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Sixty seconds about each student–studying qualitative and quantitative differences in teachers' knowledge and perceptions of their students

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Abstract
This study explored the content and nature of teachers' knowledge and perceptions of their students. The knowledge and perceptions of seven Dutch secondary school teachers regarding the same 33 students in one second-year school class were studied. Each teacher was invited to tell (in 60 s per student) how he/she perceived and what he/she knew about, each individual student. Interview data were analysed using both qualitative and quantitative methods. Results showed within- and between-teacher differences in the content, amount and evaluative nature of their knowledge and perceptions. In addition, there were within- and between-student differences in how their teachers knew and perceived them. The results suggest that teachers' knowledge and perceptions of their students varies per teacher-student combination and substantiate an interpersonal nature of teachers' knowledge and perceptions. To understand the function of teachers' knowledge and perceptions of students for teaching, future research should focus on how different knowledge and perceptions lead to differential educational trajectories for individual or specific groups of students.

Keywords Adaptive teaching · Teacher knowledge and perceptions · Teacher-student relationship · Student characteristics

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1 Introduction

Internationally, there is an increasing plea that education should become more learner-centered (Reigeluth and Carr-Chellman 2012; Watson and Reigeluth 2008). More than two decades ago, McCombs and Whisler (1997) described learner-centred education as

> a perspective that couples a focus on individual learners (their heredity, experiences, perspectives, backgrounds, talents, interests, capacities, and needs) with a focus on learning (the best available knowledge about learning and how it occurs and about teaching practices that are most effective in promoting the highest levels of motivation, learning and achievement for all learners). (p.8)

Many scholars (e.g., Corno 2008; Parsons et al. 2017; Tomlinson et al. 2003) have followed this perspective, stating that learners are distinct and unique and that their individual differences must be taken into account to provide them with the necessary challenges and opportunities for learning. For their own part, schools and educators turned to this perspective and are currently transforming their practices into more learner-centred forms of education. Accordingly, teachers are expected to adapt their instructional practices to the needs of individual students (Mills et al. 2014; Onderwijsraad 2017; Prud'homme et al. 2006). However, adapting teaching in response to the uniqueness of students has proved to be complex and not without controversy (Deunk et al. 2018; Peterson et al. 2016; Van Geel et al. 2018). Teachers could use more support in how to teach adaptively (Parsons et al. 2017). Therefore, more insight is necessary into how teachers connect individual learner characteristics with specific teaching practices.

Teachers' knowledge of their students is seen as a prerequisite for making adequate instructional adaptations (Corno 2008; Tomlinson et al. 2003) and as an important domain of their whole knowledge base (Woolfolk 2013). It is assumed that teachers must know their students well before they can adjust and personalise their instruction. However, opinions about what knowledge teachers should have about their students differ. Studies with different conceptual and methodological backgrounds have provided different insights into the student characteristics that are salient for teaching and how such characteristics become meaningful for teachers. For example, there are different views on whether and why knowing and adapting to students' learning styles is important (Gregory and Chapman 2007; Hall and Moseley 2005) or whether and how teachers take students' cultural backgrounds into account (Glock 2016; Hachfeld et al. 2015). In addition, it has been argued that determining which student characteristics are relevant for teaching is connected to teachers' individual approaches to instruction and their classroom context (Cochran-Smith et al. 2016; Mayer and Marland 1997). These insights raise the question of whether the meaningfulness of specific student characteristics can be determined outside the particular context of a teacher and his or her class. However, the personal or contextual nature of teachers' knowledge and perceptions of their students has not yet been well studied.

Understanding the nature of teachers' knowledge and perceptions is also important for helping teachers identify (a) what they need to know about their students and (b) what is relevant to adapt their teaching to. These questions seem especially important in secondary education, where teachers see students only for a limited time (a few lessons per week) and teach many students (multiple school classes). In these settings, teachers are restricted in getting to know individual students and responding to their unique characteristics. To further explore the personal and contextual nature of teachers' knowledge and perceptions, this study examines the knowledge and perceptions of seven teachers of the same students from a secondary school class.

2 Theoretical framework

2.1 Adaptive teaching and teachers' knowledge of their students

Adaptive teaching is conceptualized as teaching in which teachers use their knowledge of their students to make instructional decisions (Corno 2008; Hoffman and Duffy 2016; van de Grift et al. 2014; Vogt and Rogalla 2009). Such decisions can lead to instructional variations between students within a lesson. Teachers have been seen to vary their questions and assignments to match a student's abilities, interests and personality (Parsons et al. 2017; Peterson et al. 2016). However, adaptive teaching is complex (Corno 2008; Mills et al. 2014; van Geel et al. 2018). To respond adequately to differences across students, teachers need to have sufficient subject-matter knowledge and a variety of teaching skills (van der Lans et al. 2017; van Geel et al. 2018). In addition, teachers need to know their students and, further, how to link this knowledge with teaching strategies that will positively affect student learning (Banks et al. 2005; Corno 2008; Deunk et al. 2018; Watson and Reigeluth 2008). For example, there are several ways to help struggling students. In order to choose an adequate strategy, the teacher needs to know why a student is struggling and connect this with specific strategies adequate for the situation.

Teachers make adaptive decisions based on their knowledge of their students. However, the educational literature regarding the knowledge and perceptions of students that teachers have, and how this relates to practice, is diffuse. Using the framework of Fenstermacher (1994), we distinguish three different research approaches in this paper. These approaches vary in their epistemological backgrounds, methodologies used, and conclusions drawn about teachers' knowledge and perceptions of students. The first approach values what is known (by scholars) about what teachers should know of their students. It is mostly prescriptive and is often described to generate *knowledge for teachers.* The second approach values what teachers express about what they know and believe is important to know about students. It is mostly descriptive and sheds light on the *knowledge of teachers*, or practical knowledge. The third approach values the knowledge teachers have of their students that can be inferred by studying teachers' actions in response to a given student. Studies using this approach produce *knowledge about teachers and teaching*. Across these approaches, one finds different views on the content and nature of teachers'

knowledge and perceptions of their students, that is, which student characteristics are important to know and why those attributes are salient.

Approach 1: *Knowledge for teachers* regarding meaningful student characteristics

Studies using this approach shed light on the knowledge teachers should have, that is, they discuss knowledge *for* teachers. For example, there are several conceptual frameworks and educational theories designed to help teachers adapt their instruction to individual students' needs. Most frameworks focus on several specific student characteristics that teachers should address in their adaptive practices. Banks and collegues (2005) emphasised the importance for teachers to know about their students: '*who they are'*, '*what they care about'*, '*what languages they speak*' and '*what customs and traditions are valued at their homes*' (p. 264). Other authors have endorsed the importance of acting on students' sociocultural and socioeconomic backgrounds (George 2005), readiness, interest, and learning profile (Tomlinson et al. 2003), achievements on standardised tests (Prast et al. 2015) or learning preferences (Tulbure 2011). Underlying these conceptual frameworks are both ideological arguments and empirical research. Investigations from within this framework shed light on specific student characteristics (i.e., ability, motivation) that can influence their learning. Because such characteristics differ among students, they should be taken into account when teaching students. Examples of such characteristics are student personality (Poropat 2009) and emotion regulation skills (Camacho-Morles et al. 2019); metacognitive abilities; and psychosocial factors such as self-esteem, reading habits, gender and other characteristics (Woolfolk 2013). These characteristics stem from various disciplinary backgrounds such as sociology, social and instructional psychology, and pedagogy, and reflect a broad range of student attributes. Taken together, the studies in this approach imply that teachers' knowledge about their students should be breadth, i.e. teachers should know and take into account many aspects of their students. Such prescriptive frameworks imply that what is important or relevant to know for teachers is rather universal and alike for all teachers.

Approach 2: *Knowledge of teachers* regarding meaningful student characteristics

The second research approach studies the knowledge base that teachers possess regarding their own students. It sheds light on the knowledge and perceptions instructors have and use in their adaptive practices by studying those student characteristics they regard as important. Mayer and Marland (1997) studied such knowledge, as found in 'experienced and highly effective' primary school teachers, by interviewing them. These teachers expressed knowledge of their students' work habits/attitudes, abilities, previous schooling, personalities, family/home background, playground behaviour, and peer relationships. In addition, these teachers experienced their knowledge as critical to functioning effectively in the classroom. Other researchers (Blease 1995; Kagan and Tippins 1991; Paterson 2007), applying the same kind of approach, came to similar conclusions: teachers are knowledgeable of a variety of student characteristics and this knowledge enables them to optimise

student learning by tailoring educational programmes. Although these studies are somewhat dated, they show that teachers have and value knowledge about a variety of student-characteristics.

The range and breadth of teachers' knowledge of their students seems aligned with the suggested breadth by the '*knowledge for teachers'* research approach. However, there have been both commonalities and differences in the student characteristics that various teachers have identified as meaningful for their teaching. Such differences have been both within studies and between studies. This variety (or even, at times, discrepancy) across teachers has not been well explored. Mayer and Marland (1997) described qualitative differences in teachers' knowledge bases. For example, one teacher focused more on students' (inter)dependence whereas another teacher focused more on students' family backgrounds. Kagan and Tippins (1991), studying the knowledge of student-teachers about their pupils, concluded that there were quantitative differences between the student-teachers participating in their study, that is, some student-teachers knew more about their students than others.

In addition, such differences among teachers have been interpreted in different ways. For example, Calderhead (1983) argued they could be explained in terms of teacher experience, with beginning teachers having broad knowledge and expert teachers having more selective understanding of their students. Kagan and Tippins (1991) attributed the differences they found to teacher quality, with student-teachers who did showed meager professional growth knowing less about their students than those who showed greater professional development. However, in the study of Mayer and Marland (1997), all teachers were highly experienced and effective, yet still differed in their knowledge bases. These authors concluded that what is relevant for teachers to know might be context-specific and connected with individual approaches to teaching; thus, teachers must identify which features of their students are personally and situationally relevant.

Approach 3: *Knowledge about teachers and teaching* regarding meaningful student characteristics

The third research approach considers the association between teachers' adaptive practices and student characteristics, separate and apart from the teachers' own perspectives. This approach produces knowledge *about teachers and teaching*. In these studies, classroom observations of instructional behaviours or assessments of student learning were associated with information about specific student characteristics. Studies using this approach have demonstrated that teachers can have knowledge of their students' characteristics yet still fail to use this knowledge to (observably) adapt their practices (Savage and Desforges 1995). Moreover, teachers have shown to be adaptive to student characteristics of which they were not aware (Consuegra et al. 2016; Good and Brophy 1974). Studies within this third approach have examined 'teacher perceptions of their students', rather than 'teacher knowledge of their students'. For example, Rubie-Davies (2010) studied the association between teacher expectations and perceptions of student attributes such as motivation, cognitive engagement, and self-esteem. Although knowledge and perceptions are different constructs, they both focus on student characteristics that are important

for teachers' adaptive practices. It has been shown that teachers' perceptions of students' study behaviour, (disruptive) classroom behaviours, and academic abilities are related to student characteristics such as sex or socioeconomic and cultural background (Consuegra et al. 2016; Ready and Chu 2015; Timmermans et al. 2016; Walters 2007). Student characteristics thus can be relevant for adaptive practices without teachers' awareness; as well, not all student characteristics expressed as relevant by teachers themselves might actually influence their teaching.

Similar to studies using the second approach, studies applying this third approach (Rubie-Davies 2010; Timmermans et al. 2016) have found differences across teachers in how student characteristics affect their practices. For example, teachers have been found to differ in the extent to which students' cultural-ethnic background influence their perceptions of ability (McKown and Weinstein 2008). Not all teachers take all student characteristics into account; further, the meaning attributed to a given student characteristic, in terms of instructional approach, differ widely across teachers.

2.2 Teachers' knowledge and perceptions of their students

It has been argued (Moon 2005; Tomlinson et al. 2003) that teachers should base their adaptive practices solely on formal assessments of student characteristics, because this would lead to more reliable and valid knowledge. However, teachers' knowledge of their students is often based on a mix of formal and informal assessments (Corno 2008; Mayer and Marland 1997). Moreover, teachers' knowledge of their students is often not objective; rather, their knowledge reflects subjective interpretations of students (Walters 2007). For example, teacher utterances about students, such as 'always achieves high grades', 'is very smart', 'rather works alone', or 'is a bit autistic' all reveal what teachers know and perceive about their students. However, this knowledge ranges from objective facts to subjective interpretations. Altogether, then, the adaptive practices of teachers are not based on the objective characteristics of students alone, but also on teachers' subjective knowledge and perceptions of students' characteristics. To emphasise this subjective nature, what teachers know about their students' characteristics is referred to in this study as *teachers' knowledge and perceptions of their students*.

2.3 The present study: exploring differences in teachers' knowledge and perceptions of their students

From the perspective of adaptive teaching, teachers are often urged to make educational decisions with a focus on individual students and their unique characteristics. However, it remains unclear which student characteristics are important to take into account in adaptive teaching and, as well, what determines this importance. On the one hand, several frameworks prescribe important student characteristics that seem universal, in that they are equally important for all teachers and all students. On the other hand, other studies (*cf.* Mayer and Marland 1997; Rubie-Davies 2010)

shed light on differences among teachers and emphasise the personal and contextual nature of teachers' knowledge and perceptions of their students. In yet other studies (*cf.* Banks et al. 2005; Kagan and Tippins 1991) differences among teachers are associated with better or worse teaching qualities and subsequent student learning. Empirically, however, the function of teachers' knowledge and perceptions of their students remains underexplored.

It is important to gain insight into the student characteristics that teachers take into account – and, further, how these characteristics become meaningful. Teaching various students differently can lead to more optimal learning opportunities for all. However, teachers who let student characteristics influence their practices and who teach individual students differently have also been shown to decrease opportunities for some students, rather than increasing them for everyone (Rubie-Davies 2010). Thus, adapting education to the unique characteristics of individual students per se is not desirable. Also, insufficient and/or inadequate knowledge can produce inadequate teaching practices (van Geel et al. 2018). To support teachers in making adequate adaptions, it is important to shed light on: (a) their knowledge and perceptions of their students, and (b) how those perceptions came about and how they affect the person's teaching style. This is especially salient in secondary education, in which teachers have to get to know over 100 individual students, teach multiple students simultaneous, and see their students for a limited amount of time each week.

To understand how specific student characteristics become meaningful, and whether and how this is registered across teachers, we wanted to systematically map differences in teachers' knowledge and perceptions of their students. To gain further insight in the personal nature of this content, we strived to study differences among teachers who instruct in similar situations (cf. Verloop et al. 2001). Therefore, in this study, the knowledge and perceptions of several teachers of the same group of students were studied. Specifically, teachers' knowledge and perceptions of all *individual* students in one classroom were explored. In earlier studies, teachers' knowledge and perceptions of their whole class were explored, with teachers portraying some students very deeply, while other students were not or scarcely addressed (Blease 1995; Civitillo et al. 2016; Kagan and Tippins 1991; Mayer and Marland 1997). The design of this study is unique in that the knowledge and perceptions of several teachers teaching the same classroom of students were investigated. This research context made it possible to study differences across teachers in how they perceived the same students and, as well, differences among students in how they were perceived by several of their teachers.

The central research question was: *How do teachers' knowledge and perceptions of their students vary between teachers and between students?* To answer this question and map the variety of responses among both teachers and students, the following sub-questions were formulated: (a) How do the knowledge and perceptions that teachers have of their students vary within and between teachers? (b) How do the knowledge and perceptions that teachers have of their students vary within and between students? Because earlier studies suggest that teachers' knowledge and perceptions of students differ in both in content and amount, we also focused on both.

3 Method

To answer the research questions, a research methodology was used in which qualitatively gathered data were analyzed both quantitatively and qualitatively. Teachers' knowledge and perceptions of their students were assumed to be contingent on teachers' personal frameworks (Mayer and Marland 1997). Sensitivity to the personal context is a strength of qualitative research because it allows participants to think from their own personal framework without being influenced or prompted by external input (Bryman 2006). However, to also shed light on quantitative differences and be able to compare teachers' knowledge and perceptions systematically, a quantitative approach was needed. Quantitative approaches yield results that can be related to data from other samples. Therefore, data from the interviews were handled in a two-fold process. First, they were analyzed qualitatively. Second, the data were transformed to quantitative data in order to perform quantitative data-analysis and to explore quantitative differences between and within teachers. Third, a qualitative data-analysis strategy was used to deepen the findings.

3.1 Research context and participants

This study was part of a project that aimed to develop, and shed light on, the adaptive practices of eight secondary school teachers. The school in which these teachers worked was making a shift towards '*personalised learning*'. Personalised learning is an educational approach that aims to adapt teaching to the learning needs of individual students or subgroups of students (Murphy 2016). There were between 900–1000 students enrolled in the school that (located in a small town in the Netherlands). The teachers in the research project participated in a professional learning community (PLC) in which they discussed how to best personalise their lessons for the students. The teachers all taught the same group of students in their second year of secondary education; their discussions within the PLC focused on this particular group. Ethical approval was given by the Ethics Committee of the Radboud Teachers Academy.

The study started with eight teachers. One teacher stopped teaching before all data were collected. The investigation thus reports on the data of seven teachers, teachers A–G. The teachers varied in age ($M = 40.14$, $SD = 10.21$), years of experience ($M = 13.57$, $SD = 8.06$) and sex (one male, six female). Each teacher taught a different curriculum subject. The subjects were mathematics, science, history, Dutch, French, German, and English. The school class consisted of 34 students, 19 boys and 15 girls, ranging from 12 to 14 years old. We removed all data from a student with family ties to one of the researchers participating in the larger research project but not involved with the data collection of this study, leaving 33 students for data analyses. The group was a mixed-level school class of the upper two levels of general education in the Netherlands, that is, 'HAVO' (higher general education, comparable with 0-levels) and 'VWO' (pre-university track, comparable with A-levels). The class followed bilingual education, meaning that science, history, math,

Table 1 Per teacher, the subject, years of experience (Y/Experience) working as a teacher, years of experience teaching these specific students (Y/students), and the number of lessons a week teaching these students (Lessons/week)[a]

Subject	Teacher A Science	Teacher B French	Teacher C Dutch	Teacher D History	Teacher E Math	Teacher F German	Teacher G English
Y/experience	11	30	5	11	22	5	12
Y/students	1	1	2	2	2	1	2
Lessons/week[a]	3	2	4	2	4	2	4

[a]one lesson has a duration of 50 min

and English were taught in English. The subjects Dutch, French, and German were taught in the subjects' language.

We aimed to study the differences in teachers' knowledge and perceptions of their students among those teaching in a similar context. However, there were some contextual differences that may have impacted teachers' knowledge and perceptions of their students. First, depending on the subject, the teachers taught the class for two to four 50-minute lessons a week. Second, four teachers had already taught the class the year before. Table 1 presents an overview of the teachers, their subjects and both contextual factors. Because it has been suggested that teachers' experience impacts their knowledge and perceptions (Calderhead 1983), this information is provided in the table as well.

3.2 Data collection and procedure

To elicit teachers' knowledge and perceptions about their classes, we interviewed each teacher individually about each individual student. All interviews took place at the end of November and beginning of December 2017. This period was chosen for two reasons. First, all teachers had taught the class for at least 2 months and were expected to have started 'personalising' their lessons towards individual or subgroups of students. Second, the results of the first summative assessments of each subject were known. The teachers thus had opportunities to interact with all students and were expected to make decisions based on their knowledge and perceptions of their students.

As mentioned, the interview was part of a larger project. One aim of the project was to – together with the teachers – filter out important factors when adapting lessons for individual students. Learning which student characteristics were important for such decisions was an important part of the project; the interview served as one of the tools to achieve this. To ensure confidentiality interviews, were held in a quiet and private conference room. The researcher who collected the data for this study also observed one or two lessons by each teacher and interviewed the teachers about these lessons. The researcher and teachers thus were familiar with each other; as well, the researcher had observed the students for several lessons.

3.3 The instrument

Although the interview procedure was highly structured, the content of the interview was left open to be responsive to teachers' personal frameworks. The goal of the interview was to elicit each teacher's knowledge and perceptions of their students that was most likely to be relevant for their adaptive teaching. However, as indicated above, teachers are not always aware of the student characteristics that are relevant for their teaching practices (Consuegra et al. 2016; Good and Brophy 1974; Savage and Desforges 1995). Interviewing teachers explicitly about the knowledge they perceive as relevant might therefore not be appropriate to elicit salient student characteristics. Interviewing assumes that relevance is subjectively experienced and available for report and intentional use (Winkielman and Schooler 2012). Therefore, the teachers were not asked directly about their knowledge perceptions of their students that they experienced as relevant.

Teachers were asked three general questions that were aimed to elicit their own knowledge and perceptions of a student. These questions were '*Describe this student, what image do you have of him/her?' 'What do you know about this student?'* and '*What does this student need in order to achieve important goals?'.* At the start of the interviews, the interviewer stated the aim of the research (to learn which student characteristics are relevant for adaptive teaching, according to teachers). This statement was followed by emphasising that what was relevant probably was very personal; and, for this reason, the interview had an open procedure. Next, the interview procedure was explained and the three questions were presented. The questions were printed on a paper and placed in front of the teacher during the interview. Pertaining to the last question, the interviewer indicated that 'important goals' could be both subject related and, as well, more pedagogical in nature. The interviewer did not repeat the questions during the interview and did not ask any follow-up questions. The questions were meant to elicit teachers' most salient knowledge and perceptions about their students; teachers were not asked to answer each question separately.

To prompt the teachers, a profile photo of each student was used. The image of each student was placed in front of the teacher and, while placing the photo, the researcher stated the first and last name of the student. The teachers had exactly one minute to elaborate on each student. After each minute, a timer rang. The teacher could finish the sentence he or she had started, after which the profile photo was removed and a new student was presented. In all interviews, the students were presented in the same order.

From a pilot version of the interview, we had learned that interviewing teachers without this highly structured format was both time consuming and ineffective. Teachers revealed very detailed information about some students and were often anecdotal. Many parts of the interviews became redundant because teachers gave several different examples of the same student characteristic. In addition, some of the information seemed not relevant for teachers' daily practice. Therefore, we set a time constraint of 1 min per student. This constraint urged teachers to express their first associations and to lower the probability of disclosing knowledge and perceptions that were not relevant for their daily practices or that were redundant.

Most interviews took less time than the planned 45 min because teachers did not need the full minute for several students. Teachers did not use anecdotes and were less repetitive in their knowledge and perceptions of individual students than the teachers in the pilot version. After discussing half the students, there was a short break, during which the interviewer asked the teacher how he/she experienced the interview procedure. Almost all teachers stated that they were surprised either how well, or in most instances how poorly, they knew their students. For example, while Teacher D said, "*Fine. And I think I am not doing too bad of a job in knowing the students"*, Teacher G expressed that she became aware of her lack of knowledge. She stated, "*I experience the class as lovely. However, I do notice that being so specific about what you know of them, it disappoints me.'* The teachers did not experience the interview as unnatural or restrictive. The researcher, who was familiar with the teachers, experienced no differences in interaction with the teachers during this interview (compared to the interviews about teachers' lessons). This 'sixty-seconds about your student' interview method seemed an appropriate means of eliciting teachers' knowledge and perceptions of their students.

3.4 Data analysis

The data analysis was performed in two steps. The first step was the development of a coding scheme (Miles et al. 2014) and coding of the data. In the second step, the data were transformed to quantitative data followed by quantitative analyses of variance and qualitative compare-and-contrast analyses to explore the variability in teachers' knowledge and perceptions of their students.

3.4.1 Step 1: development of the coding scheme

All interviews were transcribed and anonymised by providing each teacher with a letter (A–G) and each student with a number (1–33). All anonymised transcripts were uploaded in Atlas.ti (Version 7).

For development of the coding scheme and the transcripts, the first researcher worked together with a research assistant who was not involved in the data collection. To develop the coding scheme, both deductive as well as inductive coding were performed on the interview transcripts of three teachers. In the deductive round, the codes were derived from earlier empirical studies on teachers' knowledge of students. Next, the index list of the Twelfth edition of *Educational Psychology* (Woolfolk 2013) was scanned for student characteristics. The first author and the research assistant went through the index and selected all entries that were related to learner characteristics (e.g., ability, behaviour, motivation, learning preferences). Related items were grouped (for example: attention, work attitude and task involved learners were grouped into work behaviours/attitudes). This resulted in a coding scheme including 29 student characteristics. After the coding of the transcripts of three teachers, the coding scheme was revised by deleting codes that were not used by the teachers. To further develop the coding scheme and to establish intercoder reliability and agreement the three-phase procedure described by Campbell et al. (2013) was used.

In the first phase, all interview fragments that could not be coded with the existing code list were discussed. Many students were described with affective remarks such as 'sweet' or 'nice'. These do not refer to specific learner characteristics but, instead, address the affection of the teacher for a student. The code *'affective evaluation'* was added to the coding scheme. In addition, many teachers stated that they did not know a student very well or did not know specific information about a student or 'I do not really know this student', or 'Actually, I have no idea what his/her current grade is'. Therefore, we supplemented the coding scheme with the subcode '*visibility'*. Similar to the affective evaluations of students, this information seemed to reveal more information about the teacher and his or her relation with the specific student. Therefore, we named this category '*teacher-student relationship characteristics*'.

Moreover, during this phase, the evaluative codes '*positive'* and '*negative'* were added to the coding scheme. Teachers often were outspokenly positive or negative in their statements about students. The evaluative nature of teacher perceptions has been shown to affect teachers' expectations and adaptive practices (Rubie-Davies 2010; Timmermans et al. 2016). Important information about the knowledge and perceptions of teachers seemed to be lost if this distinction was not included. In a positive statement a teacher indicated that a student had much of a quality or was good at something, for example, 'very smart student' (positive abilities), 'very motivated' (positive motivation) or 'has a good study approach' (positive work behaviours/attitudes). In the same way, a negative statement indicated that a student was lacking in a characteristic, for example, 'is very insecure' (low self-esteem), or reflects a negative evaluation of a specific characteristic, for example, 'has bad working behaviour' (negative work behaviour/attitude).

After the development of the coding scheme on the full transcripts of three teachers, we drew a random sample of interview fragments from all teachers' transcripts. A fragment included one teacher describing one student. Independently, the two researchers coded the same sample of 10% of the total of 212 fragments. Using the framework of Campbell et al. we first focused on increasing inter-coder agreement by thoroughly discussing fragments that were coded differently. The interpretation of the data was complex because teachers described students with both a high level of abstraction and very specific behaviours. What became apparent during the discussion was that, when interpreting the data, complete teacher-student quotations should be taken into account when coding the statements. Within the discussion, the need for a new code, that is, 'domain-specific abilities', emerged. For example, "She is a very bright student, writing and reading French is not a real problem for her. However, she always struggles with the listening exercises" (Teacher B) was a fragment that could not be coded correctly with the term 'student ability' because the fragment revealed not just information about general ability (bright student), but also about the domain-specific abilities. At the end of the meeting, the coding scheme was finalised by adding the code 'domain-specific abilities'.

After the meeting, a new random sample of 10% of fragments was drawn and coded interdependently. Based on the coding of these fragments, intercoder reliability was calculated using Cohen's kappa. Reliability was $\kappa = .71$ for the content codes and $\kappa = .69$ for the evaluative codes. This values meet general guidelines for

sufficient reliability (Landis and Koch 1977; McHugh 2012). Therefore, the dataset was divided among the researchers to be coded. The full coding scheme is in Appendix 1.

3.4.2 Step 2: Data transformation and further analyses

Further data analyses were aimed at exploring the variability of teachers' knowledge and perceptions. First differences between and within teachers were analysed. Second, differences between students were explored. To do so, the qualitative data were transformed into quantitative data. Each code was given a number (1–23) followed by a second number referring to the evaluative nature. All *neutral* statements were coded with the number of the code following *'.1'*, *positive* statements were coded with *'.2'* and *negative* statements with *'.0'*. For example, '*very intelligent student'* received the code '1.2', i.e., 'abilities.positive'. An illustrative example of the coding can be found in Table 2.

Next, a matrix was created. Each row represented a teacher-student combination and the columns contained all codes. The first analysis was quantitative and shed light on both between-teacher and between-student variability. Since we aimed to identify the variability between and within teachers, we calculated intraclass correlation coefficients for each code. For the calculation of intraclass correlations (r),[1] we applied analyses of variance as suggested by Kenny et al. (2006). To study the variance within and between teachers and students, both the intraclass correlation (ICC) of the teachers (r_{tchr}) and the students (r_{stdnt}) were relevant. To further analyse differences between teachers and students these quantitative findings were examined in more detail in a qualitative analysis that included both a compare and contrast strategy and extreme-case analysis (Miles et al. 2014).

4 Results

This study aimed to answer the question: *How do teachers' knowledge and perceptions of their students vary between teachers and between students?* During the development of the coding scheme, two new attributes of teachers' knowledge and perceptions emerged, that is, the evaluative nature and the category 'teacher-student relationship'. As can been seen in Table 3, the frequencies of the category 'teacher-student relationship' were among the highest. Teachers' knowledge and perceptions of their students seemed closely bound with their affection for a student and the visibility of a student for the teacher. Therefore, in addition to analysing differences in teachers' knowledge and perceptions of their students, differences in the evaluative

[1] r_{tchr} can be estimated by $(MS_b - MS_w)/(MS_b + (k' - 1)MS_w)$ using teacher as a factor and where k' is the corrected number of students rated per teacher, because we gathered ratings of 33 students for 6 teachers and ratings of 14 students for 1 teacher, $k' = 30{,}71$, see Kenny et al. (2006, p. 276). R_{stdnt} can be estimated by $(MS_b - MS_w)/(MS_b + (k' - 1)MS_w)$ using student as a factor and where k' is the corrected number of teachers that rated the student because we gathered ratings of 6 teachers of 14 students and 7 teachers of 19 students, $k' = 6.38$, see Kenny et al. (2006, p. 276).

Table 2 Part of teachers' quotations, and their subsequent codes, about Student 32

Teacher	Part of quotes about Student 32	Codes
A	"Very intelligent, or at least I think he is a very intelligent boy. Um, he knows a lot, and he is able to organise his own work. Working together is somewhat difficult for him, because he is a perfectionist."	A1.2, A3.2, A4.1, A5.2, B19.0, B11.1
B	"He struggles with French. He has his own way of studying, which is fine, but…yeah…when I discussed the test with him, after handing it back, he admitted that "yes, I have to pay more attention to this and that". Apart from that, um, he's a strange boy, very stubborn."	A7.0, A4.1, A5.2, C22.1, B11,1
D	"[Student 32], um, I think [student 32] is a smart boy. A bit of a loner, possibly slightly autistic. He knows a lot about history, lots of facts mainly. I think he learned that from gaming, because he's a gamer and he plays a lot of games with a historical setting. He is a typical nerd, works hard, um, keeps to himself…you know the type. "	A1.2, B8.0, B13.1, A3.2, B16.1, B15.2.
E	"A very introverted student, I suspect he has autism, or Asperger's maybe, based on his disposition and lack of communicative skills. Very smart boy, really into computers. Um, also a little lazy, it's very difficult to get him to start working. He is under the impression that he can manage things himself, but that doesn't work as well in practice."	B11.1, B13.1, A1.2, B16.1, B15.0, B17.0
G	"Well, [student 32] has fascinated me from the start…But beneath the surface there are a lot of layers with him…He really goes the extra mile, so I give him extra time for literary assignments, book reports and tasks and such. He never disappoints, always goes for straight A's. He perceives himself as a good student, but that means he can be very disappointed and sad when he doesn't do so well. He's willing to help others, but not when he suspects that they're just trying to freeload."	C22.1, B17.1, A2.2, B10.1, B8.1

Table 3 Teachers' knowledge and perceptions of students ($n=7$ teachers and $n=33$ students), per code the frequency (*f*), variance between teachers (r_{1tchr}) and variance between students (r_{1stdnt}) and, per teacher, the proportion of students in the classroom that were described using the code***

					Teacher						
		f	r_{tchr}	r_{stdnt}	A	B	C	D	E	F	G
A. Cognitive characteristics											
1	Abilities	95	.16**	.09	.55	.27	.42	.58	.73	.09	.57
2	Achievements	57	.17**	−.07	.18	.12	.64	.09	.18	.12	.93
3	Knowledge	6	.01	.04	.09	.00	.00	.03	.00	.03	.07
4	Learning preference	13	.16**	.06	.27	.03	.06	.00	.00	.00	.07
5	Metacognition/Self-regulation	33	.08*	.03	.30	.09	.27	.03	.18	.09	.07
6	Learning difficulties	6	.03	.16**	.00	.09	.06	.03	.00	.00	.00
7	Domain-specific abilities	30	.06*	−.01	.15	.03	.33	.03	.15	.03	.43
B. Noncognitive characteristics											
B1 Social-emotional characteristics											
8	Psychosocial	29	.04	.09	.06	.03	.27	.12	.18	.06	.36
9	Emotional maturity	9	.02	.00	.06	.00	.00	.09	.09	.00	.07
10	Self-concept/self-esteem	43	.16**	.05	.42	.15	.09	.03	.36	.00	.57
11	Personality	67	.13**	.07	.15	.15	.27	.52	.46	.42	.14
12	Wellbeing	11	.10**	−.01	.00	.00	.03	.03	.03	.21	.07
13	Soc.-emot[a] and behavioural difficulties	13	.06*	.18**	.09	.03	.00	.09	.18	.00	.00
B2 Motivational and behavioural characteristics											
14	Motivation/goal orientation	35	.02	−.03	.09	.09	.18	.12	.30	.09	.43
15	Effort	46	.01	.11*	.12	.21	.24	.30	.21	.06	.57
16	Interests	23	.06	.03	.27	.03	.03	.12	.06	.06	.29
17	Work behaviours/attitudes	66	.06*	−.06	.46	.12	.42	.12	.33	.30	.57
18	Classroom behaviours	44	.02	.16*	.15	.09	.18	.15	.27	.33	.36
19	Collaborative abilities	4	.04	−.01	.03	.00	.09	.00	.00	.00	.00
B3 Background characteristics											
20	Home environment	5	−.01	.06	.00	.03	.00	.00	.03	.06	.07
21	Background information	12	.05	.13	.00	.00	.06	.03	.03	.06	.43
C. Teacher-student relationship characteristics											
22	Affective evaluations	90	.15**	.04	.18	.39	.70	.39	.30	.58	.44
23	Visibility	74	.24**	.15*	.24	.49	.15	.49	.06	.70	.29

$p<.001$, * $p<.01$, * For Teachers A–F, $n_{students}=33$, for Teacher G, $n_{students}=14$

[a]Social-emotional

nature and the teacher-student relationship characteristics were analysed as well. Throughout the results, teachers' knowledge and perceptions (codes from categories A and B in the coding scheme, i.e., codes 1–21) are discussed separately from the teacher-student relationship characteristics (the codes from category C, i.e., codes 22 and 23).

Table 4 Per teacher, the amount of codes and categories used, and the distribution between the positive and negative evaluative nature of their knowledge and perceptions of their students

	Teacher A	Teacher B	Teacher C	Teacher D	Teacher E	Teacher F	Teacher G
Codes	111	52	121	83	125	67	85
Categories	18	16	18	18	17	16	17
% Positive	23	15	45	35	23	34	24
% Negative	22	35	30	7	23	5	25

4.1 Variability in teachers' knowledge and perceptions of their students

Tables 3 and 4 show the results of teachers' knowledge and perceptions of their students. In Table 3, the content of teachers' knowledge and perceptions are presented. Results show that the teachers expressed knowledge and perceptions about students' cognitive characteristics and noncognitive characteristics. The student characteristics expressed the most were: abilities (code1, $f=95$), personality (code11, $f=67$), work behaviour/attitudes (code17, $f=66$), achievements (code2, $f=57$), and effort (code15, $f=46$). In general, students' abilities, personalities and their work mentality were the most salient student characteristics for teachers.

Although all teachers expressed knowledge and perceptions of students' personality, academic ability, and their work mentality, they did not do so about all individual students. Many student characteristics, such as students' learning preferences, wellbeing or background, were only used by some teachers. The student characteristics that were mentioned least were: 1) collaborative abilities (code19, $f=4$) 2) home environment (Code 20, $f=5$), and 3) knowledge (code3, $f=6$) and learning difficulties (code6, $f=6$). These characteristics were mentioned only by some teachers regarding only a few students. These results indicate that there are differences between teachers in what they know and perceive of their students. Teachers seemed to focus on different student characteristics while thinking about their students. These results also indicate that there are differences within teachers in what they know and perceive of different students. The characteristics that were salient in teachers' knowledge and perceptions differed within teachers and across different students. Teachers thus seemed to have an eye for students' uniqueness.

This variation between and within teachers was indicated by the two ICC scores for each characteristic, presented in Table 3. A high ICC (r_1) indicates that a code was used consistently. In general, the ICC scores that indicated the consistency between teachers (r_{1tchr}) were relatively low and the variance among teachers pertaining to all codes was high. The student characteristics *abilities, achievements, learning preference, self-concept, personality,* and *wellbeing* showed the highest commonality and seemed similarly meaningful for all teachers. However, for most characteristics, teachers seemed to differ in how meaningful the characteristic was for them. These results thus confirm that there are differences among teachers in what they know and perceive regarding students. They also suggest that there are differences within teachers in what they know and perceive of different students. To

further explore this variability, we compared and contrasted the knowledge and perceptions of the individual teachers.

4.2 Differences between teachers in their knowledge and perceptions

In Table 4, per teacher, results are presented on the number of characteristics and the diversity of categories used. With regard to the differences between the teachers, the results show that there is large variation in the amount of knowledge and perceptions the teachers expressed. The teacher who expressed the most knowledge and perceptions, Teacher E, expressed over two times more characteristics as did the teacher who expressed the fewest characteristics (Teacher B). The number of categories used, that is, how diverse teachers' knowledge and perceptions were, ranged from 16 to 18 different characteristics. All teachers thus used a variety of different characteristics in describing their students and did not differ from each other in this respect.

To explore differences between teachers in their knowledge and perceptions, the data were compared and contrasted. First, differences between teachers were analysed by making horizontal comparisons between the data from the individual teachers presented in Table 3. For example, Teacher A described her students' abilities (55% of the students), work behaviours/attitudes (46% of the students) and self-concept/self-esteem (46% of the students) the most. Compared with the other teachers, she expressed knowledge and perceptions about her students' metacognition/self-regulation (30%) and interests (27%) more often. In contrast, Teacher F described the student personality (42%) and classroom behaviours (33%) the most. Thus, the relative importance of specific student characteristics differed between teachers.

Because teachers differed in the total number of characteristics expressed, to explore differences between teachers, relative scores were compared. That is, the frequencies were divided with the total number of codes used by a teacher. From this between-teacher analysis it became clear that teachers' knowledge and perceptions differed in their relative focus. Teachers A, B, and C were relatively more focused on students' cognitive characteristics than the other teachers. Teachers D and E, compared to the other teachers, were more focused on students' social-emotional characteristics. For these teachers, students' social-emotional characteristics seemed more salient than for the other teachers. Teacher F was more strongly focused on students' motivational and behavioural characteristics. Of all teachers, she focused the least on students' cognitive characteristics. Teacher G did not seem to have a particular focus. She used all categories about equally often. Teachers' knowledge and perceptions thus differed in their overall focus.

4.3 Differences among teachers in the evaluative nature of their knowledge and perceptions

Figure 1 shows the evaluative nature of teachers' knowledge and perceptions. Most knowledge and perceptions of students were neutral (48%), followed by slightly more positive (30%) and negative (22%) statements. As can been seen in Fig. 1,

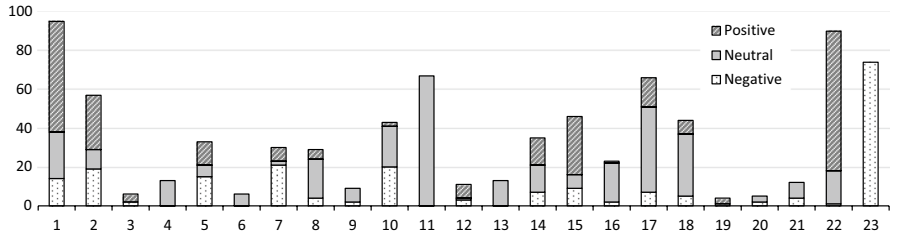

Fig. 1 The evaluative nature per Code

some characteristics did not have a positive–negative dimension. The number of positive and negative statements thus cannot be compared with the number of neutral statements. Results showed that teachers' knowledge and perceptions concerned both whether a student was able to do something and whether he/she was weak in, or lacked, an attribute.

In Table 4, the evaluative nature of teachers' knowledge and perceptions per teacher is displayed. As can be seen, knowledge and perceptions differed in their evaluative nature. Teachers D and F focused more on students' positive characteristics, while Teacher B was more negative. In addition, teachers were not all very outspoken in their evaluative nature. Teacher C seemed more outspokenly judgmental; she described her students' most often either outspokenly positive or negative. Teachers A and E were more balanced in their assessments. We will further discuss these findings in relation with the findings for teacher-student relationships.

4.4 Exploring the variability between students in how they are known by their teachers

As can be derived from the ICC scores in Table 3, there was much variance across students (r_{stdnt}) regarding the characteristics used to describe them. Some characteristics (for example, 'achievements') had consistencies close to zero or negative consistencies. This indicates that whether or not a student was described on his/her achievements did not predict whether he/she would be described on this characteristic by other teachers. However, some characteristics were used more consistently, that is, were used by multiple teachers to describe the same student. The characteristics used most consistently were: 'learning difficulties' and 'social/emotional and behavioural difficulties'. If a student was known and perceived to have difficulties, this was salient for several teachers. For example, Student 9 was described by three teachers as 'dyslexic', for example, by Teacher C: "Very weak. I think he doesn't realize this. Dyslexic". However, even with more consistently-used characteristics such as 'learning difficulties', there was variance among the teachers. Teacher A, for example, did not use the characteristic 'learning difficulties' at all. She described Student 9 as "Yeah, [STDNT 9]. [STDNT 9] does need, I'd say, a bit of structure. Kind of what I just said about [STDNT 12] and [STDNT 14]. He knows it all, but if you ask him something it all stays really superficial. He won't go more in depth. He really needs guidance to reach those deeper layers." Students' learning difficulties,

social/emotional and behavioural difficulties, effort and classroom behaviour seemed more consistently relevant for some teachers. However, even these consistencies were relatively low, indicating that such characteristics were not relevant for all teachers pertaining a given student.

Important factors that varied among teachers were the number of characteristics used as well as the evaluative nature of their knowledge and perceptions. Exploring these factors among students showed differences on these factors as well. Most students were described with 22 codes. On average, students were described with 31% positive characteristics and 19% negative characteristics. However, among all factors the variance was high. The student described with the fewest codes only received 9 codes, four times less than the student described with the most codes (38). The student described most negatively had both the largest percentage of negative codes (58%) and the fewest positive codes (0.03%). Other students were not described with negative codes at all. The student described most positively received 64% positive codes. Different students thus were perceived differently by their teachers. To further explore the differences between students, we will describe some extreme cases in more detail.

Student 32 (see also Table 2) was the student described with the most codes. Although there were some commonalities across teachers in what they knew and perceived of this student, teachers also differed in the characteristics they used. Student 32 was perceived as highly intelligent by Teachers A, D, and E. Teacher G described him as a high-achieving student who did well. Teacher B did not make general statements; she only described that he was very weak in her subject (French). Teacher C did not mention his abilities nor achievements. Almost all teachers commented that there was something special about this student in the way he learned. Teacher C said: "[STDNT 32] learns differently when compared to the other students". She observed that he learned by listening to other students or the teacher and by doing rather than reading. Teachers A, B, D, and E also described him as having his own way of working, however not always specifying what was particular about this. For example, Teacher A: "He [STDNT 32] knows how to organise his work so it works for him". Teacher E also perceived that this student knew how to organise his work; however, he was the only teacher who stated this organisation was flawed, he stated: "He believes that he can organise his work really well, but what he does is not always sufficient". Moreover, Teacher A perceived the student as hard working, whereas Teacher D described the student as lazy and hard to motivate. In addition, teachers differed in their interpretation of his work behaviour and whether this was perceived as a personality trait, originating from social or behavioural difficulties, or due to weak collaborative abilities. Some teachers seemed to attribute this to the student's personality, for example describing him as an 'einzelganger' (Teacher D), an 'introvert' (Teacher E), and being (slightly) autistic (Teachers D and E). Teacher A, in contrast, interpreted his behaviour as stemming from being a perfectionist and therefore having difficulties with collaboration. While most teachers observed similar behaviours, their interpretations differed.

This was alike for Student 14, an extreme case in that he was described both most negatively (64%) and least positively (0.03%). Teachers varied in their interpretation of this student. He was depicted as struggling by all teachers, with insufficient

achievements to pass the year. Teachers B and C described this student as having low abilities and not putting in effort. Teacher A perceived this student as lazy and attributed his disruptive behaviours to puberty. She did not comment on his abilities. Teacher C attributed his disruptive behaviours to being bothered by his own low achievements and masking this by being funny and laughing about it. In contrast, Teacher D described the student as very quiet and lacking presence. She also perceived the student as weak; however, she thought this might be more due to frequent gaming than to than his abilities. Teacher E perceived the student as lazy and unmotivated for school in general. Teacher E stated: "[STDNT 33] is a lazy oaf…Yeah, that's the first thing that springs to mind. [STDNT 33] is quite clever, that's clear to me based on everything he does. But I…the boy just doesn't have any motivation". In contrast, Teacher F perceived this student as a nice person whom she hardly had to address. She also said that she did not really know him well. Teacher G perceived this student as struggling due to his concentration. She stated that his achievements were very low and was not sure whether this was due to his abilities or his gaming.

Both examples make clear that teachers use their knowledge and perceptions to interpret student behaviour. Teachers differ in their interpretations of the origins of student behaviour occurs and attribute this behaviour to different student characteristics.

4.5 Variability in the teacher-student relationship characteristics

The variability among teachers in their teacher-student relationship characteristics can be derived from Table 3. All teachers used affective evaluations, but not for all students. Teacher C expressed the most affective evaluations of her students; 70% of her students were described with an affective statement. Teachers A and E expressed the fewest affective evaluations. This ranking seems in accordance with the variety of the evaluative nature of teachers' knowledge and perceptions. The knowledge and perceptions of Teacher C were more outspokenly evaluative and those of Teachers A and E the most balanced.

The code 'visibility' indicated whether a teacher reported not knowing a student at all or not knowing specific information about a student. The code 'visibility' was the only code that showed consistency across both teachers (r_{tchr}=.24) and students (r_{stdnt}=.15). This indicated that some students were more consistently experienced as scarcely known by their teachers than other students, and that some teachers expressed more often that they did not know a student than did other teachers.

Previous research on teachers' knowledge and perceptions did not report on teachers indicating their not knowing students. To better understand the code 'visibility' and this expressed lack of knowledge, we discuss some contrasting teachers and a student in more detail and relate these findings with those on teachers' knowledge and perceptions.

Contrasting the teachers with the highest and lowest frequencies of the code 'visibility', it seems that experiencing a lack of knowledge was related to naming fewer student characteristics. Teachers A, C, and E were least likely to say that did not know a student and expressed the most student characteristics. Teachers B and F

named the fewest characteristics (Table 4, p. 15), and were most likely to say they did not know a student. Teacher B hardly knew 49% of her students and expressed the most that she experienced a lack of knowledge of her students. Teacher F named 67 characteristics and indicated for 70% of her students that she hardly knew them. Although there seemed to be an association between the number of characteristics expressed by teachers and the number of students they experienced as not knowing, this association was not straightforward. Teacher F named more characteristics than Teacher B. However, she indicated for more students that she did not know them. Teacher D did not know the same number of students as Teacher B (49%), but named more characteristics (83) and thus had more knowledge and perceptions of her students.

There were two students that none of the teachers felt they knew. The student that was least known was Student 18. This person was described with the fewest characteristics: only 9 codes. He was described by his teachers with the following statements. Teacher A: '[Student 18] is a boy I just can't seem to figure out. I really can't. Yeah. He'll be in my class…doesn't ask questions, he just sits there. He pays attention, because he realises he needs to. But no, no, I really don't understand him. Not at all. That also makes it hard for me to determine what he needs. He's just one of those quiet ones, you know, a quiet student.' Teacher B: 'I don't have anything yet…um, no.' Teacher C: 'This is a tough one. Can't make heads or tails of Student 18'. Teacher D: '[STDNT 18]. Sits at the front on the left. Uhm. Quiet boy. I think he is doing a fine job, but the kind of boy that doesn't show much of himself, a nice chap, but a bit of a blind spot to me'. Teacher E: 'Yes, nice boy, spontaneous. Does not need much help. Just goes about it and does a stellar job. I think he is ok with how we are currently working. He is fine with it when I explain things to the entire group, but when I let him work by himself, he does fine as well. I just cannot say a lot about him. He does not ask a lot of questions'. Teacher F: 'He sits in front of STDNT 14, that I know. But I don't have that clear a picture of STDNT 18. He is a nice boy, friendly, participates, I hardly ever have to correct him. The combination of him and STDNT 1 doesn't work that well, because STDNT 1 is very outgoing. But uhm, a good boy.' Although all teachers stated they did not know this student, these statements show that he was described by his teachers on some characteristics, such as affective remarks, personality, and classroom behaviours. It seemed this knowledge was not sufficient for these teachers to feel that they 'knew' him.

What this case shows is that how well a student is known is perceived as a mutual responsibility. In this case, teachers blamed themselves ('*I cannot seem to know him'*) as well as the student ('*he does not let himself be known'*). Such an explicitly-stated shared responsibility in knowing a student was not always present in the data. When students were described as not or hardly known, most of the time they were good achievers who did not show disruptive behaviours and were motivated to work. In some cases, teachers were very explicit about this. For example, Teacher F about Student 22: "I don't have that clear of a picture of her. Yeah. I think she is a very nice girl. She is doing a fine job in my opinion. But if I am being honest, to me she is still pretty invisible. This often means students are doing fine and participate well in class. I don't really dare to say anything else about her". In some cases, teachers were more implicit about the association between 'being a good

student' and 'not being known'. For example, Teacher E about Student 15: "Quiet, diligent, well-behaved boy, I do not know him". What is interesting is that not all students who were perceived as 'hard working good achievers' were also explicitly described as not being known. For example, Student 12 was described by Teacher B: "Nice spontaneous girl. She speaks up regularly. She is doing a fine job. She sits next to [Student3]". Teacher D said: "[STDNT 12] … she sits next to [STDNT 3]. [STDNT 12] she's a darling girl. Always happy and glowing, has those rosy cheeks. Yes….". Only one teacher reported not knowing this student. What teacher should know about a student to feel they know the student sufficiently seems to differ across teachers as well as across students.

4.6 Differences among teachers in their knowledge and perceptions and contextual differences

Teachers' knowledge and perceptions differed in content, amount, and evaluative nature. To explore the origins of such differences, we related the findings of these differences with the contextual differences across teachers described in Table 1, that is, teachers' years of experience being a teacher and teaching these particular students. The years of experience teachers had in teaching seemed not related to their knowledge and perceptions. Teachers B and E were most experienced (30 and 22 years, respectively). However, Teacher B named the fewest characteristics and Teacher E the most. Teachers C and F were the least experienced (both 5 years), Teacher C was one of the teachers who expressed the most characteristics, while Teacher F was one of the teachers who expressed the fewest.

A different tendency appeared when relating findings regarding teachers who taught the students the most. The teachers who had started with the students that year were Teacher A, B, and F. These teachers also saw their students less than Teachers C, E, and H, who had started teaching these students the previous year. Teachers B and F named the fewest characteristics and had the highest number of students that, in their regard, they did not know very well. Teachers C and E named the most characteristics and the fewest students that they did not know well. This could lead to the conclusion that how well teachers know their students is influenced by the amount of time they teach them. This is a very logical hypothesis. However, Teacher D already had taught the class the year before and named fewer characteristics than Teacher A, for whom it was the first year. Teacher D was teaching these students for the second year but named the same number of students that she did not know well as Teacher B (for whom these students were new). Thus, although there was a tendency for teachers who had taught the students the most to know them the most, this tendency was not a given and should be further explored.

5 Discussion of findings and limitations of the study

This study explored the variability of teachers' knowledge and perceptions of students by studying the knowledge and perceptions of seven teachers teaching the same class. The central research question was: *How do teachers' knowledge and perceptions of their students vary between teachers and between students?* In this discussion, we will first reflect on our findings regarding teachers' knowledge and perceptions. This study revealed three sources that contribute to the variety of teachers' knowledge and perceptions of their students: differences across teachers, differences within teachers, and differences in how students are perceived by individual teachers. These three sources will be discussed below. Second, the findings regarding students who were hardly known is a finding of major interest that needs further exploration. We will elaborate on this finding as well as suggestions for future research. Third, we reflect on both the potential and limitations of our research methodology and discuss implications for further research.

5.1 Discussion of the results

5.1.1 Differences among teachers in their knowledge and perceptions of students

The results showed that teachers' knowledge and perceptions varied in their focus. Some teachers were more concerned with students' cognitive characteristics such as their abilities or achievements, while others focused more on social-emotional characteristics. Teachers also differed in the extent to which specific student characteristics were salient for them. For example, the learning preference of a student was salient for some teachers, but others did not describe this student characteristic at all. Such findings confirm the idea that teachers' knowledge and perceptions are personal in nature and connected to teachers' individual approaches to teaching (Mayer and Marland 1997). Although this study did not map teachers' adaptive practices, this finding suggests that different teachers might be adaptive to different student characteristics, even regarding the same student. Future research could shed light on the different adaptive strategies of different teachers.

In addition to differences in the content of teachers' knowledge and perceptions, teachers differed in the number of characteristics expressed and the evaluative nature of their knowledge and perceptions. Regarding the evaluative nature, some teachers were more focused on negative student characteristics while others focused on positive characteristics. These differences seemed implicit. They were derived from the analysis of how teachers spoke about their students' characteristics. Teachers might not be aware of the evaluative nature of their knowledge and perceptions. In their explicit affective evaluations of their students, teachers were only positive. The findings of this study indicated a connection between teachers' affective statements and the evaluative nature of their knowledge and perceptions. It would be interesting to further explore the association between teachers' attitude regarding students, the evaluative nature of their knowledge and perceptions and their adaptive practices regarding students perceived either in predominantly positive or predominantly

negative terms (especially because studies have shown that perceptions, attitudes, and subsequent teaching actions seem closely connected). Moreover, negative attitudes might hinder providing students with optimal learning opportunities (Glock, Krolak-Schwerdt, KIapproth and Bohmer 2013; Peterson et al. 2016).

5.1.2 Differences within teachers in their knowledge and perceptions of their students

The aim of this study was to shed light on differences between teachers' knowledge and perceptions to explore the personal nature of teachers' knowledge and perceptions. Teachers differed in the knowledge and perceptions they expressed about individual students. It seemed that they had an eye for the uniqueness of their students. The results of this study suggest that teachers' knowledge and perceptions are not only contingent on the personal interpretative framework of a teacher but also on the teacher-student combination. On the one hand, the teachers perceived their students by their personal interpretative frames. They differed in the student characteristics that are meaningful for them in understanding their students. On the other hand, the students affected what the teachers knew and perceived about them (since the teachers did not describe all their students using the same student characteristics). Indeed, different students were known and perceived differently by different teachers. These findings indicate that the nature of teachers' knowledge and perceptions of their students may be interpersonal. Information with an interpersonal nature does not refer to a single person (the teacher or the student) but rather to multiple persons embedded within a social context (Kenny, Kashy, and Cook 2006, p. 1). The literature review in the introduction led to the conclusion that teachers' knowledge and perceptions are personal. It has been suggested (Peterson et al. 2016) that future research should focus on differences across teachers. Results from this study suggest that teachers' knowledge and perceptions are not only personal, but also interpersonal. Future research that aims to develop insights into how student characteristics are related to adaptive practices could benefit from designs that shed light on this interpersonal nature (i.e., by analysing the interaction between teacher and student).

5.1.3 Differences across students in how they are known

The third source of variance of teachers' knowledge and perceptions were differences between students in how well they were known. It is often assumed that detailed knowledge about individual students allows teachers to give meaning to their behaviours and to accurately interpret students' states and needs (so they can optimise the learning and development of their students by tailoring processes, opportunities, and educational programmes to suit individual learners; Corno 2008; Mayer and Marland 1991; Tomlinson et al. 2003). This study indicated that the teacher participants differentially understood the origins, causes, and meaning of a single student's behaviours. There are several points to consider, based on this finding. First, is seems to challenge the 'accuracy' of teachers' knowledge and perceptions and lays open to question how to determine such accuracy. For teachers, it

could be important to share and discuss their knowledge and perceptions regarding individual students. It could help them keep an open mind and, further, question the accuracy of their own knowledge and perceptions. Second, it has been shown that the attributions teachers make about students affect subsequent teaching behaviours (Georgiou, Christou, Stavrinides, and Panaoura 2002; Lucas, Collins, and Langdon 2009). When events were attributed to uncontrollable factors such as puberty or inherent abilities, for example, teachers seemed more likely to help the student. When events were attributed to controllable factors such as effort or motivation, teachers reacted more with anger and less helping behaviours (Georgiou et al. 2002; Lucas et al. 2009). It might be that such different interpretations lead to different ways of teaching a single student. Future empirical studies should investigate how different knowledge and perceptions lead to differential educational trajectories for individual students.

5.1.4 The invisibility of students

An interesting difference between the current results and those of earlier studies regarding teachers' knowledge and perceptions of students was the emergence of the category 'student–teacher relationship' and the finding that some students seemed invisible to their teachers. Our research procedure, in which teachers were asked to express their knowledge and perceptions of individual students, could explain the emergence of the lack of visibility of some students for the participants. In previous investigations, teachers could disguise a lack of knowledge of some students more easily because they were not asked to discuss each individual student. It would be interesting to further explore how and when teachers experience their knowledge as adequate and sufficient in contrast to when they experience their knowledge as lacking – especially since the qualitative data analysis showed different patterns in how and when teachers made their lack of knowledge explicit. Some students were described on multiple characteristics and teachers still experienced insufficient knowledge, while others were described using only a few characteristics (without an explication of an experienced lack of knowledge). Future research could shed light on the processes by which teachers get to know their students and how they evaluate and give meaning to the knowledge gained about particular youngsters.

In addition, results showed that some students were known less to the teachers than others. Besides exploring teacher factors that impact their knowledge, it is important to explore student factors that may influence how well they are known. Students are not passive recipients of education; they play a role in 'letting themselves be known' by their teachers. This is particularly true for students in highly personalised or adaptive teaching contexts, since they have more responsibility for their own educational course (Prain et al. 2013). Given the finding that some students were not known by the majority of their teachers, it seems that some students might need support to let themselves be known.

Moreover, it is important to explore the implications of such an experienced lack of knowledge for a student (especially since our results showed that an expressed lack of knowledge related to the extent of teachers' knowledge and perceptions).

In general, teachers who experienced insufficient knowledge about more students expressed fewer student characteristics. Teachers not only experienced a lack of knowledge, they also seemed to know less and perceived little of some students. Such a lack of knowledge seems problematic in a context in which teachers are expected to adapt their teaching to individual students' characteristics.

5.2 Evaluation of the research methodology and limitations of the study

To explore teachers' knowledge and perceptions of their students, the interview methodology used appears to have been quite fruitful. Our methodology captured different aspects of teachers' knowledge and perceptions. The open interview made it likely that results reflected the personal interpretative framework of a teacher when compared with pre-structured questionnaires for specific student characteristics. The ecological validity of the interview seemed high. The set-up of 1 min per student made the interview feasible and the amount of material to be transcribed and analysed workable.

A limitation of the interview methodology was that it remained unclear whether the knowledge and perceptions teachers expressed affected their teaching practices. On the one hand, based on the premise that teachers try to make sense of their students in order to guide their own actions and interactions, it can be assumed that the information teachers expressed was relevant for their practices. This premise stems from the central notion of theories of social cognition and social perception that people are accurate perceivers for current purposes and that, as such, their perceptions are strongly related to people's goals, sets, motives, and needs (Fiske 1993).

On the other hand, future research should connect teachers' knowledge and perceptions of their students to their teaching to better understand how student characteristics play a role in adaptive teaching. However, the complexity of the research being suggested should not be underestimated. Empirical investigations that shed light on the association between knowledge and teaching indicate that the association between the knowledge teachers possess about their students, and their subsequent teaching decisions, is not easily understood. Some researchers (Florian and Black-Hawkins 2011; Paterson 2007) have argued that this association is strong and that knowledge always affects practice (although this is mostly unobservable). Others (Babad 1993; Good and Brophy 1974; Savage and Desforges 1995) have argued that not all knowledge and perceptions serve to guide teachers' instructional decisions and that the way knowledge and perceptions affect practice is not always obvious. The association between teacher knowledge and their adaptive practices is not unambiguously observable; it calls for complex research designs that combine exploring the deliberate practices of teachers in combination with classroom interactions.

Based on the results of this study, we conclude that this research method is a fruitful way to explore the content and nature of teachers' knowledge and perceptions. The approach lays the foundation for a further exploration of the relative importance and nature of teachers' knowledge and perceptions. The sample in this study was small. Such a small sample made it possible to explore this method and

include qualitative data-analysis strategies to deepen the variability between teachers and between students. However, findings regarding the content and nature of the knowledge and perceptions teachers have of their students are not automatically generalisable beyond the context of this study. Further research could include more cases – a case being a group of students and their teachers – to disclose insights in contextual influences that might explain variance in teachers' knowledge and perceptions between teachers, within teachers, and between students (as subjects of teachers' perceptions). Specific characteristics of the context in this study for example might be the upper educational track and the absence of cultural-ethnic diversity among the students. Conducting this research in culturally diverse classrooms or in schools using other pedagogical or didactical methods might lead to different conclusions about the relative importance of specific knowledge and perceptions.

6 Conclusion

In the context of learner-centred education, it is often argued that teachers need to know their students well on a variety of characteristics and should also know them individually. Understanding the nature of teachers' knowledge and perceptions is important to support teachers to identify the student characteristics that are most meaningful – especially in secondary education where large groups of students create teaching contexts in which teachers are restricted in getting to know individual students and respond to their unique characteristics.

The contribution of this study to research on teachers' knowledge and perceptions of their students is that it showed that these differed between teachers as well as within teachers, between students. The student characteristics salient for teachers are different for teachers as well as for the individual learner. Based on the results of this study, teachers' knowledge and perceptions thus seem interpersonal in nature and it is important for future research to explore interpersonal factors that may influence teachers' knowledge and perceptions of their students. More research is needed to understand how student characteristics become meaningful for teachers and how, in turn, they develop adaptive practices according to their knowledge and perceptions of those pupils.

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Compliance with ethical standards

Conflict of interest The authors hereby declare that there is no conflict of interest.

Appendix 1 Overview of the coding scheme consisting of four main categories, accompanying sub codes, descriptions and interview examples

	Code	Description	Related terminology/ cue's	Examples of interview quotes, negative (.0), neutral (.1) and positive (.2).
A	**Cognitive learner characteristics**			
	Terms that directly relate to, or describe, characteristics of the students (mental) process of acquiring, remembering and using knowledge.			
1	Abilities	Ability or abilities to acquire and use knowledge for solving problems and adapting to the world (p.119[a]).	Intelligence/IQ Disposition Understanding	.0 'Very weak' .1 'I think he is smart' .2 'Very intelligent'
2	Achievements	Performance of a student on an assessment/test or an academic task.	Test scores Performance	.0 'His test scores are low' .1 'If she works hard, she does fine on the test' .2 'She always achieves highly'
3	Knowledge	Information that is useful in many different kinds of tasks; information that applies to many situations (p.284).		.0 'His knowledgebase is very weak' .2 'He just knows a lot'
4	Learning preference	Characteristic approaches to learning and studying/ preferred ways of studying and learning (p. 128).	Learn. preferences Learn. Strategies Learn. Styles	.1 'He has his own way of studying'

	Code	Description	Related terminology/ cue's	Examples of interview quotes, negative (.0), neutral (.1) and positive (.2).
5	Metacognition/ Self-regulation	Knowledge about students' own thinking and learning processes. Knowledge and skills to activate and sustain thoughts, behaviours and emotions to reach goals. Focus on how to approach, plan or execute assignments/ tests. Knowing weaknesses and strengths of one self (p. 318, p.410).	Planning Monitoring Evaluating	.0 'With respect to planning, he always ends up having to do all his assignments at the latest moment' .2 'She knows how to deal with the freedom she is given, she knows when to stay in class and listen to instruction when she needs it'
6	Learning difficulties	Problems with acquisition and use of language; may show up as difficulty with reading, writing, reasoning and mathematics (p.136)	Dyslexia Dyscalculia	.1 'I think dyslectic'
7	Domain specific abilities	Information of students' knowledge, abilities or achievements regarding domain specific skills (p.284).		.0 'She is very weak in French' .1 'She really has grown in my subject' .2 'He is really strong in English'
B1	**Social-emotional learner characteristics**			
	Terms that directly relate to, or describe, characteristics of the students personality, emotional (in relation with self) and social (in relation with others) needs.			
8	Psychosocial	The students' individual needs in relation with (and place in) the social environment (p.87)	Peers Bullying	.1 'Whenever there is bullying, she seems involved'.
9	Emotional maturity	The emotional readiness of a student to perform at the expected level (Tollefson et al. 1990)	Childish	.0 'She really behaved like a childish girl' .1 'Emotionally he seems younger than the rest'

	Code	Description	Related terminology/ cue's	Examples of interview quotes, negative (.0), neutral (.1) and positive (.2).
10	Self-concept/self-esteem	The students' knowledge, beliefs and values, about themselves- their ideas, feelings, attitudes and expectations (p.95, p.97).	Self-esteem Overestimation Insecurity	.0 'Very insecure' .1 'She needs much assurance before she knows she can do something' .2 'He is really good in knowing what his strengths and weaknesses are'
11	Personality	The students' personality; description of how a student is. In terms of a student is… (not behavioural description, but only in terms of personality)	Neuroticism (stability), openness, extraversion, agreeableness, conscientiousness.	.1 'He is a perfectionist', 'very introvert', 'is friendly'
12	Wellbeing	Students' evaluation of life in terms of satisfaction and balance of positive and negative affect (Keyes et al. 2002).		.0 'A boy who is really is experiencing some struggles, with himself with life' .2 'He is very content with who he is and in life'
13	Social/emotional and behavioural difficulties	Behaviours or emotions that deviate so much from the norm that they interfere with the students' growth and development and/or the life of others – inappropriate behaviours, unhappiness or depressions, fears and anxiety in relationships (p.144).	ADHD, Autism, Depression.	.1 'Is diagnosed with some form of ADHD or ADD', 'seems autistic'.
B2	**Motivational and behavioural characteristics**			
	Terms that directly relate to, or describe, characteristics of the students motivation, task related effort, classroom behaviour and interest.			

	Code	Description	Related terminology/ cue's	Examples of interview quotes, negative (.0), neutral (.1) and positive (.2).
14	Motivation/goal orientation	The tendency to find academic activities meaningful and worthwhile and to try to benefit from them. Patterns of beliefs about goals related to achievement in schools. NB. No behavioural descriptions. (p. 439).	Intrinsic, extrinsic, failure-avoiding learners, ego-involved learners, work-avoidant learners	.0 'Just does not want to do anything' .1 'Wants to do well in school' .2 'Really wants to do everything at her best'
15	Effort	An internal state that arouses, directs and maintains behaviour (p.430). Task-specific motivation of a student to work on and succeed in (Tollefson et al. 1990). NB. Behavioural descriptions	Effort, Laziness.	.0 'Does not put in the effort' .1 'Does the work' .2 'He works very hard'
16	Interests	Information where a student finds enjoyment in, within and outside school (p. 457).		.1 'Very into sports', 'Games a lot'
17	Work behaviour/ attitude	Description of typical work behaviour of the student. How a student accomplishes academic task, including content covered, mental operations required. NB. Behaviour during or pertaining the execution of tasks in lessons/homework.	Questions Attentiveness Pace of working	.0 'Always is late with his assignments' .1 'Sits in class without asking questions' .2 'she always participates in class'
18	Classroom behaviour	General classroom behaviour, not task specific.	Disruptiveness, Talkative	.0 'complaining a lot' .1 'shares personal stories' .2 'tells a lot of funny jokes'

	Code	Description	Related terminology/ cue's	Examples of interview quotes, negative (.0), neutral (.1) and positive (.2).
19	Collaboration	Working together and in parallel with others to reach a shared goal (p. 372). NB. Specific focus on collaboration regarding assignments.		.0 'Collaboration is very hard for him'
B3	**Background characteristics**			
	Terms that directly relate to, or describe, characteristics of the students home environment or social/cultural background			
20	Home environment	Influence from the home-environment (family) on the student.	Parental style, Family composition, social-economic status, culture.	.0 'her family-situation is complex' .1 'has a lot of freedom at home'
21	Background information	Influence of other (not home-environment) external factors on the student	Physical illness	.1 'is ill a lot'
C	**Teacher-student relationship characteristics**			
	Terms that directly relate to, or describe, characteristics of the relation between the teacher and student.			
22	Affective/evaluative remarks	Evaluative or affective remarks of the teacher about the student, describing or indicating sympathy/affection/attitude towards, or evaluation of the student. NB. No personality statements.	Kind/sweet, special	.1 'special chap', 'kind of positive' .2 'sweet' 'nice' 'such a funny boy'
23	Visibility	Remarks or description about how well the teacher knows the student.	Invisible, Don't know him/her.	.1 'I do not know him', 'I really do not know how she is doing at the moment'

[a]Descriptions are derived from Woolfolk (2013), unless stated otherwise

References

Babad, E. (1993). Teachers' differential behavior. *Educational Psychology Review*, *5*, 347–376.

Banks, J., Cochran-Smith, M., Moll, L., Richert, A., Zeichner, K., LePage, P., et al. (2005). Teaching diverse learners. In L. Darling-Hammond & J. Bransford (Eds.), *Preparing teachers for a changing world* (pp. 232–274). San Fransisco, CA: Wiley.

Blease, D. (1995). Teachers' judgements of their pupils: Broad categories and multiple criteria. *Educational Studies, 21*(2), 203–215. https://doi.org/10.1080/0305569950210205.

Bryman, A. (2006). Integrating quantitative and qualitative research: How is it done? *Qualitative Research, 6,* 97–113.

Calderhead, J. (1983). Research into teachers' and student teachers' cognitions: Exploring the nature of classroom practice. Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada.

Camacho-Morles, J., Slemp, G. R., Oades, L. G., Morrish, L., & Scoular, C. (2019). The role of achievement emotions in the collaborative problem-solving performance of adolescents. *Learning and Individual Differences, 70,* 169–181. https://doi.org/10.1016/j.lindif.2019.02.005.

Campbell, J. L., Quincy, C., Osserman, J., & Pedersen, O. K. (2013). Coding in-depth semistructured interviews: Problems of unitization and intercoder reliability and agreement. *Sociological Methods & Research, 42,* 294–320. https://doi.org/10.1177/0049124113500475.

Civitillo, S., Denessen, E., & Molenaar, I. (2016). How to see the classroom through the eyes of a teacher: Consistency between perceptions on diversity and differentiation practices. *Journal of Research in Special Educational Needs, 16,* 587–591. https://doi.org/10.1111/1471-3802.12190.

Cochran-Smith, M., Ell, F., Grudnoff, L., Haigh, M., Hill, M., & Ludlow, L. (2016). Initial teacher education: what does it take to put equity at the center? *Teaching and Teacher Education, 57,* 6778. https://doi.org/10.1016/j.tate.2016.03.006.

Consuegra, E., Engels, N., & Willegems, V. (2016). Using video-stimulated recall to investigate teacher awareness of explicit and implicit gendered thoughts on classroom interactions. *Teachers and Teaching, 22,* 683–699. https://doi.org/10.1080/13540602.2016.1158958.

Corno, L. (2008). On teaching adaptively. *Educational Psychologist, 43*(3), 161–173. https://doi.org/10.1080/00461520802178466.

Deunk, M. I., Smale-Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation practices: A systematic review and meta-analysis of studies on the cognitive effects of differentiation practices in primary education. *Educational Research Review, 24,* 31–54. https://doi.org/10.1016/j.edurev.2018.02.002.

Fenstermacher, G. D. (1994). The knower and the known: The nature of knowledge in research on teaching. In: L. Darling-Hammond (Ed.), *The review of research in education* (Vol. 20) (pp. 3–56). Washington, DC: American Educational Research Association.

Fiske, S. T. (1993). Social cognition and social perception. *Annual Review of Psychology, 44,* 155–194.

Florian, L., & Black-Hawkins, K. (2011). Exploring inclusive pedagogy. *British Educational Research Journal*, *37*(5), 813–828.

George, P. S. (2005). A rationale for differentiating instruction in the regular classroom. *Theory Into Practice, 44*(3), 185–193. https://doi.org/10.1207/s15430421tip4403_2.

Georgiou, S. N., Christou, C., Stavrinides, P., & Panaoura, G. (2002). Teacher attributions of student failure and teacher behavior toward the failing student. *Psychology in the Schools, 39,* 583–594. https://doi.org/10.1002/pits.10049.

Glock, S. (2016). Does ethnicity matter? The impact of stereotypical expectations on in-service teachers' judgments of students. *Social Psychology of Education, 19,* 493–509. https://doi.org/10.1007/s11218-016-9349-7.

Good, T. L., & Brophy, J. E. (1974). Changing teacher and student behavior: An empirical investigation. *Journal of Educational Psychology, 66,* 390–405.

Gregory, G. H., & Chapman, C. (2007). *Differentiated instructional strategies: One size doesn't fit all* (2nd ed.). Thousand Oaks, CA: Corwin.

Hachfeld, A., Hahn, A., Schroeder, S., Anders, Y., & Kunter, M. (2015). Should teachers be colorblind? How multicultural and egalitarian beliefs differentially relate to aspects of teachers' professional competence for teaching in diverse classrooms. *Teaching and Teacher Education, 48,* 44–55. https://doi.org/10.1016/j.tate.2015.02.001.

Hall, E., & Moseley, D. (2005). Is there a role for learning styles in personalised education and training? *International Journal of Lifelong Education, 24,* 243–255. https://doi.org/10.1080/02601370500134933.

Hoffman, J. V., & Duffy, G. G. (2016). Does thoughtfully adaptive teaching actually exist? A challenge to teacher educators. *Theory Into Practice, 55*(3), 172–179. https://doi.org/10.1080/00405841.2016.1173999.

Kagan, D. M., & Tippins, D. J. (1991). How student teachers describe their pupils. *Teaching and Teacher Education, 7,* 455–466.

Kenny, D. A., Kashy, D. A., & Cook, W. L. (2006). *Dyadic data analysis*. New York, NY: Guilford.

Keyes, C. L. M., Shmotkin, D., & Ryff, C. D. (2002). Optimizing well-being: the emperical encounter of two traditions. *Journal of Personality and Social Psychology, 82,* 1007–1022. https://doi.org/10.1037//0022-3514.82.6.1007.

Lucas, V. L., Collins, S., & Langdon, P. E. (2009). The causal attributions of teaching staff towards children with intellectual disabilities: A comparison of 'Vignettes' depicting challenging behaviour with 'real' incidents of challenging behaviour. *Journal of Applied Research in Intellectual Disabilities, 22,* 1–9. https://doi.org/10.1111/j.1468-3148.2008.00428.x.

Mayer, D., & Marland, P. (1997). Teachers' knowledge of students: A significant domain of practical knowledge? *Asia-Pacific Journal of Teacher Education, 25*(1), 17–34. https://doi.org/10.1080/1359866970250103.

McCombs, B. L., & Whisler, J. S. (1997). *The learner-centered classroom and school*. San Francisco: Jossey-Bass.

McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica, 22,* 279.

McKown, C., & Weinstein, R. S. (2008). Teacher expectations, classroom context, and the achievement gap. *Journal of School Psychology, 46,* 235–261. https://doi.org/10.1016/j.jsp.2007.05.001.

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis* (3rd ed.). London: SAGE.

Mills, M., Monk, S., Keddie, A., Renshaw, P., Christie, P., Geelan, D., et al. (2014). Differentiated learning: From policy to classroom. *Oxford Review of Education, 40,* 331–348. https://doi.org/10.1080/03054985.2014.911725.

Moon, T. R. (2005). The role of assessment in differentiation. *Theory Into Practice, 44,* 226–233. https://doi.org/10.1207/s15430421tip4403_7.

Onderwijsraad. (2017). *De leerling centraal* [The student central]. The Hague, The Netherlands: Onderwijsraad

Parsons, S. A., Vaughn, M., Scales, R. Q., Gallagher, M. A., Parsons, A. W., Davis, S. G., et al. (2017). Teachers' instructional adaptations: A research synthesis. *Review of Educational Research*. https://doi.org/10.3102/0034654317743198.

Paterson, D. (2007). Teachers' in-flight thinking in inclusive classrooms. *Journal of Learning Disabilities, 40,* 427–435.

Peterson, E. R., Rubie-Davies, C., Osborne, D., & Sibley, C. (2016). Teachers' explicit expectations and implicit prejudiced attitudes to educational achievement: Relations with student achievement and the ethnic achievement gap. *Learning and Instruction, 42,* 123–140. https://doi.org/10.1016/j.learninstruc.2016.01.010.

Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological Bulletin, 135,* 322–338. https://doi.org/10.1037/a0014996.

Prain, V., Cox, P., Deed, C., Dorman, J., Edwards, D., Farrelly, C., et al. (2013). Personalised learning: Lessons to be learnt. *British Educational Research Journal*, *39*(4), 654–676.

Prast, E. J., van de Weijer-Bergsma, E., Kroesbergen, E. H., & van Luit, J. E. H. (2015). Readiness-based differentiation in primary school mathematics: Expert recommendations and teachers self-assessment. *Frontline Learning Research, 3,* 90–116. https://doi.org/10.14786/flr.v3i2.163.

Prud'homme, L., Dolbec, A., Monique, B., Presseau, A., & Martineau, S. (2006). Building an island of rationality around the concept of educational differentiation. *Journal of the Canadian Association for Curriculum Studies, 4*(1), 129–151.

Ready, D. D., & Chu, E. M. (2015). Sociodemographic inequality in early literacy development: The role of teacher perceptual accuracy. *Early Education and Development, 26,* 970–987. https://doi.org/10.1080/10409289.2015.1004516.

Reigeluth, C. M., & Carr-Chellman, A. (2012). Understanding instructional theory. In C. M. Reigeluth & A. A. Carr-Chellman (Eds.), *Instructional-design theories and models* (Vol. III, pp. 3–26)., Building a common knowledge base London, England: Taylor and Francis.

Rubie-Davies, C. M. (2010). Teacher expectations and perceptions of student attributes: Is there a relationship? *British Journal of Educational Psychology, 80*(1), 121–135. https://doi.org/10.1348/000709909X466334.

Savage, J., & Desforges, C. (1995). The role of informal assessment in teachers' practical action. *Educational Studies, 21,* 433–446. https://doi.org/10.1080/0305569950210308.

Timmermans, A. C., de Boer, H., & van der Werf, M. P. C. (2016). An investigation of the relationship between teachers' expectations and teachers' perceptions of student attributes. *Social Psychology of Education, 19,* 217–240. https://doi.org/10.1007/s11218-015-9326-6.

Tollefson, N., Melvin, J., & Thippavajjala, C. (1990). Teachers' attributions for students' low achievement: a validation of cooper and good's attributional categories. *Psychology in Schools, 27,* 75–83.
Tomlinson, C. A., Brighton, C., Hertberg, H., Callahan, C. M., Moon, T. R., Brimijoin, K., et al. (2003). Differentiating instruction in response to student readiness, interest, and learning profile in academically diverse classrooms: A review of literature. *Journal for the Education of the Gifted, 27*(2–3), 119–145. https://doi.org/10.1177/016235320302700203.
Tulbure, C. (2011). Do different learning styles require differentiated teaching strategies? *Procedia-Social and Behavioural Sciences, 11,* 155–159. https://doi.org/10.1016/j.sbspro.2011.01.052.
van de Grift, W., Helms-Lorenz, M., & Maulana, R. (2014). Teaching skills of student teachers: Calibration of an evaluation instrument and its value in predicting student academic engagement. *Studies in Educational Evaluation, 43,* 150. https://doi.org/10.1016/j.stueduc.2014.09.003.
van der Lans, R. M., van de Grift, W., & van Veen, K. (2017). Developing an instrument for teacher feedback: Using the rasch model to explore teachers' development of effective teaching strategies and behaviors. *The Journal of Experimental Education*. https://doi.org/10.1080/00220973.2016.1268086.
van Geel, M., Keuning, T., Frèrejean, J., Dolmans, D., van Merriënboer, J., & Visscher, A. J. (2018). Capturing the complexity of differentiated instruction. *School Effectiveness and School Improvement, 30*(1), 51–67. https://doi.org/10.1080/09243453.2018.1539013.
Verloop, N., Van Driel, J. H., & Meijer, P. C. (2001). Teacher knowledge and the knowledge base of teaching. *International Journal of Educational Research, 35,* 441–461.
Vogt, F., & Rogalla, M. (2009). Developing adaptive teaching competency through coaching. *Teaching and Teacher Education, 25,* 1051–1060. https://doi.org/10.1016/j.tate.2009.04.002.
Walters, S. (2007). How do you know that he's bright but lazy? Teachers' assessments of Bangladeshi English as an additional language pupils in two Year Three classrooms. *Oxford Review of Education, 33*(1), 87–101. https://doi.org/10.1080/03054980601094644.
Watson, S. L., & Reigeluth, C. M. (2008). The learner-centred paradigm of education. *Educational Technology, 48,* 42–47.
Winkielman, P., & Schooler, J. W. (2012). Consciousness, metacognition, and the unconscious. In S. T. Fiske & C. N. Macrae (Eds.), *The Sage handbook of social cognition*. Thousand Oaks, CA: Sage.
Woolfolk, A. (2013). *Educational Psychology* (12th ed.). London, England: Pearson.

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