate DI like the acts implemented in Mongolia may positively affect DI. In prior studies South Korean teachers were typically found to show high-quality instruction, including DI. In Indonesia and Pakistan, there are no specific country-level initiatives addressing DI, which may lead us to expect less DI in these countries. There may also be between country-differences stemming from differences in how the educational system is set up or how resources are divided. How country-level differences interact with personal- and contextual factors is yet to be explored.

3 Methods

3.1 *Sample and Procedure*

The current study includes observation data of lessons of a subsample of 1822 teachers in secondary education selected from the data of 4643 teachers from six countries involving Indonesia, the Netherlands, Mongolia, Pakistan, South Korea and Spain. Convenience sampling was used to collect each country sample. All teachers participated on a voluntary basis. Typical lessons of the participating teachers were observed in authentic classroom settings. Data were collected in different years ranging from 2015 to 2020. Observation ratings of one full lesson of each participating teacher were used. More information on the country samples can be found in Maulana et al. (2022).

In the original sample, the number of teachers in both South Korea and the Netherlands was considerably larger than in the other countries (e.g. 2–6 times larger than the sample from Indonesia), which might affect the outcomes. In order to better balance the sample, teachers from these countries were randomly assigned into ten subgroups. We randomly selected a subsample of the subgroups from these two countries for inclusion in the analyses. In the main text, we will present the analyses with the balanced sample of 1822 teachers. The descriptives of the first balanced subsample of in total 1822 teachers included in the main analyses are provided in Table 23.1. The results for two other randomly chosen balanced samples and the unbalanced sample are added to the chapter as supplementary materials (see web version) as a robustness check. More information about the variables can be found in the description of the instruments.

Table 23.1 Descriptives of the balanced sample used in the main analyses per country

	Indonesia	Mongolia	Pakistan	South Korea	Spain	the Netherlands	total
Number of teachers	426	352	373	280	114	277	1822
Number of schools	29	51	20	84	29	163	376
Teacher gender: Female	263	300	179	188	76	169	1175
Teacher subject: alpha*	93	111	162	107	41	113	627
Teacher subject: beta*	184	164	177	124	49	93	791
Teacher subject: gamma*	149	77	34	49	24	71	404
Teacher experience in years(<i>M, sd</i>)	16.2 (9.9)	11.1 (8.6)	6.6 (5.3)	11.4 (8.8)	21.0 (9.5)	3.6 (6.8)	10.9 (9.6)
Teaching behavior: Management (<i>M, sd</i>)	2.8 (0.8)	3.0 (0.5)	2.0 (0.6)	3.2 (0.6)	3.4 (0.6)	3.2 (0.6)	3.2 (0.7)
Teaching behavior: Climate (<i>M, sd</i>)	3.0 (0.6)	3.1 (0.5)	2.0 (0.5)	3.2 (0.6)	3.4 (0.6)	3.3 (0.6)	3.0 (0.7)
Teaching behavior: Instruction (<i>M, sd</i>)	2.7 (0.7)	2.9 (0.5)	1.9 (0.5)	3.1 (0.6)	3.2 (0.6)	3.0 (0.6)	2.9 (0.6)
Teaching behavior: Activation (<i>M, sd</i>)	2.3 (0.6)	2.7 (0.5)	1.9 (0.4)	3.0 (0.6)	3.0 (0.5)	2.5 (0.6)	2.6 (0.6)
Teaching behavior: Learning strategies (<i>M, sd</i>)	2.1 (0.7)	2.7 (0.5)	1.8 (0.5)	2.9 (0.6)	2.8 (0.8)	2.0 (0.7)	2.0 (0.7)
Teaching behavior: Differentiated instruction (<i>M, sd</i>)	1.8 (0.7)	2.3 (0.6)	1.9 (0.5)	2.6 (0.7)	2.2 (0.8)	1.8 (0.7)	2.3 (0.8)
Class size (<i>M, sd</i>)	31.5 (7.8)	26.8 (10.4)	48.0 (14.7)	26.6 (5.8)	17.0 (6.5)	23.1 (5.2)	31.0 (13.3)

* alpha subjects: Native- and foreign language subjects; beta subjects: Mathematics and natural sciences; gamma subjects: Social sciences and humanities

3.2 *Instruments*

3.2.1 **Personal and Contextual Variables**

Teachers' gender, school subject and class size were collected by the observers in the classroom. Class size represents the number of students present during the observation. Because of the variety of subjects differing across countries, school subjects were collapsed into three categories: alpha, beta and gamma. Alpha subjects refer to native- and foreign language subjects like Dutch or English. Beta subjects refer to mathematics and natural sciences subjects like science or biology. Gamma subjects refer to social sciences and humanities like history or geography. Subjects in the arts, crafts and physical education were not included in the analyses.

3.2.2 **Observation Measure of Teaching Behavior Including Differentiated Instruction**

To measure teaching behavior in the six countries, the International Comparative Analysis of Learning and Teaching (ICALT) observation instrument was used (de Grift & Wim, 2014). The instrument consists of 32 high-inferential, observable teaching quality indicators, accompanied by 120 low-inferential observable teaching activities. The differentiation scale of the instrument consists of four high-inferential items like "The teacher offers weaker learners extra study and instruction time" and "The teacher adjusts instruction to relevant inter-learner differences" (see Appendix A for all items and corresponding low inference examples of good practices). Each high-inferential item was rated on a 4-point Likert scale with the following categories: '1 = mostly (predominantly) weak', '2 = more often weak than strong', '3 = more often strong than weak' and '4 = mostly strong'. The sum score of these differentiation items was used as the outcome measure of the study. For all of the countries included in this study the scale reliability is acceptable, ranging from .67 in Pakistan to .84 in South Korea.

The items in the ICALT represent the six domains of teaching behavior discussed in the theoretical section including: safe and stimulating educational climate (4 items), efficient classroom management (4 items), clarity of instruction (7 items), activating teaching (7 items), differentiated instruction (4 items), and teaching learning strategies (6 items). Previous research confirmed the six-factor structure of observed teaching behavior, as well as measurement invariance and applicability of the instrument in secondary schools from different countries (Maulana et al., 2021, 2022). Please refer to Maulana et al. (2021) for examples of items in the other teaching domain-scales.

Trained observers observed a full lesson of each teacher using the ICALT. All observers completed an observer training before they executed the observations. A detailed description of the observer training can be found in Maulana et al. (2021, 2022).

3.3 Analyses

Multilevel regression analyses were used to analyze the relations of different variables with DI in R studio using the packages *multilevel* (Bliese, 2021; Bliese, 2016), *nmle* (Pinheiro et al., 2021), *LME4* (Bates et al., 2021; Bates et al., 2015) and *sjPlot* (Lüdtke, 2021).¹

In order to answer research questions 1–3, we used multilevel modeling by adding personal and contextual variables step-wisely, evaluating the improvement of the model fit as well as the specific influence of different personal and contextual variables. In Model 0, the fixed effect of the school level was added to the model. Then, in Model 1, teachers' gender and experience were added as personal case-mix characteristics of the teacher. After this, teachers' school subject was added to the model (Model 2). In Model 3, indicators of other domains of teaching behavior were added to study the hypothesized relations between teaching behaviors and DI. In Model 4, we added class size as a relevant classroom characteristic. In Model 5, country was added to the equation as a fixed effect. Country was added as a fixed effect instead of as a separate level in the model because there were only 6 countries included in the analyses, which is too limited to treat it as a separate level in the model. Lastly, in order to determine whether the relations between personal and contextual characteristics and DI were affected by the country in which the data was collected, we analyzed Model 4 again splitting the data per country to assess possible country-specific differences.

4 Results

In Fig. 23.1, the results of five different multilevel models are presented. Based on Models 1–4, there is a small, significant effect of gender. The effect of gender is negative for males as compared to females. The estimate becomes insignificant ($p = .056$) in Model 5. There is also a small, positive effect of teaching experience on DI. However, the effect becomes insignificant when the other teaching behavior domains are added into Model 3. The figure further shows that DI is related to classroom management, activating teaching, and teaching learning strategies. Adding the teaching behavior domains improves the model fit most strongly (see Table 23.3). To check whether these results were influenced by the subsample that we used, we compared the findings to results in two other random subsamples and in the unbalanced data (see supplementary materials). Across all random samples, positive relations were found between DI and classroom management, activating teaching and teaching learning strategies. At the country level, significant positive estimates were found for South Korea, Pakistan and (all but one sample) Mongolia. Teaching

¹The analyses were performed in SPSS as well as in R to check comparability. The outcomes were nearly identical (see supplementary materials in the web version of this chapter).

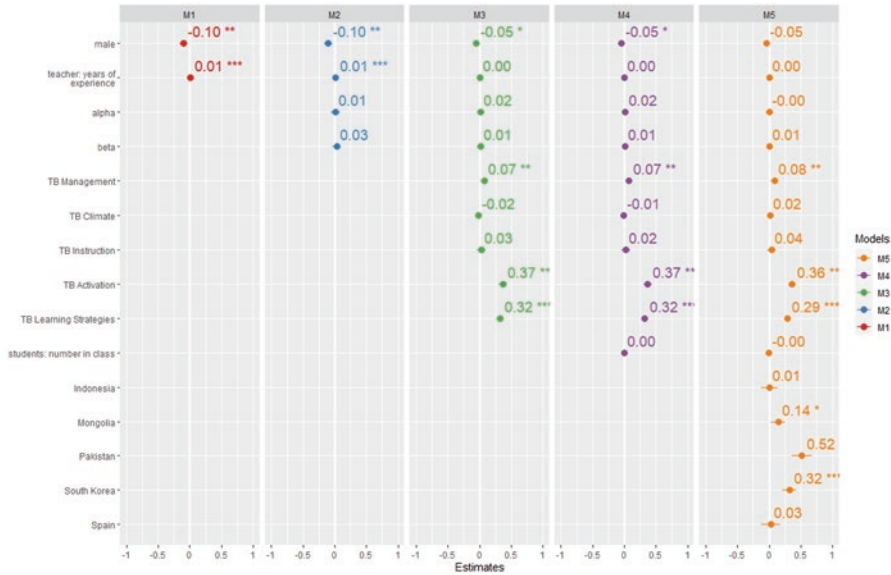


Fig. 23.1 The relations between personal factors, teaching behaviors and contextual factors and DI based on multilevel regression Models 1–5

learning strategies is strongly related to DI in all countries (ranging from $r = .52$ in the Netherlands and Spain to $r = .76$ in Pakistan) as is the quality of activating teaching (ranging from $r = .57$ and $r = .58$ in the Netherlands and Spain respectively to $r = .74$ in South Korea). See Appendix B for the correlations.

The country-level was added to Model 5, showing significantly higher quality DI compared to the Dutch sample for teachers in Pakistan and South Korea, and to a lesser extent Mongolia (see Fig. 23.1 and Table 23.2). The conditional R^2 for Model 5 in Table 23.2 shows that about 70% of the total variance in DI is explained through both fixed and random effects in the model. The ICC indicates that about maximally 33% of this estimated variance could be explained by differences at the school level.

Adding the different countries to the Model significantly improves the model fit (see Table 23.3).

In order to further assess country-level differences regarding how the different personal and contextual characteristics were related to DI, we compared Model 4 across the different countries in Table 23.4.^{2,3} When performing the multilevel analyses for the countries separately, it becomes clear that activating teaching and teaching learning strategies are significant and stable correlates of DI across the different countries. Additionally, in some countries, other teaching behaviors are

²In this case, the full data of South Korea and the Netherlands was used.

³Adding interaction-effects to the full model showed some interactions between variables in the model and different countries, mostly related to the varying effect of experience (see supplementary materials in the web version of the chapter).

Table 23.2 Predictors and estimates of DI based on model 5 of multilevel regression modelling (also presented in the last column of Fig. 23.1).

Predictors	Differentiated instruction		
	Estimates	SE	p-value
Fixed effects			
(intercept)	-0.04	0.09	0.631
Teacher gender male (reference: Female)	-0.05	0.02	0.056
Teacher experience	0.00	0.00	0.840
Teacher subject: alpha (reference: gamma)	-0.00	0.03	0.997
Teacher subject: beta (reference: gamma)	0.01	0.03	0.784
Teaching behavior: Management	0.08	0.03	0.002
Teaching behavior: Climate	0.02	0.03	0.525
Teaching behavior: Instruction	0.04	0.04	0.246
Teaching behavior: Activation	0.36	0.03	<0.001
Teaching behavior: Learning strategies	0.29	0.03	<0.001
Class size	-0.00	0.00	0.530
Country: Indonesia (reference: The Netherlands)	0.01	0.07	0.922
Country: Mongolia (reference: The Netherlands)	0.14	0.06	0.015
Country: Pakistan (reference: The Netherlands)	0.52	0.08	<0.001
Country: South Korea (reference: The Netherlands)	0.32	0.06	<0.001
Country: Spain (reference: The Netherlands)	0.03	0.08	0.744
Random effects			
σ^2 teacher level	0.14		
τ_{00} school level	0.07		
ICC	0.33		
N school	376		
Observations	1822		
Marginal R ² / conditional R ²	0.542 / 0.694		

Table 23.3 Model fit indices of the different multilevel models presented in Fig. 23.1

Model	df	AIC	BIC	logLik	Model Fit	Test	Likelihood Ratio	p-value
Intercept (GLM)	2	3850.1	3861.1	-1923.0	3846.1			
Model 0: Intercept + random effect	3	3071.3	3087.8	-1532.6	3065.3	GLM-0	780.8	<.0001
Model 1: Adding teacher gender + teacher experience	5	3047.8	3075.4	-1518.9	3037.8	0-1	27.4	<.0001
Model 2: Adding teacher subject	7	3050.7	3089.3	-1518.4	3036.7	1-2	1.1	0.5685
Model 3: Adding teaching behavior domains	12	2084.1	2150.2	-1030.0	2060.1	2-3	976.6	<.0001
Model 4: Adding class size	13	2083.9	2155.5	-1029.0	2057.9	3-4	2.1	0.1445
Model 5: Adding countries	18	2031.4	2130.6	-997.7	1995.4	4-5	62.5	<.0001

Table 23.4 Multilevel Model 4 specified for all of the different countries in the sample

<i>Predictors</i>	Indonesia		Mongolia		Pakistan		South Korea		Spain		The Netherlands						
	<i>Estimate</i>	<i>SE</i>	<i>p</i>	<i>Estimate</i>	<i>SE</i>	<i>p</i>	<i>Estimate</i>	<i>SE</i>	<i>p</i>	<i>Estimate</i>	<i>SE</i>	<i>p</i>					
Fixed effects																	
(intercept)	0.19	0.19	0.322	-0.03	0.19	0.887	0.23	0.21	0.14	0.126	0.29	0.45	0.524	0.33	0.09	<0.001	
Teacher gender: Male	-0.01	0.04	0.891	-0.16	0.06	0.006	0.05	0.04	0.202	0.03	-0.09	0.12	0.464	-0.02	0.02	0.380	
Teacher experience	-0.00	0.00	0.666	-0.00	0.00	0.498	0.00	0.00	0.709	0.00	0.003	-0.01	0.01	0.018	0.00	0.003	
Teacher subject: Alpha	-0.01	0.05	0.776	0.02	0.06	0.674	-0.04	0.06	0.466	0.04	0.690	0.14	0.15	0.353	0.03	0.027	
Teacher subject: Beta	-0.03	0.04	0.508	-0.01	0.05	0.885	0.01	0.06	0.889	0.04	0.691	0.19	0.15	0.202	0.12	<0.001	
Teaching behavior: Management	0.02	0.05	0.597	-0.02	0.07	0.753	0.14	0.05	0.004	0.04	0.135	0.13	0.13	0.311	0.16	<0.001	
Teaching behavior: Climate	-0.05	0.06	0.400	0.13	0.06	0.038	0.02	0.04	0.547	0.04	0.093	-0.19	0.12	0.126	-0.03	0.03	0.220
Teaching behavior: Instruction	0.02	0.07	0.774	0.20	0.09	0.021	0.11	0.06	0.065	0.05	0.064	-0.14	0.20	0.470	-0.10	0.03	0.002
Teaching behavior: Activation	0.30	0.07	<0.001	0.31	0.07	<0.001	0.17	0.06	0.009	0.34	<0.001	0.81	0.20	<0.001	0.38	0.03	<0.001
Teaching behavior: Learning strat.	0.42	0.05	<0.001	0.20	0.07	0.002	0.51	0.05	<0.001	0.26	<0.001	0.19	0.10	0.080	0.26	<0.001	
Class size	0.00	0.00	0.689	-0.00	0.00	0.896	-0.00	0.00	0.016	0.00	0.049	-0.01	0.01	0.554	-0.01	0.00	0.006
Random effects																	
σ^2 teacher level	0.14		0.12		0.08			0.13				0.22		0.26			
τ_{00} school level	0.10		0.08		0.00			0.06				0.09		0.03			
ICC	0.41		0.39		0.01			0.3				0.29		0.1			
N schools	29		51		20			142				29		428			
N observations	426		352		373			860				114		2518			
Marginal R2 / conditional R2	0.467 / 0.685		0.418 / 0.646		0.669 / 0.671			0.511 / 0.655				0.423 / 0.589		0.356 / 0.417			

significant predictors like classroom management (the Netherlands and Pakistan), learning climate, and clarity of instruction (Mongolia). In Pakistan, the Netherlands and South Korea, a small negative effect of class size was found indicating that better DI was related to smaller classes. In the Netherlands and South Korea, teaching experience was significantly related to DI. On the other hand, the effect of experience was small and in the reverse direction in the Spanish sample. In the Mongolian sample, a negative effect of gender in favor of females was found. This may be an artefact of the fact that there were few male teachers in the sample. In the Netherlands, alpha and beta subjects were found to be related to higher quality DI as compared to gamma subjects. The percentage of the variance explained at the school level is relatively small, especially in Pakistan and the Netherlands. Overall, there were many commonalities across the countries, but we also found some country-specific influences of personal and contextual factors on DI.

5 Discussion and Conclusions

In this study, we have addressed research questions about how characteristics of the teacher, the teaching and the teaching context are related to teachers' DI and about how these relations differ across countries. Starting with the personal characteristics of the teacher: in our sample, the hypothesis of a small gender effect on DI favoring females was confirmed. Our finding is in line with previous research on gender differences in teaching quality (Fernández-García et al., 2019; Maulana & Helms-Lorenz, 2017). When looking into the country-specific results, the benefit of females is most profound in the Mongolian sample in which only 17% of the teachers was male, which may have affected this finding. Furthermore, a small positive effect of teaching experience was found. This is in line with previous empirical studies (Suprayogi et al., 2017; Van Tassel-Baska et al., 2008; Van der Pers & Helms-Lorenz, 2019) and theoretical assumptions that teachers, overtime, tend to shift their focus from themselves to the learning process of their students (Beijaard et al., 2000; Fuller, 1969). Nevertheless, the positive relation of experience and DI across countries is relatively small and even reversed (experience is negatively related to DI) in Spain. The latter can be caused by the fact that less experienced teachers in Spain tend to be better trained in their initial education and professionalization to address individual students' needs (Fernández-García et al., 2019). The significant relation between experience and DI in Spain and in the Netherlands could also be affected by the fact that the sample in the Netherlands was relatively inexperienced (average experience of 3 years) and the sample in Spain was relatively experienced (average experience of 21 years). Possibly, relations with DI are more profound in these specific groups of teachers. Overall, in our sample, the relations of both gender and experience with DI are small, and they become non-significant when adding teaching behavior indicators to the model. Nevertheless, the fact that they are significant predictors of DI in some of the countries shows that it is interesting to include these personal factors in further investigations. We did not find strong

evidence of differences in relations with DI between school subjects. Only in the Dutch sample, teachers from alpha and beta subjects generally showed higher quality DI than teachers in gamma subjects. More research would be needed to gain insights into differences between specific subjects causing these variations. National-level studies may provide more insight into differences between the execution of DI in specific school subjects within the county.

Indicators of effective teaching behavior were shown to be the strongest correlates of DI in our models. In particular, teachers' ability to manage the classroom, to activate students and to teach about learning strategies were found to be related to teachers' DI. The strong relations between activating teaching, teaching learning strategies and DI are in line with previous studies showing these domains of teaching being clustered together as relatively difficult teaching domains for teachers (Maulana et al., 2021; Maulana et al., 2015; Maulana et al., 2020; Van der Lans et al., 2017). The relatedness of these teaching behaviors can also be traced back to the literature. For instance, expert teachers from the Netherlands stated that they used DI as a means to stimulate students' self-regulative behavior, which is in line with stimulating learning strategies (Keuning et al., 2017; Van Geel et al., 2019). In addition, activating teaching can be connected to DI when teachers deliberately differentiate within the didactical approaches they use to activate students. The relatedness of DI and classroom management was also reported before in literature (Prast et al., 2015). As Tomlinson and Imbeau (2010, preface) write "classroom management is the process of figuring out how to set up and orchestrate a classroom in which students sometimes work as a whole group, as small groups, and as individuals". Teachers who are not able to ensure an orderly and efficient lesson will probably not succeed in flexibly adapting the organization towards DI. But it may also work the other way around; providing students with instruction matching their learning needs may help learners into a state of flow (Csikszentmihályi, 2008) and cultivate a higher sense of competence and autonomy (Deci & Ryan, 1985), which in turn may prevent disorderly behaviors.

Overall, class size was not significantly related to DI over and above the influence of other teaching behavior domains. This is in line with prior findings in secondary education (Brühwiler & Blatchford, 2011). For good teachers who teach in a well-organized, effective manner, some variation in the number of students may not directly affect the quality of their differentiation. Nevertheless, class size was significantly related to DI in some countries. This was the case in Pakistan, South Korea and the Netherlands in which the classes were above average in size; this may make DI more challenging. However, overall, teaching quality seems to be more determining for DI than class size (OECD, 2010).

The variance explained by the school level was limited, even in countries like the Netherlands and South Korea where schools have relatively much autonomy. We did find that teachers in some countries – South Korea, Mongolia and Pakistan – showed higher levels of differentiation relative to teachers in the Netherlands. In Mongolia, classes are relatively heterogeneous and there are specific policy developments aimed at improving individual students' learning processes that may have stimulated teachers' application of DI (Government of Mongolia, 2013; Pavlova et al., 2017). South Korean teachers are typically highly skilled and receive high-quality training and professionalization which may facilitate teaching quality. The

finding that Pakistani teachers showed relatively high-quality DI was somewhat unexpected since educational policies in Pakistan do not specifically address DI and prior research found teachers to show relatively traditional types of teaching (Andrabi et al., 2013). Nevertheless, teachers in Pakistan do have to teach in relatively large, heterogeneous classes with a big spread of learning needs. In such a context, DI seems a logical approach to keep all students on track. Additionally, implementation of DI in Dutch secondary education may be limited since teachers in secondary education may hold the notion that DI is less needed because of the rigorous tracking system (Van Casteren et al., 2017). The fact that teachers in Indonesia showed relatively little high-quality differentiation in reference to other countries is in line with previous studies (Maulana et al., 2021). This may be explained by the fact that DI is not adequately included in educational policies at the country level nor in teacher training or professionalization programs. The fact that Spanish teachers did not show higher quality DI than teachers in the Netherlands may partly be affected by the relatively experienced sample in this study. In Spain, inexperienced teachers were found to implement DI better than more experienced counterparts (Fernández-García et al., 2019). Also, policies regarding attending to individual differences are relatively new and it may take some time before they affect daily classroom practices.

Although we can hypothesize about country-specific circumstances that may explain differences in correlates of DI, more in-depth studies are needed to verify such influences. One finding that is consistent throughout our study though, is that across and within the participating countries, teaching quality in other domains of teaching – particularly activating instruction and learning strategies – is related to the implementation of DI.

Scientific and Practical Implications On the scientific level, the fact that activating teaching and teaching learning strategies are positively related to DI is in line with a stage-like framework of teaching in which these relatively difficult domains of teaching cluster together (Maulana et al., 2021; Van der Lans et al., 2017). The relatedness across the domains could also adhere to the idea that these teaching domains can be clustered into a broader overarching domain aimed at student-centered teaching or student-support (compare the model of Praetorius et al., 2018).

On a practical note, the relatedness between different domains of teaching may imply that educators aiming to stimulate DI are best off targeting a broad development of teaching behaviors that may facilitate DI. For example, (prospective) teachers could be taught how to manage the classroom well in order to teach them skills useful for managing different instructional routes. Alternatively, related teaching behaviors may be taught in interaction. For instance, teacher educators could prompt teachers to activate their students by using differentiated activating approaches suitable to students' learning needs. By helping their students to monitor their own learning and by encouraging the use of learning strategies differentiated to students' needs, teachers could connect the dots between differentiation and self-regulated learning. Lastly, we found that personal and contextual factors could affect the implementation of DI to a certain extent. Teaching does not happen in a vacuum and professionalization initiatives should thus take the teachers' characteristics and context into account.

Limitations Although this chapter explores the characteristics of the teacher, the teaching process and the context of the classroom, school, and country with observations from a broad range of educational contexts, there are some limitations. First, although observation measures are suitable to capture a lot of information in authentic situations, the observation instrument used in this study does not capture all aspects of DI. The concept was measured using certain specific indicators focusing on convergent differentiation (aimed at supporting weaker students) and on differentiation of instructions and processing. Other forms of DI such as differentiation of learning materials, differentiating the end product and making adaptations in the learning environment are underrepresented. Future refinement of the instrument could help to capture a more comprehensive operationalization of DI. In addition, the observational data do not give insights in the reasoning of the teachers when implementing DI. Further research is needed to get more insight in the why's and how's of the teaching behavior (Gheysens et al., 2021; Vantieghem et al., 2020). Additionally, although the lesson observations give valuable insights into classrooms across the globe, only one lesson of each teacher was included. Across the sample, the mean scores presumably give a good indication of the average DI of teachers. Nevertheless, data from one lesson may be less suitable for reflection on individual qualities of teachers. In studies that aim to give insights on the individual level, more lesson observations should be included (Van der Lans et al., 2016).

Secondly, although the data from the individual countries are sufficiently large and relatively representative, teachers participated on a voluntary basis. This means that the current sample may not include specific groups of teachers needed for making inferences at the country level. Hence, caution against the generalization of findings to the country level is warranted until replication studies with broader and more representative samples are available.

Lastly, only a limited number of variables about personal- and contextual factors were collected because of practical reasons. There are relevant variables that were not included into our study like heterogeneity of the class (Tomlinson et al., 2003), team collaboration in the school (Smit & Humpert, 2012), lesson materials and curriculum (Van Geel et al., 2019), teacher beliefs and self-efficacy for implementing DI (Suprayogi et al., 2017; Whitley et al., 2019) and professional vision (Gheysens et al., 2021; Vantieghem et al., 2020). This study offers an insightful starting point, but further studies including more personal-, pedagogical-didactical and contextual characteristics are needed to shed more light on how teachers' DI is related to personal characteristics, teaching and context.

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Appendix A

The DI-scale of the ICALT observation instrument

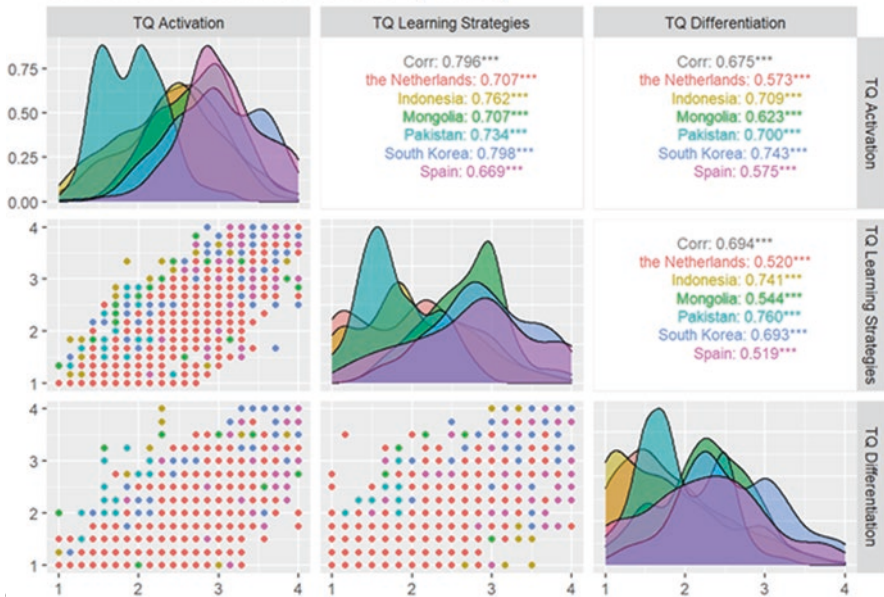
.		Indicator: The teacher...	Examples of good practice: <i>The teacher ...</i>	Observed
Differentiated instruction	23	...evaluates whether the lesson aims have been reached	1 2 3 4 ...evaluates whether the lesson aims have been reached	0 1
			...evaluates learners' performance	0 1
	24	...offers weaker learners extra study and instruction time	1 2 3 4 ...gives weaker learners extra study time	0 1
			...gives weaker learners extra instruction time	0 1
			...gives weaker learners extra exercises/practices	0 1
			...gives weaker learners 'pre- or post-instruction'	0 1
	25	...adjusts instructions to relevant inter-learner differences	1 2 3 4 ...puts learners who need little instructions (already) to work	0 1
			...gives additional instructions to small groups or individual learners	0 1
			...does not simply focus on the average learner	0 1
	26	...adjusts the processing of subject matter to relevant inter-learner differences	1 2 3 4 ...distinguishes between learners in terms of the length and size of assignments	0 1
			...allows for flexibility in the time learners get to complete assignments	0 1
			...lets some learners use additional aids and means	0 1

Note. *The ICALT instrument is freely available upon request. However, do note that use of the instrument requires extensive and proper training. Examples of high and low inference indicators of the other teaching behavior domains can be found in the paper of Maulana et al. (2021)*

Appendix B

Correlations between DI and the 'activating teaching'- and 'teaching learning strategies' scale of the ICALT across the countries in our

correlation 3 most difficult domains by country



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