
Article:
Burić, Irena, Butkovic, Ana and Kim, Lisa orcid.org/0000-0001-9724-2396 (2023) Teacher personality domains and facets:Their unique associations with student-ratings of teaching quality and teacher enthusiasm. Learning and Instruction. 101827. ISSN 0959-4752

https://doi.org/10.1016/j.learninstruc.2023.101827

Teacher Personality Domains and Facets: Their Unique Associations with Student-Ratings of Teaching Quality and Teacher Enthusiasm

Irena Burić[a], Ana Butković[b] & Lisa E. Kim[c]

[a] Department of Psychology, University of Zadar, Croatia; e-mail: iburic@unizd.hr; https://orcid.org/0000-0001-9182-968X

[b] Faculty of Humanities and Social Sciences, University of Zagreb; Croatia; e-mail: abutkovic@ffzg.hr

[c] Department of Education, University of York, UK; e-mail: lisa.kim@york.ac.uk

Corresponding author:

Irena Burić

Department of Psychology, University of Zadar
Obala kralja Petra Krešimira IV., br. 2
23000 Zadar
Croatia

E-mail: iburic@unizd.hr; buric.irena@gmail.com Phone: +38523200550

Funding: This research was supported by Croatian Science Foundation (Grant No. IP-04-2019-5472).

Highlights

- The hierarchy of teacher Big Five personality was modeled.
- Teacher personality was related to teaching quality and teacher enthusiasm.
- The general reference factor and specific factors incrementally explained teaching.

Abstract

Background: Previous research on the relationship between teacher personality and teaching performance yielded mixed results and typically considered only the broad personality domains while neglecting the narrower personality facets that constitute the domains.

Aim: The aim of this study was to examine the incremental value of teacher Big Five personality facets in explaining student-ratings of teaching quality and teacher enthusiasm.

Samples: In total, 1,067 teachers and 18,814 of their students from 73 secondary schools in Croatia participated in the study.

Method: Teachers self-reported their personality whereas students rated the teaching quality and displayed enthusiasm of their teachers. Each teacher was rated by one class of students.

Results: The bifactor-(S-1) multilevel structural equation models for each Big Five personality domain showed that both the general reference factor and the specific factors explained the variance in student-ratings of teaching quality and teacher enthusiasm.

Conclusions: A more fine-grained approach to examining the effects of teacher personality at different levels of hierarchy might be helpful for identifying specific parts of teacher personality with the greatest explanatory power in predicting teaching performance.

Key words: teacher personality, Big Five, incremental facets, teaching quality, teacher enthusiasm

Teacher Personality Domains and Facets: Their Unique Associations with Student-Ratings of Teaching Quality and Teacher Enthusiasm

Understanding the role of teachers' non-cognitive characteristics such as personality traits in shaping their classroom behavior is important for promoting student learning and academic achievement. An extensive literature has evolved to evaluate the associations between personality and job-related outcomes across occupations (Barrick & Mount, 1991; He et al., 2019). However, the existing research on the association between teacher personality and teacher performance (or effectiveness) in the classroom showed mixed results and focused almost exclusively on broad personality domains that were found to be only weakly related to indicators of teaching effectiveness (Kim et al., 2019). Typically, research on teacher personality has neglected the importance of more specific and narrower personality traits (i.e., facets) that constitute personality domains, even though such traits predict certain life outcomes even better than domains (e.g., Anglim & Grant, 2016; Stewart et al., 2022). Thus, to gain more comprehensive and detailed picture of the role of teacher personality in explaining their teaching behavior, we investigated teacher personality as a hierarchical construct by acknowledging the existence of both broad personality domains and narrower facets that constitute them.

We conceptualized teacher personality through the lens of the Big Five theoretical framework (Goldberg, 1990; Soto & John, 2017) and modeled its hierarchical structure using the bifactor-(S-1) approach to examine the incremental value of personality facets in explaining teaching quality and teacher enthusiasm over and above the general personality factor clearly defined by its reference facet (Eid et al., 2017). Such an analytical approach can provide valuable information about specific aspects of teacher broad personality domains that are of particular relevance with regard to teaching practice. Recognizing which specific personality traits may act either as beneficial or impeding while teaching may raise teacher

self-awareness and serve as a basis for improving teacher social, emotional, and behavioral skills (Soto et al., 2021) that can help them to perform better in the classroom.

Teaching Quality and Teacher Enthusiasm

Teaching quality is an important component of understanding what makes an effective teacher, otherwise broadly conceptualized as teacher effectiveness (see Goe et a., 2008 for a review). Though teaching quality is used interchangeably with other terms in research, practice, and policies, according to Goe and colleagues (2008), teaching quality is a unique component of teacher effectiveness. That is, it forms one component of teacher effectiveness: (a) *input* (e.g., teacher qualifications, teacher characteristics); (b) *processes* (e.g., teacher practices; aka. teaching quality or instructional quality); and (c) *outcomes* (e.g., impact on student achievement, student engagement or social-emotional well-being).

Teaching quality can be defined as an instruction that enables successful learning to a wide range of students by ensuring the classroom discipline, accomplishing the goals of instruction, and fulfilling students' needs in a particular context (Darling-Hammond, 2015). A model of teaching quality with parsimonious structure and strong theoretical foundations, that has been mostly used in German-speaking contexts, refers to the three basic dimensions (Klieme & Rakoczy, 2003; Praetorius et al., 2018). The three dimensions of teaching quality are: (a) classroom management (i.e., identifying and promoting positive student behaviors and preventing and managing negative student behaviors), (b) student support (i.e., social and emotional rapport and relationship between teacher and student and between students), and (c) cognitive activation (i.e., opportunities for intellectual stimulation and knowledge accumulation). These three dimensions are considered generic in nature, thus justifying their applicability across school subjects, grade levels, and cultures (Praetorius et al., 2018).

In addition to teaching quality, we assessed student-ratings of teacher enthusiasm. While teacher enthusiasm can be viewed as an affective-motivational disposition that can

shape teaching quality (Kunter et al., 2008), it can also be considered as a strategy of delivering high-quality instruction. Specifically, a vast body of research on teacher effectiveness considers teacher enthusiasm as one component of effective teaching (Feldman, 2007; Marsh, 2007). In this line of research, teacher enthusiasm is understood as a set of behaviors in the classroom that convey energy and excitement and helps in creating an environment conducive to learning (see Keller et al., 2016). Indeed, research shows that displayed teacher enthusiasm is related to students' interests, positive emotions, and motivation to learn (Author, 2019; Frenzel et al., 2018; Keller et al., 2014; Kim & Schallert 2014, König, 2021). Teacher enthusiasm has two dimensions: namely, subject enthusiasm (i.e., topic-related enthusiasm) and teaching enthusiasm (i.e., activity-related enthusiasm; Kunter et al., 2011). However, given that students may not be able to distinguish between whether teachers' displayed enthusiasm stems from their excitement of the topic or it is part of their teaching practices, teacher enthusiasm will be examined holistically through a student-rated scale assessing whether the teacher displays excitement while teaching.

Regarding methods to assess teaching quality and teacher enthusiasm, there are a variety of available measures including classroom observations, teacher self-reports, and student-ratings (see Goe et al., 2008 for a review). Each of these methods has its strengths and weaknesses. For example, teacher self-reported teaching quality and enthusiasm may be biased by teaching ideals or self-serving strategies (Wubbels et al., 1992), while classroom observations tend to be expensive and time-consuming and provide only a snapshot of classroom events (Scherzinger & Wettstein, 2019). Likewise, the validity of student-ratings can be compromised by students' insufficient knowledge of methodology and didactics (Wagner, 2008) and/or colored by teacher popularity and grades they obtain (Aleamoni, 1999; Muijs & Bokhove, 2017). Despite these drawbacks, students are considered to be an excellent source of information on classroom processes (Montuoro & Lewis, 2015) since they

are the direct and regular observers of teaching, they can compare different teachers, and they tend to have strong opinions on who the 'good' and 'bad' teachers are (Muijs & Reynolds, 2018). Indeed, in addition to the widespread use of student-ratings in secondary and higher education, student surveys are gaining popularity as a method of assessment of teaching quality in upper elementary grades as well (e.g., Cohen et al., 2018; Fauth et al., 2019; Fauth et al., 2014).

In student-ratings of teaching quality and teacher enthusiasm, there are two sources of variance. The first refers to the interindividual differences between students within a class (i.e., variability in individual student idiosyncratic perspectives or within-class variability), while the second refers to the differences between different classes of students (i.e., variability in shared perspectives of students within the same class or between-class variability; Lüdtke et al., 2009). A recent study that used longitudinal data from six education systems showed that student surveys are a valid measure for teaching quality when assessed at the *class* level (Herbert et al., 2022). Moreover, Worrell and Kuterbach (2001) reported that student-ratings from secondary students were as valid as those from college students and argued that they are cost-efficient and time-efficient methods of measuring teaching quality. Lastly, as further evidence of its validity, student-ratings of teaching quality and teacher enthusiasm have been found to be substantially related to various outcomes such as academic achievement, interest, and motivation (e.g., Author, 2019; Author, 2020; Fauth et al., 2014; Wagner et al., 2016).

Teacher Personality: The Big Five Domains and Their Facets

For the last three decades, the Big Five model, developed through lexical studies (Goldberg, 1990), and the Five Factor Model, developed using both natural language adjectives and theoretically grounded personality questionnaires (Costa & McCrae, 1992), have been dominantly used to describe and assess human personality. According to these

models, personality is distinguished as five broad domains: (1) extraversion (entails an energetic approach to things, events, and other people and is described by adjectives such as energetic, talkative, or assertive); (2) agreeableness (refers to prosocial and collective orientation towards others and is captured by descriptors such as warm, cooperative, or trustful); (3) conscientiousness (refers to impulse control fostering task- and goal directed behavior and is described by adjectives such as organized, hardworking, or responsible); (4) neuroticism (implies negative emotionality and is characterized by descriptors such as tense, nervous, or discontented); and (5) openness (refers to breadth, originality, and complexity of individual's mental processes and life experiences and is captured by descriptors such as curious, imaginative, or creative; Goldberg, 1992; John & Srivastava, 1999).

The Big Five domains have been extensively studied and found to be important explanatory predictors of various life outcomes, including well-being (Anglim et al., 2020), job performance (Barrick & Mount, 1991), academic performance (Mammadov, 2022), and occupational interests (Larson et al., 2002). However, despite a long history of research attempts to reveal the personality profiles of effective teachers (Dodge, 1943), teacher personality has been rarely examined systematically through the lens of the established personality theories. Nonetheless, the existing studies that assessed teacher personality in a way that they can be classified within the Big Five framework demonstrated the usefulness of the five personality domains for explaining important teacher job-related outcomes such as motivation (Perera et al., 2018), burnout (Kim et al., 2019; Roloff et al., 2022), and teaching quality (Baier et al., 2019). Moreover, it seems that personality matters even at the stage of selecting and entering the teaching profession. For example, a study found that students who enrolled in teacher education programs had higher scores on openness, extraversion, and agreeableness dimensions when compared to students who enrolled in other programs. Moreover, these differences were already present during their secondary level schooling

(Savage et al., 2021). Similarly, among German students with study majors in the science, technology, engineering, and mathematics (STEM) fields, those who were teacher candidates scored higher on extraversion than their colleagues (Roloff Henoch et al., 2015).

Nonetheless, the full complexity and explanatory power of human personality cannot be grasped without considering lower levels of personality hierarchy such as facets (Anglim & O'Connor, 2019). For example, according to the hierarchical model of the Big Five (Soto & John, 2017), each of the five personality domains subsumes three specific facets. Extraversion incorporates sociability (i.e., desire to approach and engage with others in social interactions), assertiveness (i.e., expressing personal opinions and goals in social situations), and energy level (i.e., physical activity level). Agreeableness captures compassion (i.e., emotional concern for others), respectfulness (i.e., treating others with respect and consideration), and trust (i.e., having positive general beliefs about others). Conscientiousness includes organization (i.e., preference for order and structure), productiveness (i.e., having a work ethic and being persistent in accomplishing goals), and responsibility (i.e., being committed to duties and obligations). Negative emotionality incorporates anxiety (i.e., tendency to experience fear and anxiety), depression (i.e., tendency to experience sadness and low levels of energy), and emotional volatility (i.e., being prone to mood swings). Lastly, open-mindedness subsumes intellectual curiosity (i.e., intellectual interest and enjoyment of thinking), aesthetic sensitivity (i.e., having aesthetic interests), and creative imagination (i.e., being creative and original).

Hierarchical models of personality and their respective measurement instruments are useful as they allow simultaneous assessment of personality at both the domain and facet levels (Costa & McCrae, 1995). That is, domain-level scales ensure conceptual breadth and high bandwidth predictive efficiency, while facet-level scales provide more fine-grained descriptions and greater predictive fidelity. Indeed, hierarchical models of personality have

shown strong evidence of construct and predictive validity at both the domain and facet levels (Rammstedt et al., 2018). To date, such models have rarely been used for studying the associations between teacher personality and teaching quality and teacher enthusiasm, thus leaving the field underdeveloped. However, research from other fields (e.g., Anglim & Grant, 2016; Stewart et al., 2022) suggests that investigating teacher personality at the facet level could provide a more nuanced picture of the role of teacher personal dispositions in explaining their teaching performance.

Association Between Teacher Personality and Teaching Quality

Research on the predictive effects of the Big Five personality domains on various life outcomes is based on a premise that personal factors (e.g., teacher personality traits) interact with environmental factors (e.g., characteristics of students within a class) resulting in a unique set of experiences and behaviors. Specifically, personality traits influence how people select, perceive, interpret, and modify their environment, creating an array of behavioral, emotional, social, and material life outcomes (John, 2021). According to the five-factor personality theory (McCrae & Costa, 2008), personality traits are basic tendencies that refer to the underlying potential of a person. Basic tendencies interact with environmental demands and accumulate over time in the form of people's characteristic adaptations (e.g., what people learn, what attitudes and goals they have).

The role of teachers' personality in the classroom is acknowledged in various models. For example, according to the multidimensional adapted process model of teaching (Metsäpelto et al., 2022), teachers' individual characteristics — such as knowledge, thinking skills, social skills, professional identity, professional well-being but also personal orientations and *dispositions* (which can be considered as personality) — are proposed to shape teaching competences and teaching practice and consequently influence student outcomes. Similarly, other models including the COACTIV model (Kunter& Voss, 2013)

recognize that teachers' personal characteristics, including personality, influence their propensity to engage in learning opportunities, their professional competence, as well as their professional practice.

The Big Five and Teaching Quality

We outline how each of the Big Five domains, under the BFI framework (Soto & Joh, 2017; extraversion, agreeableness, conscientiousness, negative emotionality, and open-mindedness) may be associated with teaching quality in different ways.

Extraversion. Effective teaching often requires assertiveness, high energy levels, and intense social interactions with students (Kim et al., 2019). As such, teachers with higher levels of extraversion may demonstrate these characteristics more easily in classroom situations, such as when managing the classroom, providing support to students, and engaging students in classroom discussions. Moreover, building and maintaining a positive class atmosphere and establishing high quality relationships with students might come more easily to extroverted teachers. Indeed, meta-analytic evidence shows that extraversion is positively related to job performance in occupations requiring high level of interpersonal interactions (e.g., as managers) compared to employees in other occupational groups (Barrick & Mount, 1991).

Agreeableness. Teachers with higher levels of agreeableness are more likely to display compassion, warmth, and sensitivity to students. In turn, these qualities may help them in creating supportive and warm learning environments that are needed for successful learning (Pianta & Hamre, 2009). Thus, students taught by teachers with higher levels of agreeableness may report higher levels of teacher enthusiasm and student support. Indeed, this is in line with meta-analytic evidence that of the Big Five, agreeableness is the strongest predictor of job performance in occupations that require interpersonal interactions (Mount et al., 1998). Since teachers spend most of their working hours in intense interpersonal

interactions with their students, high levels of agreeableness may be beneficial in creating a supportive classroom climate.

Conscientiousness. Individuals with higher levels of conscientiousness tend to be organized, responsible, and oriented toward achievement (John et al., 2008). Since effective teaching requires organization, planning, and persistence in completing tasks (Klassen et al., 2018), it can be expected that teachers with higher levels of conscientiousness will more likely deliver instruction in an organized, structured, and timely manner, which will further reflect in more positive students' perceptions of classroom management and cognitively activating teaching. Indeed, meta-analyses showed that conscientiousness (among all other personality domains) is the strongest predictor of job performance (Barrick & Mount, 1991; Salgado, 2003).

Negative Emotionality. Teachers who are more prone to experiences of negative emotions (i.e., with lower levels of emotional stability) are more likely to transmit such emotional states to their students (Hatfield et al. 1994) and thus are expected to negatively affect their ratings of teaching quality, especially learning support and teacher enthusiasm. In addition, dealing with students' sudden disruptive behaviors can be more challenging for teachers who tend to be more nervous and tense. Meta-analytic evidence again supports these assumptions by showing that emotional stability helps individuals to establish trustful and secure relationships with others in jobs marked with frequent and intense interpersonal interactions (Mount et al., 1998). Moreover, other meta-analytic evidence suggests that emotional stability is the second strongest predictor of job performance across occupations (Barrick & Mount, 1991; Salgado, 2003), thus, pointing to the importance of this personality domain for successful teaching as well.

Open-Mindedness. Since being creative and flexible in teaching and open to student ideas and opinions are valued qualities in teaching, teachers with higher levels of open-

mindedness are expected to have higher student-ratings of teaching quality, especially of cognitive activation and teacher enthusiasm. In addition, providing students with challenging and stimulating tasks that can catch their interest and engage them in learning might be easier for more creative, flexible, and open-minded teachers. Indeed, flexibility and adaptability in lesson delivery is recognized as an important personal characteristic for successful teaching (Klassen et al., 2018), thereby suggesting that teacher open-mindedness could be related to students' perceptions of teaching quality. Nonetheless, research indicates that openness is one of the weakest predictors of job performance across occupations (Judge et al., 2013), perhaps as this domain may not be advantageous in job productivity (which can be the focus of job performance measures) but more advantageous in measures of creativity.

Breadth of Construct Measurement

As outlined above, empirical studies support the notion that teacher personality is associated with teacher effectiveness. When measured as a general factor, overall teacher personality was found to be modestly but positively related to student achievement and external observer-ratings of teaching (Klassen & Tze, 2014). A more recent meta-analysis (Kim et al., 2019) revealed that all Big Five domains (except agreeableness) were positively (neuroticism was reverse coded as emotional stability) related to a composite measure of teacher performance, which consisted of student achievement, students' evaluations of teaching, classroom observations, and student performance self-efficacy. However, the effects of teacher personality domains on their performance were moderated by the type of measure used. For example, teacher extraversion had stronger effects on students' evaluations of teaching than on student achievement or classroom observations. In sum, the nature of the measure examining teacher effectiveness can be important in understanding its association with teacher personality.

Though studies examining student-ratings of teaching quality as a measure of teacher effectiveness are rare in teacher personality studies, there is evidence that they are indeed associated with each other. For example, in a study conducted on samples of secondary school teachers across a variety of subjects and their students, Kim and colleagues (2018) found that of the Big Five domains, teacher conscientiousness was the strongest positive predictor of student-ratings of academic support while agreeableness was the strongest positive predictor of personal support. Similarly, in a study of mathematics teachers and their students, Baier and colleagues (2019) revealed that among different generic and profession-specific variables, teachers' conscientiousness was the strongest predictor of student-ratings of classroom discipline (i.e., classroom management), and extraversion of learning support (i.e., supportive climate). Lastly, Roloff and colleagues (2020) found in their longitudinal study that teachers with higher levels of agreeableness at the end of their high school provided stronger social support in their lessons as teachers and this effect was stable even after controlling for their cognitive abilities, high school GPA, and other personality dimensions.

Studies examining teacher personality at the facet level (in contrast to the domain level) are scarce, though some evidence exists in teacher effectiveness studies. For example, Murray and colleagues (1990) measured peer-rated teacher personality on 29 personality traits and examined their associations with teacher effectiveness. The results showed that the personality traits of leadership, extraversion, liberalism, supportiveness, intellectual curiosity, and changeableness had the highest positive correlations with the composite teacher effectiveness ratings. Furthermore, Cutchin (1998) assessed the five broad personality factors and its 30 facets and found that some facets (e.g., depression, positive emotions, straightforwardness, altruism, and tender-mindedness) were negatively associated with teaching performance whether they were rated by the teachers themselves or the school

principals. In contrast, some facets (e.g., gregariousness, openness to ideas, openness to values, trust, order, and achievement striving) were positively associated with teaching performance regardless of whether they were rated by the students, school principals, or teachers. Finally, a study involving a sample of beginner teachers that investigated teacher personality at both the domain and facet levels, as well as its relation to teacher effectiveness, found that conscientiousness as a domain, but also general self-efficacy as a facet of conscientiousness, were significantly associated with students' achievement and school administrators' teaching evaluation ratings (Bastian et al., 2017).

Modeling the Hierarchy of Personality

Many researchers have been using the bifactor approach (Reise, 2012) to model personality domains and facets (e.g., Abad et al., 2018; Danner et al., 2021; McAbee et al., 2014; Debusscher et al., 2016). Typically, in such bifactor representations, each item is specified to load on (1) the general factor (domain), (2) specific factors (facets) representing a common variance that is not explained by the general factor, and (3) the method factor caused by the acquiescence response style (Abad et al., 2018). In addition, all factors are specified to be independent of each other, thus allowing a straightforward examination of incremental predictive power of facets over and above domains while simultaneously reducing the bias caused by a response style. Unfortunately, when such bifactor representations of hierarchical constructs are used to predict criterion variables of theoretical interest, researchers are frequently faced with nonidentification issues and anomalous results like empirical vanishing of specific factors, irregular patterns of factor loadings, or even correlated specific factors (Eid et al., 2017). Such anomalies can change the substantive meaning of the general factor and make the comparison of results across studies difficult (Heinrich et al., 2023). Moreover, a psychometric definition and interpretation of general and specific factors are ambiguous if

the facets are not theoretically interchangeable or do not share the same nomological net (Eid et al., 2017; Lee & Cadogan, 2013).

To overcome these issues, an alternative modeling framework was recently proposed, namely the bifactor-(S-1) approach (Eid et al., 2017). The bifactor-(S-1) model has the advantage of accounting for structurally different specific factors that cannot be considered as theoretically interchangeable. Since personality facets constituting each domain were selected based on theory and ample of empirical evidence (Soto & John, 2017), they cannot be viewed as randomly chosen facets from a set of all possible facets that are inherently substitutable. Thus, for modeling personality hierarchy, the bifactor-(S-1) approach could be more suitable than the classic bifactor approach. In the bifactor-(S-1) model, items measuring the reference facet of a certain domain are used as indicators of the general reference factor, while items measuring other non-reference facets are specified to load both on the general reference factor and their respective specific factors. Unlike classic bifactor models in which both the general and specific factors are orthogonal, in the bifactor-(S-1) approach, specific factors are allowed to correlate with each other, and this partial correlation reflects whether the factors have something in common that is not shared with the general reference factor (Eid et al., 2018).

In the bifactor-(S-1) model, the general reference factor does not represent the overarching domain, but rather it is psychometrically unambiguously defined by the items of the reference facet. Thus, to achieve a clear definition of the general factor, it is of great importance to *a priori* select theoretically meaningful facet as a reference (Eid et al., 2017). In the present research, we chose the "factor-pure facets" as the reference facets. The factor-pure facets refer to facets that were in previous research identified as central to the personality domain they constitute and orthogonal to the other four personality domains (Hofstee et al., 1992; Soto & John, 2017). Specifically, sociability was identified as a facet

central to extraversion, compassion as a facet central to agreeableness, organization to conscientiousness, anxiety to negative emotionality, and intellectual curiosity to open-mindedness (Soto & John, 2017).

For example, when modeling the hierarchy of the extraversion domain, the general factor is theoretically and explicitly defined by the reference facet of sociability while specific factors of assertiveness and energy level are residualized with respect to sociability. In other words, the specific factors of assertiveness and energy level cannot be predicted by sociability (i.e., the general reference factor). In such a model, it is possible to examine whether specific factors of assertiveness and energy level uniquely explain teaching quality and teacher enthusiasm over and beyond the general reference factor of sociability (Eid et al., 2018). Even though they were only recently proposed as an alternative to the classic bifactor models, the bifactor-(S-1) models have been successfully used in previous research on psychopathology (e.g., Heinrich et al., 2023; Junghänel et al., 2020), intelligence (e.g., Eid et al., 2018), and personality (Forster et al., 2020; Gäde et al., 2017; Meyer et al., 2023). As such, modelling teacher personality domains and its facets using this type of modelling may be promising.

The Present Study

Unlike previous studies that examined teacher personality by focusing almost exclusively on broad personality domains, the present study took a fine-grained approach to investigate the association of teacher personality facets with teaching quality and teacher enthusiasm. First, we assessed teacher personality by examining its hierarchical structure, that is by acknowledging narrower personality facets that constitute broad personality domains. Second, we investigated the incremental value of teacher personality facets in explaining teaching quality and teacher enthusiasm. Third, we tested these associations by focusing on student-ratings of teaching quality and teacher enthusiasm to tackle teachers' instructional

behavior from the perspective of their students. As noted earlier, students are the only direct observers of instruction on a regular basis with many opportunities to witness how is teacher personality fueled into instruction.

Available meta-analytic evidence showed that broad Big Five personality domains were only weakly associated with overall teacher effectiveness (d ~ .106; Kim et al., 2019). Such findings call for a more detailed investigation of teacher personality at the facet level to examine whether narrower aspects of teacher personality can yield stronger effects. In addition, the application of the bifactor-(S-1) models (Eid et al., 2017) can reveal whether facets explain the variance of teaching quality and teacher enthusiasm over and above the pure-factor reference facet. Such analysis can enrich previous research findings on the importance of teacher broad personality domains by showing which specific aspect(s) of the domain has the greatest explanatory power. In addition, identifying narrower aspects of personality that play a considerable role in shaping teaching behavior can not only help teachers to raise self-awareness, but can also serve as a starting point of building social, emotional, and behavioral skills that will promote their performance.

Based on the content definition of personality domains and previous study findings, we hypothesized that teaching quality will be negatively associated with negative emotionality and positively associated with other Big Five domains. However, due to the scarcity of research on teacher personality examined at the facet level and mixed and inconsistent previous findings, we do not make specific predictions about the unique contribution of particular facets to the outcome variables, rather we approached this research question in an exploratory manner.

Method

Participants

In total, 1,067 teachers (881 female) and 18,814 students (10,251 female) from Croatia participated in the study. On average, teachers had 15.88 years of teaching experience (SD = 9.13) and taught a wide range of school subjects (e.g., languages, STEM subjects, history, geography, arts). Teachers taught in secondary schools offering gymnasium programs (N = 603), vocational programs (N = 350), or both (N = 114).

Participating students were on average 16.13 years old (SD = 1.20) and were enrolled either in gymnasium (N = 11,288) or vocational programs (N = 7,526). Students at grade levels from 1 to 5[1] were represented in the sample as follows: N_1 = 4289, N_2 = 5121, N_3 = 5134, N_4 = 4172, N_5 = 98. The average number of students per class was 18, which closely resembles the average number of students per class in Croatian schools implying that almost all students within a class filled out the questionnaire.

Procedure

Out of the initial pool of 133 secondary schools in Croatia that were approached, after obtaining a permission of school principals, teachers and students from 73 (response rate of 55%) schools were enrolled in the study. Prior to data collection, the purpose of the study and procedure were explained to teachers by members of the research team during a regular staff meeting. Both teachers and students were assured that their data would be treated with strict confidentiality, analyzed only at the group level, and used exclusively for research purposes. Participation in the study was voluntary for both teachers and students who were additionally told that they can withdraw from the study at any point if they prefer so.

Data from teachers and students were collected online and with the assistance of school coordinators (i.e., school psychologists or school counselors who were employed in participating schools) who posted links to the questionnaires for teachers and students in

[1] In Croatia, secondary education can last up to 5 years (grades 1 to 5), but most schools offer either 3- or 4-years programs, as indicated by the number of participating students. Croatian grades of 1 to 5 correspond to grades 9 to 12 in a K-12 education classification system.

teachers' virtual staffrooms and students' virtual classrooms. Teachers completed the questionnaire during their free time, and students completed the questionnaire during regularly scheduled classes under the supervision of school coordinators. Teachers and classes were coupled in a way that only one class of students could be matched to only one teacher to avoid cross-classified data. School coordinators matched the teachers and classes by a random order to reduce possible bias. Next, to ensure participant anonymity and increase honest responding, responses from teachers and students were matched via specially assigned codes.

While rating the teaching quality dimensions, students were instructed to think about and evaluate instructional behavior of one (i.e., target) teacher, while teachers gave self-reports of their personality regarding their typical behavior in life. Student-ratings of teaching quality and teacher enthusiasm were chosen given theoretical and empirical evidence for the advantages of their use (see Goe et al, 2008 for a review), but also because of their cost-effectiveness in studies involving large number of teachers.

The study was approved by the Ethics Committee of the institution of the first author, Croatian Ministry of Science and Education, and Education and Teacher Training Agency.

Instruments

Teacher Personality. Teacher personality was measured with the Big Five Inventory-2 (BFI-2; Soto & John, 2017). The inventory contains 60 items, 12 items for each of the Big Five domains: extraversion (e.g., *I am someone who is outgoing, sociable*), agreeableness (*I am someone who has a forgiving nature*), conscientiousness (e.g., *I am someone who is dependable, steady*, negative emotionality (e.g., *I am someone who worries a lot*) and open-mindedness (e.g., *I am someone who is original, comes up with new ideas*). The BFI-2 also measures personality at the facet level with four items per facet: sociability, assertiveness, and energy (extraversion); compassion, respectfulness, and trust (agreeableness); organization,

productiveness, and responsibility (conscientiousness); anxiety, depression, and emotional volatility (negative emotionality); and intellectual curiosity, aesthetic sensitivity, and creative imagination (open-mindedness). Teachers rated each item on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) to indicate how well it describes them.

Teaching Quality. The three basic dimensions of teaching quality (i.e., classroom management, student support, and cognitive activation) were measured with scales and items used in previous research on samples of Croatian secondary school students across school subjects (Author, 2020; Author, 2021). These studies confirmed the underlying three-factor structure and demonstrated that teaching quality dimensions are both reliable and valid in explaining important student outcomes such as self-efficacy, task value, positive affect, and academic engagement. Number of items per scale and sample items were as follows: classroom management (n = 4; e.g., *Our teacher always knows exactly what is going on in the classroom*), student support (n = 5; e.g., *Our teacher cares about the problems of the students*), and cognitive activation (n = 6, e.g., *Our teacher gives tasks and asks questions that make us think*). Items were rated using a 5-point scale ranging from 1 (*totally disagree*) to 5 (*totally agree*).

Teacher Enthusiasm. The Teacher Enthusiasm Scale (Burić, 2019) assessed levels of displayed teacher enthusiasm in the classroom (n = 5; e.g., *Our teacher teaches with great enthusiasm*. Students rated the items using a 5-point scale ranging from 1 (*totally disagree*) to 5 (*totally agree*).[2]

Analyses

Since students were nested within classes (i.e., teachers), a doubly latent multilevel structural equation modeling (MSEM) approach (Muthèn & Asparouhov, 2011) was used to

[2] Full list of items measuring teaching quality and teacher enthusiasm are shown in the Supplementary Material.

analyze the data. Doubly latent multilevel models enable the measurement of 1) latent constructs using multiple items to correct for inter-item reliability and 2) group-level constructs using multiple raters to correct for inter-rater agreement (Morin et al., 2022). The MSEM decomposes the observed variance in student-ratings of teaching quality and teacher enthusiasm into two orthogonal parts: 1) level 1 (L1) variance that refers to residual climate ratings after controlling for a shared agreement in perceptions of teaching quality and teacher enthusiasm between students (Marsh et al., 2012) and 2) level 2 (L2) variance that represents class aggregated climate constructs of teaching quality and teacher enthusiasm. In contrast, teacher personality is a true L2 construct since it only exists at the teacher level, hence, its relationship with teaching quality and teacher enthusiasm could by analyzed only at L2. Moreover, climate constructs, like student-ratings of teaching quality and teacher enthusiasm, conceptually belong to L2 and should be, therefore, primarily investigated at L2 (Marsh et al., 2012). Although residual climate ratings at L1 reflecting inter-individual differences in students' perceptions of their shared classroom reality may actually stem from their unique interactions with the teacher, they can also be caused by perceptual differences, personal bias, or differences in expectations (Morin et al., 2022). Thus, in the present research, we chose to model the variance of student-ratings of teaching quality at both levels, however, only the variance components that occur at L2 (i.e., teacher personality and aggregated student-ratings of teaching quality) were of our substantial interest.[3]

[3] As suggested by Lüdtke et al. (2008, 2011), imposing measurement isomorphism (i.e., constructs at L1 and L2 having the same latent structure and factor loadings; Morin et al., 2021) in MSEM aids in stabilizing the estimation process and obtaining more accurate parameter estimates. Thus, we ran a multilevel confirmatory factor analysis (MCFA) in which we specified the unconstrained model with the same four-factor structure for teaching quality dimensions and teacher enthusiasm at both levels: χ^2 (366) = 11653.646, CFI = .935, TLI = .926, RMSEA = .042, $SRMR_W$ = .035, $SRMR_B$ = .050. In the second step, we imposed constraints on factor loadings across levels, which worsened the model fit: χ^2 (383) = 12138.981, CFI = .933, TLI = .926, RMSEA = .041, $SRMR_W$ = .035, $SRMR_B$ = .077. Model comparison indicated that current data failed to support measurement isomorphism (*TRd* = 497.34, *df* = 17, $p < .001$). However, when researchers are not interested in the interpretation of the L1 components of climate variables (as was the case in the present study), isomorphism is not required (Morin et al., 2021). Thus, in all the predictive models, factor loadings of teaching quality dimensions and teacher enthusiasm were freely estimated.

The data were analyzed in several steps. First, we calculated descriptive statistics and omega reliability coefficients (Ω) for all analyzed variables. Additionally, we calculated intraclass correlation coefficients ICC1 (i.e., the proportion of the total variance occurring at L2) and ICC2 (i.e., the reliability of the L2 aggregate) for teaching quality dimensions and teacher enthusiasm. ICC1 values greater than .05 (Lüdtke et al., 2008) and ICC2 values greater than .70 (Morin et al., 2014) are considered sufficient for using the multilevel approach. Second, Pearson correlation coefficients were calculated between manifest scores on teacher personality domains and facets, teaching quality dimensions, and control variables (i.e., teacher gender, years of teaching experience, gymnasium vs. vocational program, and students' final school grade in a subject taught by the target teacher). Third, following the hierarchical model of the Big Five (Soto & John, 2017), a series of three predictive models (in which teaching quality dimensions and teacher enthusiasm were regressed on the personality variables) were tested for each of the personality domain separately (i.e., 15 models in total): (a) single-domain model (all items load on one general factor), (b) three-facets model (items of each facet load only on its respective factor and factors are allowed to correlate), and (c) bifactor-(S-1) model (items of the reference facet load exclusively on the general factor while items of the nonreference facets load both on the general factors and their respective specific factors; specific factors are specified to correlate). In all the models, acquiescence method factor was also modeled by fixing the loadings of all positively worded items to +1 and loadings of all negatively worded items to -1, which is a common procedure for testing the effect of acquiescence response style bias when reverse items were recoded (Abad et al., 2018) as was the case with our data. This method factor was specified to be orthogonal to personality factors and criteria factors.

Finally, after establishing the best fitting models, we ran additional five models (for each personality domain separately) in which teaching quality dimensions and teacher

enthusiasm were regressed on personality factors, years of teaching experience, and class average achievement. To facilitate interpretation and reduce nonessential multicollinearity, the true L2 manifest variables (i.e., teacher personality and years of teaching experience) were grand-mean centered. The three models are graphically illustrated in Figures 1 to 3.

- Figure 1
- Figure 2
- Figure 3

Analyses were conducted using M*plus* 8.8 (Muthèn & Muthèn, 1998-2017) and with maximum likelihood robust estimator (MLR). We used comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square (SRMR) to evaluate goodness of model fit. Models were compared using the differences in AIC. Values of CFI and TLI greater than .90 suggest acceptable fit, while values greater than .95 suggest good fit (Hu & Bentler, 1999). RMSEA values that fall between .05 and .08 indicate an acceptable fit, whereas values lower than .05 indicate good fit (McDonald & Ho, 2002). Values of SRMR that are below the .08 cutoff indicate good fit (Marsh et al., 2005). Lastly, the lower the AIC value, the better the fit. However, as a rule of thumb, ΔAIC equal or greater than 2 indicates that there is substantial support for the model with lower AIC value (Burnham & Anderson, 2004).

Results

Descriptive Statistics, Reliability Coefficients, and Bivariate Correlations

Descriptive statistics and reliability coefficients are shown in Tables 1 and 2. ICC1 values for the sum of scores on teaching quality dimensions and teacher enthusiasm were significantly above the threshold of .05, justifying the multilevel approach to analyzing data (at the item level, ICC1 values ranged from .109 to .341). ICC2 values were larger than .70 proving high level of reliability of the aggregated teaching quality dimensions and teacher

enthusiasm at L2. Finally, omega (Ω) values suggested either acceptable or high levels of reliability of analyzed variables at both levels.

- Table 1 -

Regarding the correlations of the manifest scores at L2 (see Table 2)[3], it can be concluded that teacher personality is rather weakly and inconsistently related to student-ratings of teaching quality and teacher enthusiasm. Extraversion as a domain and its sociability facet were positively related to classroom management, student support, and teacher enthusiasm. Additionally, facets of assertiveness and energy level were positively related to classroom management. Agreeableness as a domain was positively related only to student support and teacher enthusiasm but its facet compassion exhibited positive correlations with all dimensions of teaching quality and teacher enthusiasm. Finally, trust was significantly but weakly related to higher levels of student support. Contrary to expectations, conscientiousness and its facets were either unrelated or negatively related to student-ratings of teaching quality. More specifically, conscientiousness as a domain was associated with lower ratings of cognitive activation, while organization facet was related to lower levels of both the cognitive activation and teacher enthusiasm. Regarding negative emotionality, neither the domain nor its facets correlated with teaching quality dimensions and teacher enthusiasm. Lastly, open-mindedness as a domain and creative imagination as its facet correlated positively with student support and teacher enthusiasm. Additionally, aesthetic sensitivity was positively related to teacher enthusiasm.

Among the analyzed covariates, at L2 and across all dimensions, teaching quality and teacher enthusiasm were rated as being lower for more experienced teachers. In contrast, classes of students with higher levels of previous academic achievement in the subject taught

[3] The complete correlation matrix of all analyzed variables at L1 and L2 is shown in Table S2 in the Supplementary Material.

by the target teacher (measured as a final school grade at the end of the last school year), gave higher ratings of teaching quality and teacher enthusiasm. Due to the consistent pattern of these correlations across dimensions of teaching quality and teacher enthusiasm, years of teaching experience and class achievement were entered as predictors in all bifactor-(S-1) MSEM models to test whether the incremental associations between personality facets remain stable even after controlling for these covariates[4].

- Table 2 -

Model Fit

Model fit indices are presented in Table 3. Based on their cut-off values, all models fit the data well. Nonetheless, the three-facets models tended to fit the data better than single-domain models. Likewise, the bifactor-(S-1) models had a better fit than the three-facets models and single-domain models. Indeed, the difference in AIC values between the single-domain and three facets models were substantially greater than 2 for all Big Five factors (ΔAIC = 456.61 for extraversion, ΔAIC = 232.08 for agreeableness, ΔAIC = 141.59 for conscientiousness, ΔAIC = 238.18 for negative emotionality, and ΔAIC = 612.23 for open-mindedness). Similarly, the difference in AIC values between the three facets models and bifactor-(S-1) models suggested better fit of the latter ones (ΔAIC = 11.50 for extraversion, ΔAIC = 24.15 for agreeableness, ΔAIC = 75.60 for conscientiousness, ΔAIC = 74.63 for negative emotionality, and ΔAIC = 35.50 for open-mindedness). These results suggest that the bifactor-(S-1) representation of teacher personality is supported by the data to the greatest extent. Moreover, if there is a facet that can be taken as a meaningful reference like in our

[4] Since school grades are measured at L1, we included them as control variables at L1 too even though their associations with residual ratings of teaching quality were not of our substantial interest. The exemplary M*plus* syntax for the bifactor-(S-1) multilevel structural equation model is provided in the Supplementary Material.

research, the bifactor-(S-1) models are considered preferable to the first-order factors models (i.e., three-facets models; Eid et al., 2018).

In the chosen bifactor-(S-1) models, standardized factor loadings of items measuring teaching quality and teacher enthusiasm were statistically significant ($p < .001$) and ranged from .636 to .832 at L1, and from .727 to .993 at L2. Likewise, factor loadings of all items measuring teacher personality were statistically significant ($p < .001$). Their mean standardized values for the general reference factor and other two specific facetors within a personality domain were: $\lambda = .544$ and $\lambda = .457$, respectively for extraversion; $\lambda = .489$ and $\lambda = .418$, respectively for agreeableness; $\lambda = .576$ and $\lambda = .342$, respectively for conscientiousness; $\lambda = .537$ and $\lambda = .370$, respectively for negative emotionality; and $\lambda = .471$ and $\lambda = .459$, respectively for open-mindedness. Lastly, an average factor loading estimate for the acquiescence response style factor was $\lambda = .158$. The full list of factor loadings are shown in Table S3 in the Supplementary Material.

- Table 3 -

Predictive Bifactor-(S-1) Multilevel Structural Equation Models

When it comes to unique predictive power of teacher Big Five personality in explaining student-ratings of teaching quality and teacher enthusiasm, the pattern of associations was somewhat different when compared to the bivariate associations based on sum of scores on domain and facet scales (see Table 4). The results showed that the general sociability reference factor was positively related to student-ratings of classroom management ($\beta = .167$, $p < .001$), student support ($\beta = .123$, $p < .001$), and teacher enthusiasm ($\beta = .099$, $p < .01$). However, contrary to positive bivariate associations between assertiveness and energy level and some examined criteria, the bifactor-(S-1) model revealed that above sociability, assertiveness and energy level failed to uniquely explain the variance of teaching quality dimensions and teacher enthusiasm.

Next, even though compassion was positively related to student-ratings of all analyzed indicators at the bivariate level, in the bifactor-(S-1) model, the general compassion reference factor was positively related only to student support (β = .129, *p* = .002). Such findings show that once the variance in compassion which is shared with respectfulness and trust is partialized out, compassion is no longer relevant in explaining the criteria other than student support. However, we found an incremental value of trust in explaining the variance of teacher enthusiasm (β = .120, *p* = .036) over and above the general compassion reference factor.

Similar to the results obtained at the bivariate level, the general organization reference factor was weakly but negatively related to cognitive activation (β = -.097, *p* = .008), student support (β = -.082, *p* = .024), and teacher enthusiasm (β = .099, *p* = .022). These results suggest that students may perceive the preference for order and structure inherent to teachers with high levels of organization as less desirable in the classroom that does not add up to their teacher's performance.

Interestingly, although negative emotionality as a domain as well as its facets were unrelated to student-ratings of teaching quality and teacher enthusiasm at the bivariate level, the bifactor-(S-1) model revealed weak and marginally statistically significant negative association between the general anxiety reference factor and classroom management (β = -.079, *p* = .054). Moreover, the analysis indicated a small and marginally statistically significant but incremental value of emotional volatility in explaining the variance of cognitive activation (β = .097, *p* = .067), classroom management (β = .106, *p* = .060), and teacher enthusiasm (β = .112, *p* = .040), over and above other the general anxiety reference factor. These results indicate that higher emotional volatility might be actually beneficial for teachers with regard to students' perceptions of their teaching performance.

Lastly, even though open-mindedness as a domain and its facets of aesthetic sensitivity and creative imagination were positively related to student support and teacher enthusiasm at the bivariate level, the bifactor-(S-1) model failed to reveal any significant unique associations between personality facets and analyzed criteria.

Adding the covariates (i.e., years of teaching experience and class-average school grade) in the bifactor-(S-1) multilevel structural equation models yielded similar results regarding the size and statistical significance of the regression coefficients (see Table 4). There were exceptions for models with conscientiousness— after controlling for the covariates, negative relationships between the general organization reference facet and cognitive activation, student support, and teacher enthusiasm became statistically non-significant ($\beta = -.057$, $\beta = -.036$, and $\beta = -.048$, ps $> .05$, respectively). Such results likely emerged because the reference factor of organization was negatively related to class average achievement ($\beta = -.111$, $p = .003$) and positively to years of teaching experience ($\beta = .104$, $p = .005$), suggesting that teachers who prefer structure and order also tend to be more experienced teachers and assign lower grades to their students. Lastly, after introducing the covariates, association between the general sociability reference factor and cognitive activation became marginally statistically significant ($\beta = .073$, $p = .048$), as well as the association between the general anxiety reference factor and student support ($\beta = - .068$, $p = .055$). Nonetheless, these effects most likely resulted from suppression. Thus, it seemed that without further empirical confirmation, giving them a substantial meaning would be of limited value.

- Table 4 -

Discussion

Although previous research examined the effects of teacher personality on various indicators of teacher effectiveness (Kim et al., 2019; Klassen & Tze, 2014), there are only few studies that considered teacher personality traits at different levels of hierarchy or used student-ratings of teaching quality and teacher enthusiasm as criteria. Moreover, previous studies have not investigated whether personality facets have incremental power in explaining teaching quality and teacher enthusiasm beyond the reference pure-factor facets and after controlling for the acquiescence response style that is common confounding method factor in personality self-reports. Thus, in the present research, we aimed to gain a deeper and more nuanced understanding of the role of teacher personality, operationalized with greater preciseness, in shaping students' perceptions of teaching quality and teacher enthusiasm.

Teacher Personality and Student-Ratings of Teaching Quality and Teacher Enthusiasm

Our results highlighted the importance of teacher extraversion in relation to classroom management, student support, and teacher enthusiasm, which is in line with previous research (Baier et al., 2019; Kim et al., 2019). However, a more nuanced analysis at the facet level suggested that such positive associations emerge most likely due to teacher sociability, rather than assertiveness or energy level. In the essence of the sociability facet is the desire to approach and engage with others in social interactions (Soto & John, 2017). Similarly, having positive interactions and relationships with students is crucial for successful teaching and desirable students' outcomes (Hamre & Pianta, 2006; Roorda et al., 2019). Thus, it is not surprising that having greater desire to interact and engage in social relationships with students helps teachers to manage their students' (mis)behavior in classroom, offer them support, or freely display their enjoyment and excitement while teaching.

Next, agreeableness was also found to be an important teacher personality domain for shaping students' perceptions of teaching quality. These results contradict previous meta-

analytic finding of null associations between teacher agreeableness and teacher effectiveness composite (Kim et al., 2019). However, they are in line with prior studies linking agreeableness to performance in jobs that are more interpersonal in nature (Hurtz & Donovan, 2000), as well as with recent research showing positive association between teacher agreeableness and student support (Roloff et al., 2020). Specifically, our study showed that teacher compassion is of particular relevance when it comes to supporting students in the classroom. Compassion refers to emotional concerns for others (Soto & John, 2017), hence, providing emotional and learning support to students can be an easier endeavor to teachers with higher levels of compassion. Interestingly, teachers who had more positive general beliefs in others, as reflected in the trust facet (Soto & John, 2017), were rated by students as those who deliver more enthusiastic teaching; this result emerged over and above general compassion reference factor. Teachers holding positive views about other people, including students, are more likely to experience positive emotions like joy while teaching and interacting with students which makes them more enthusiastic in the eyes of their students.

Contrary to expectations and previous research findings that consistently pointed to conscientiousness as the most important personality domain positively predicting performance of both teachers (Baier et al., 2019; Kim et al., 2018) and employees in other occupations (Hurtz & Donovan, 2000; Zell & Lesick, 2022), teacher conscientiousness was only weakly and negatively associated with student-ratings of teaching quality. Moreover, a more detailed analysis at the facet level revealed that these effects were entirely attributable to the pure-factor facet of conscientiousness, that is, to organization. Specifically, teachers who described themselves as more organized were seen by their students as those who provided less cognitively activating instruction and less learning support. They were also rated as less likely to display enthusiasm while teaching. Organization refers to preference for

order and structure and is considered as largely inhibitory facet of conscientiousness (Soto & John, 2017). Thus, teachers high on this facet could be perceived by their students as strict and rigid in providing stimulating and 'out-of-the-box' assignments and discussions during lessons and less likely to openly show affection and positive emotions while teaching and interacting with students. It should be noted that these negative associations disappeared after controlling for class average school grades and years of teaching experience.

Negative emotionality showed an interesting pattern of associations with teaching quality and teacher enthusiasm. The reference factor of negative emotionality— that is, a tendency to experience fear and anxiety (Soto & John, 2017) — was weakly and negatively associated with classroom management. Teachers prone to fear and anxiety could get more easily upset and frightened by disturbances in students' behavior, which makes the classroom management an especially difficult task for them. Interestingly, higher teacher emotional volatility was related to higher students' ratings of cognitive activation, classroom management, and teacher enthusiasm over and beyond anxiety. It is possible that teachers who are more prone to changing their mood are seen by students also as more spontaneous and emotionally authentic, which is generally valued by students (Keller & Becker, 2021), hence their more positive ratings. In addition, such results highlighted the importance of being flexible in emotional responding while performing the teaching job, which is marked by intense and frequent social interactions with students.

Lastly, at the bivariate level, open-mindedness and its facets were positively related to student-ratings of teacher enthusiasm and student support. That is, teachers who described themselves as having more intellectual and artistic interests and as being creative and imaginative (Soto & John, 2017), were seen by their students as more enthusiastic and supportive. However, the analysis of incremental values of openness facets revealed that none of the facets had a unique contribution in explaining student-ratings of teaching quality and

teacher enthusiasm. Even though in most hierarchical Big Five frameworks intellectual curiosity appears as a facet constituting openness (e.g., DeYoung et al., 2007; Goldberg, 1999; Saucier & Ostendorf, 1999), therefore justifying its selection as the reference facet in out bifactor-(S-1) model, the consensus regarding the defining features and optimal label for openness still has not been reached (DeYoung et al., 2014). It is possible that choosing another facet of open-mindedness as the reference facet and consequently altering the meaning of the general and specific factors would yield different results (Heinrich et al., 2023).

In sum, the application of the bifactor-(S-1) models showed that the associations between the Big Five personality domains and indicators of teaching effectiveness seem to be fueled by the factor-pure facets that act as the core defining features of their respective domains (Soto & John, 2017). Specifically, even though teacher extraversion was found as an important predictor of teacher effectiveness in previous studies (Baier et al., 2019; Kim et al., 2019), a more nuanced analysis in the present research revealed that teacher sociability, rather than assertiveness or energy level, is what mattered the most. Likewise, the explanatory power of teacher conscientiousness for predicting teaching performance could be for the most part attributable to organization or preference for order and structure, which is considered as facet central to the conscientiousness domain and independent from the other four personality domains (Soto & John, 2017). Relatedly, besides trust and emotional volatility, personality facets specified as specific factors had limited power in explaining the variance of the analyzed criteria over and above their respective general reference factors (i.e., compassion and anxiety, respectively).

Next, even though personality facets sometimes predict various life outcomes even better than general domains (Danner et al., 2021; Stewart et al., 2022), the effects established in the present investigation were generally modest and similar to those found in previous

studies focusing on broad personality domains (Kim et al., 2019). According to the construct correspondence hypothesis (Judge et al., 2013), broad personality domains should best predict overall job performance, while narrower facets should have greater explanatory power in predicting specific aspects of job performance. Since our results indicated that most of the established associations between teacher personality and the analyzed criteria outcomes stem from the factor-pure facets which define specific domains, it is not surprising that the current effects sizes for facets are similar to those found in previous research on teacher broad personality domains.

Contrary to expectations and results of previous research (e.g., Kim et al., 2019), our analysis revealed that some aspects of teacher conscientiousness (i.e., organization) may actually have undesirable effects on students' perceptions of teaching. It seems that teachers' preference for order and structure is not perceived positively by students in relation to teaching practice. However, after controlling teachers' years of teaching experience and class average achievement these effects disappeared. Since the general organization reference factor was negatively related to class average achievement and positively to years of teaching experience, it is highly likely that teachers who prefer structure and order also tend to be more experienced and assign lower grades to their students, thereby negatively affecting students' ratings. In contrast, some aspects of negative emotionality personality domain (i.e., emotional volatility), which is generally found to be negatively related to job performance (Barrick & Mount, 1991; Salgado, 2003), actually showed beneficial patterns of associations with students' perceptions of teaching quality and teacher enthusiasm. Specifically, after partializing out the effects of general anxiety reference factor, being emotionally volatile (i.e., flexible in emotional responding) seemed to help teachers in the classroom. Findings like these clearly point out that analyzing teacher personality solely at the domain level, as per common practice, most likely fails to detect any such particularities.

Lastly, it should be noted that even if teacher personality facets are taken into consideration, analyzing only their bivariate associations with the outcomes of interest and failing to examine the unique contribution of specific factors over and above the general reference factor, could lead to substantially different conclusions. Indeed, some bivariate associations in the present study differed from their counterparts obtained through the bifactor-(S-1) models. These differences stem from different specifications of the bifactor-(S-1) models in which the general factor represents individual differences in the reference facet. This general factor does not have the same meaning as in a classic bifactor model. Rather, it reflects a personality domain as captured by the reference facet. In the bifactor-(S-1) model, other specific factors (i.e., facets) are independent of the reference facet. Moreover, they are allowed to correlate with each other thereby grasping their shared variance which is orthogonal to the reference facet (Eid et al., 2018). Thus, the significant associations between the specific facets and teaching quality and teacher enthusiasm reflect their unique contribution in explaining the criteria over and beyond the general reference facet. In contrast, bivariate relationships between personality domains/facets and criteria do not separate the variance in items that is saturated either by the general reference factor or specific facetors, thus masking their contribution in explaining unique variance in teaching quality and teacher enthusiasm. Finally, we included a factor reflecting the acquiescence response style (Abad et al., 2018) in all models, which had small but statistically significant factor loadings. Inclusion of this additional factor reduced the shared variance of personality items to a certain extent, therefore reducing the size of the associations between personality variables and examined criteria in the bifactor-(S-1) models.

Limitations and Future Directions

Personality traits are considered to be rather stable in adulthood since individuals maintain very similar rank ordering on traits across the lifespan (Costa & McCrae, 1986;

Terracciano et al., 2010). Therefore, longitudinal study designs with time lags of duration that is typical in educational research would probably yield similar results. Nonetheless, due to the cross-sectional design of the present research, conclusions regarding the causal or predictive effects of teacher personality on student-ratings of teaching are not possible. Also, it is possible that events and processes that happen and evolve in the classroom most likely influence the manifestation of teacher personality in return, which calls for further empirical investigation.

Next, even though using data from different sources (i.e., teachers and students) reduces the effects of common-method variance that can artificially inflate or deflate the associations between the predictor and criterion (Podsakoff et al., 2003), teachers' self-reported personality most likely has weaker associations with the examined criteria than student-ratings of teacher personality (Kim et al., 2018). Thus, future research may wish to examine the relationship between teacher personality and teaching quality and teacher enthusiasm by capturing teacher personality through both self-ratings and student-ratings.

Furthermore, we used student ratings as a cost-efficient method of capturing teaching quality and teacher enthusiasm. Previous research has demonstrated the validity of student-ratings at the class level (Herbert et al., 2022), which was the targeted level of analysis in our research too. In addition, there is evidence on validity of student-ratings at secondary (Worrel & Kuterbach, 2001) and even primary school levels (Fauth et al., 2014). Although student-ratings can provide useful information about teacher behavior in the classroom (Wisniewski et al., 2020), they can still be subjective (Carpenter et al., 2020) and biased by teacher popularity or academic achievement (i.e., students who get better grades rate their teachers higher; Muijs & Bokhove, 2017). Thus, despite the result showing that teacher personality explained the variance of student-ratings of teaching quality and teacher enthusiasm after controlling for prior students' academic achievement, future research should continue to

investigate the issue of bandwidth–fidelity tradeoff by using different indicators of teaching effectiveness, such as classroom observations, principal-ratings, and students' attainment (Goe et al., 2008; Muijs & Reynolds, 2018).

Additionally, in the present investigation, teachers rated their personality as they were generally in life, rather than in the classroom while teaching and interacting with students. Nonetheless, measuring teachers' contextualized personality, by considering the way their personality characteristics manifest within their teacher role might yield stronger effects (Dunlop & Hanley, 2019). Thus, future studies should aim to explore the effects of teacher personality manifestation *in situ*—that is, in a given moment and a classroom situation (e.g., Horstmann & Ziegler, 2020)—to gain more complete insights into the role of teachers' personal characteristics in explaining their teaching behavior.

Lastly, most previous research in the field involved teachers from USA (e.g., Kell, 2019) or Germany (e.g., Baier et al., 2018; Fauth et al., 2014), while other education contexts were typically underrepresented. The current study was conducted in Croatian education context which was marked by post-communist transition during the last three decades (Kotarski & Petak, 2019) and ongoing education reform initiatives (Sablić et al., 2022), which may have affected students' perceptions of classroom processes. Future research should consider teachers and students from diverse cultural and ethnic backgrounds to provide a more comprehensive insight into the role of teacher personality manifestations in the classroom.

Concluding Remarks

The size of the associations established in present research were mostly small, suggesting that teacher self-reported personality explains only modest portion of variability in students' perceptions of teaching quality and teacher enthusiasm. Thus, one should be careful in drawing conclusions about implications for practice based on study findings, especially

those concerning teacher selection based on personality. Nonetheless, the present results can have implications for teacher professional development. Self-assessments of various psychological aspects, including personality, can be helpful in promoting teachers' self-awareness and helping them to become reflective on how they think, view, and behave in the classroom. Thus, schools may wish to consider helping teachers to become more self-aware of different aspects of their personality and their relevance for teaching practices and the ways students perceive them.

Furthermore, even though the Big Five personality domains can be viewed as specific patterns of thinking, feeling, and behaving that are stable across time and situations, they are tightly and probably reciprocally related to social, emotional, and behavioral skills that are malleable and can be built (Dweck, 2017; Soto et al., 2021). Thus, teachers' social, emotional, and behavioral skills that stem from the Big Five personality domains can be fostered in order to improve teaching practice (Beuchel et al., 2022; Jennings & Greenberg, 2009). For example, the beneficial effects of teacher extraversion on teaching could be further amplified through building teachers' social engagement skills (i.e., capacities for actively engaging with students during teaching), while the positive effects of teacher agreeableness could be further promoted by building teachers' cooperation skills (i.e., capacities for maintaining positive relationships with students). In contrast, the negative effects of teacher anxiety on teaching could be buffered by building teachers' emotional resilience skills or capacities for successful regulation of moods and emotions (Soto et al., 2022). Nonetheless, these proposals need to be tested empirically.

References

Abad, F. J., Sorrel, M. A., Garcia, L. F., & Aluja, A. (2018). Modeling general, specific, and method variance in personality measures: Results for ZKA-PQ and NEO-PI-R. *Assessment, 25*(8), 959-977. https://doi.org/10.1177/1073191116667547

Aleamoni, L. M. (1999). Student rating myths versus research facts from 1924 to 1998. *Journal of Personnel Evaluation in Education*, *13*, 153-166. https://doi.org/10.1023/A:1008168421283

Anglim, J., & Grant, S. L. (2014). Incremental criterion prediction of personality facets over factors: Obtaining unbiased estimates and confidence intervals. *Journal of Research in Personality*, *53*, 148-157. https://doi.org/10.1016/j.jrp.2014.10.005

Anglim, J., & O'Connor, P. (2019). Measurement and research using the Big Five, HEXACO, and narrow traits: A primer for researchers and practitioners. *Australian Journal of Psychology, 71*(1), 16-25. https://doi.org/10.1111/ajpy.12202

Anglim, J., Horwood, S., Smillie, L. D., Marrero, R. J., & Wood, J. K. (2020). Predicting psychological and subjective well-being from personality: A meta-analysis. *Psychological Bulletin, 146*(4), 279-323. https://doi.org/10.1037/bul0000226

Author (2019)

Author (2020)

Author (2021)

Baier, F., Decker, A. T., Voss, T., Kleickmann, T., Klusmann, U., & Kunter, M. (2019). What makes a good teacher? The relative importance of mathematics teachers' cognitive ability, personality, knowledge, beliefs, and motivation for instructional quality. *British Journal of Educational Psychology, 89*(4), 767-786. https://doi.org/10.1111/bjep.12256

Barrick, M. R., & Mount, M. K. (1991). The big five personality dimensions and job performance: A meta-analysis. *Personnel Psychology*, *44*, 1–26. https://doi.org/10.1111/j.1744-6570.1991.tb00688.x

Bastian, K. C., McCord, D. M., Marks, J. T., & Carpenter, D. (2017). A temperament for teaching? Associations between personality traits and beginning teacher performance

and retention. *AERA Open, 3*(1), 2332858416684764.

Beuchel, P., Ophoff, J. G., Cramer, C., & Hautzinger, M. (2022). Promoting occupational health and teaching quality: The impact of a mindfulness intervention in teacher training. *Teaching and Teacher Education*, *114*, 103703. https://doi.org/10.1016/j.tate.2022.103703

Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference: Understanding AIC and BIC in model selection. *Sociological Methods & Research*, *33*(2), 261-304. https://doi.org/10.1177/0049124104268644

Carpenter, S. K., Witherby, A. E., & Tauber, S. K. (2020). On students'(mis) judgments of learning and teaching effectiveness. *Journal of Applied Research in Memory and Cognition*, *9*(2), 137-151. https://doi.org/10.1016/j.jarmac.2019.12.009

Costa Jr, P. T., & McCrae, R. R. (1995). Domains and facets: Hierarchical personality assessment using the Revised NEO Personality Inventory. *Journal of Personality Assessment*, *64*(1), 21-50. https://doi.org/10.1207/s15327752jpa6401_2

Costa, P. T., Jr., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and*

Costa Jr, P. T., & McCrae, R. R. (1986). Personality stability and its implications for clinical psychology. *Clinical Psychology Review*, *6*(5), 407-423. https://doi.org/10.1016/0272-7358(86)90029-2

Cutchin, G. C. (1998). *Relationships between the Big Five personality factors and performance criteria for inservice high-school teachers* (Doctoral dissertation). Purdue University.

Danner, D., Lechner, C. M., Soto, C. J., & John, O. P. (2021). Modelling the incremental value of personality facets: The domains-incremental facets-acquiescence bifactor showmodel. *European Journal of Personality, 35*(1), 67–84. https://doi.org/10.1002/per.2268

Darling-Hammond, L. (2015). *Getting teacher evaluation right: What really matters for effectiveness and improvement.* Teachers College Press. https://doi.org/10.1080/00223891.2018.1539004

DeYoung, C. G., Quilty, L. C., & Peterson, J. B. (2007). Between facets and domains: 10 aspects of the Big Five. *Journal of Personality and Social Psychology*, *93*(5), 880-896. https://doi.org/10.1037/0022-3514.93.5.880

DeYoung, C. G., Quilty, L. C., Peterson, J. B., & Gray, J. R. (2014). Openness to experience, intellect, and cognitive ability. *Journal of Personality Assessment*, *96*(1), 46-52. https://doi.org/10.1080/00223891.2013.806327

Dunlop, W. L., & Hanley, G. E. (2019). Contextualizing personality: Personality within and across social roles and conceptual levels. *Journal of Personality*, *87*(4), 903-914. https://doi.org/10.1111/jopy.12443

Dweck, C. S. (2017). From needs to goals and representations: Foundations for a unified theory of motivation, personality, and development. *Psychological Review, 124*(6), 689–719. https://doi.org/10.1037/rev0000082

Eid, M., Geiser, C., Koch, T., & Heene, M. (2017). Anomalous results in G-factor models: Explanations and alternatives. *Psychological Methods, 22*(3), 541–562. https://doi.org/10.1037/met0000083

Eid, M., Krumm, S., Koch, T., & Schulze, J. (2018). Bifactor models for predicting criteria by general and specific factors: Problems of nonidentifiability and alternative solutions. *Journal of Intelligence*, *6*(3), 42. https://doi.org/10.3390/jintelligence6030042

Fauth, B., Decristan, J., Decker, A. T., Büttner, G., Hardy, I., Klieme, E., & Kunter, M. (2019). The effects of teacher competence on student outcomes in elementary science education: The mediating role of teaching quality. *Teaching and Teacher Education, 86,* 102882. https://doi.org/10.1016/j.tate.2019.102882

Fauth, B., Decristan, J., Rieser, S., Klieme, E., & Büttner, G. (2014). Student ratings of teaching quality in primary school: Dimensions and prediction of student outcomes. *Learning and Instruction*, *29*, 1-9. https://doi.org/10.1016/j.learninstruc.2013.07.001

Feldman, K. A. (2007). Identifying exemplary teachers and teaching: Evidence from student ratings. In R. P. Perry & J. C. Smart (Eds.), *The scholarship of teaching and learning in higher education—an evidence-based perspective* (pp. 93–143). Springer.

Forster, D. E., Billingsley, J., Russell, V. M., McCauley, T. G., Smith, A., Burnette, J. L., Ohtsubo, Y., Schug, J., Lieberman, D., & McCullough, M. E. (2020). Forgiveness takes place on an attitudinal continuum from hostility to friendliness: Toward a closer union of forgiveness theory and measurement. *Journal of Personality and Social Psychology, 119*(4), 861–880. https://doi.org/10.1037/pspi0000227

Gäde, J. C., Schermelleh-Engel, K., & Klein, A. G. (2017). Disentangling the common variance of perfectionistic strivings and perfectionistic concerns: A bifactor model of perfectionism. *Frontiers in Psychology, 8*, 160. https://doi.org/10.3389/fpsyg.2017.00160

Goe, L., Bell, C., & Little, O. (2008). *Approaches to evaluating teacher effectiveness: A research synthesis*. National Comprehensive Center for Teacher Quality. http://files.eric.ed.gov/fulltext/ED521228.pdf

Goldberg, L. R. (1990). An alternative" description of personality": The big-five factor structure. *Journal of Personality and Social Psychology, 59*(6), 1216–1229. https://doi.org/10.1037/00223514.59.6.1216

Goldberg, L. R. (1992). The development of markers for the Big-Five factor structure. *Psychological Assessment, 4*(1), 26–42. https://doi.org/10.1037/1040-3590.4.1.26

Goldberg, L. R. (1999). A broad-bandwidth, public domain, personality inventory measuring the lower-level facets of several five-factor models. *Personality Psychology in Europe*, *7*(1), 7-28.

Hamre, B. K., & Pianta, R. C. (2006). Student-Teacher Relationships. In G. G. Bear & K. M. Minke (Eds.), *Children's needs III: Development, prevention, and intervention* (pp. 59–71). National Association of School Psychologists.

Hatfield, E., Cacioppo, J. T., & Rapson, R. L. (1994). *Emotional contagion*. Cambridge University Press.

He, Y., Donnellan, M. B., & Mendoza, A. M. (2019). Five-factor personality domains and job performance: A second order meta-analysis. *Journal of Research in Personality*, *82*, 103848. https://doi.org/10.1016/j.jrp.2019.103848

Heinrich, M., Geiser, C., Zagorscak, P., Burns, G. L., Bohn, J., Becker, S. P., ... & Knaevelsrud, C. (2023). On the meaning of the "P factor" in symmetrical Bifactor models of psychopathology: recommendations for future research From the Bifactor-(S− 1) perspective. *Assessment*, 10731911211060298. https://doi.org/10.1177/10731911211060298

Herbert, B., Fischer, J., & Klieme, E. (2022). How valid are student perceptions of teaching quality across education systems? *Learning and Instruction*, *82*, 101652. https://doi.org/10.1016/j.learninstruc.2022.101652

Hofstee, W. K., de Raad, B., & Goldberg, L. R. (1992). Integration of the Big Five and circumplex approaches to trait structure. *Journal of Personality and Social Psychology, 63*(1), 146–163. https://doi.org/10.1037/0022-3514.63.1.146

Horstmann, K. T., & Ziegler, M. (2020). Assessing personality states: What to consider when constructing personality state measures. *European Journal of Personality*, *34*(6), 1037-1059. https://doi.org/10.1002/per.2266

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1–55. https://doi.org/10.1080/10705519909540118

Hurtz, G. M., & Donovan, J. J. (2000). Personality and job performance: The Big Five revisited. *Journal of Applied Psychology, 85*(6), 869 –879. https://doi.org/10.1037/0021-9010.85.6.869

Jackson, D. L., Teal, C. R., Raines, S. J., Nansel, T. R., Force, R. C., & Burdsal, C. A. (1999). The dimensions of students' perceptions of teaching effectiveness. *Educational and Psychological Measurement, 59*(4), 580–596. doi:10.1177/00131649921970035.

Jennings, P. A., & Greenberg, M. T. (2009). The prosocial classroom: Teacher social and emotional competence in relation to student and classroom outcomes. *Review of Educational Research*, *79*(1), 491-525. https://doi.org/10.3102/003465430832569

John, O. P. (2021). History, measurement, and conceptual elaboration of the Big-Five trait taxonomy: The paradigm matures. In O. P. John & R. W. Robins (Eds.), *Handbook of personality: Theory and research* (pp. 35–82). The Guilford Press.

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative Big Five trait taxonomy. In O. P. John, R. W. Robins & L. A. Pervin (Eds.), *Handbook of Personality: Theory and Research* (pp. 114–158). The Guilford Press.

John, O. P., & Srivastava, S. (1999). The Big Five Trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (pp. 102–138). Guilford Press.

Judge, T. A., Rodell, J. B., Klinger, R. L., Simon, L. S., & Crawford, E. R. (2013). Hierarchical representations of the five-factor model of personality in predicting job performance: Integrating three organizing frameworks with two theoretical

perspectives. *Journal of Applied Psychology*, 98, 875–925. https://doi.org/10.1037/a0033901

Junghänel, M., Rodenacker, K., Dose, C., & Döpfner, M. (2020). Applying the bifactor S-1 model to ratings of ADHD/ODD symptoms: A commentary on Burns et al. (2019) and a re-analysis. *Journal of Abnormal Child Psychology, 48*(7), 905-910. https://doi.org/10.1007/s10802-020-00637-4

Keller, M. M., & Becker, E. S. (2021). Teachers' emotions and emotional authenticity: Do they matter to students' emotional responses in the classroom? *Teachers and Teaching, 27*(5), 404-422. https://doi.org/10.1080/13540602.2020.1834380

Keller, M. M., Goetz, T., Becker, E. S., Morger, V., & Hensley, L. (2014). Feeling and showing: A new conceptualization of dispositional teacher enthusiasm and its relation to students' interest. *Learning and Instruction, 33*, 29–38. https://doi.org/10.1016/j.learninstruc.2014.03.001

Keller, M. M., Hoy, A. W., Goetz, T., & Frenzel, A. C. (2016). Teacher enthusiasm: Reviewing and redefining a complex construct. *Educational Psychology Review, 28*, 743-769. https://doi.org/10.1007/s10648-015-9354-y

Kim, L. E., Dar-Nimrod, I., & MacCann, C. (2018). Teacher personality and teacher effectiveness in secondary school: Personality predicts teacher support and student self-efficacy but not academic achievement. *Journal of Educational Psychology*, *110*(3), 309–323. https://doi.org/10.1037/edu0000217

Kim, L. E., Jörg, V. & Klassen, R. M. (2019). A meta-analysis of the effects of teacher personality on teacher effectiveness and burnout. *Educational Psychology Review, 31*, 163–195. https://doi.org/10.1007/s10648-018-9458-2

Kim, T., & Schallert, D. L. (2014). Mediating effects of teacher enthusiasm and peer enthusiasm on students' interest in the college classroom. *Contemporary Educational*

Psychology, *39*(2), 134-144. https://doi.org/10.1016/j.cedpsych.2014.03.002

Klassen, R. M., Durksen, T. L., Al Hashmi, W., Kim, L. E., Longden, K., Metsäpelto, R.-L., Poikkeus, A.-M., & Györi, J. G. (2018). National context and teacher characteristics: Exploring the critical non-cognitive attributes of novice teachers in four countries. *Teaching and Teacher Education, 72*, 64–74. https://doi.org/10.1016/j.tate.2018.03.001

Klassen, R. M., & Tze, V. (2014). Teachers' self-efficacy, personality, and teaching effectiveness: A meta-analysis. *Educational Research Review*, *12*, 59–76. https://doi.org/10.1016/j.edurev.2014.06.001

Kunter, M., Tsai, Y. M., Klusmann, U., Brunner, M., Krauss, S., & Baumert, J. (2008). Students' and mathematics teachers' perceptions of teacher enthusiasm and instruction. *Learning and Instruction, 18*(5), 468-482. https://doi.org/10.1016/j.learninstruc.2008.06.008

Kunter, M., Frenzel, A., Nagy, G., Baumert, J., & Pekrun, R. (2011). Teacher enthusiasm: Dimensionality and context specificity. *Contemporary Educational Psychology*, *36*(4), 289–301.

Kunter, M., & Voss, T. (2013). The model of instructional quality in COACTIV: A multicriteria analysis. In M. Kunter, J. Baumert, W. Blum, U. Klusmann, S. Krauss, & M. Neubrand (Eds.), *Cognitive Activation in the Mathematics Classroom and Professional Competence of Teachers: Results from the COACTIV Project* (pp. 97–124). Springer US.

Lee, N., & Cadogan, J. W. (2013). Problems with formative and higher-order reflective variables. *Journal of Business Research*, *66*(2), 242-247. https://doi.org/10.1016/j.jbusres.2012.08.004

Lüdtke, O., Marsh, H. W., Robitzsch, A., Trautwein, U., Asparouhov, T., & Muthén, B. (2008). The multilevel latent covariate model: A new, more reliable approach to group-

level effects in contextual studies. *Psychological Methods, 13*(3), 203–229. https://doi.org/10.1037/a0012869

Lüdtke, O., Robitzsch, A., Trautwein, U., & Kunter, M. (2009). Assessing the impact of learning environments: How to use student ratings of classroom or school characteristics in multilevel modeling. *Contemporary Educational Psychology*, *34*(2), 120-131. https://doi.org/10.1016/j.cedpsych.2008.12.001

Mammadov, S. (2022). Big Five personality traits and academic performance: A meta-analysis. *Journal of Personality, 90*(2), 222-255. https://doi.org/10.1111/jopy.12663

Marsh, H. W. (2007). Students' evaluations of university teaching: dimensionality, reliability, validity, potential biases and usefulness. In R. P. Perry & J. C. Smart (Eds.), *The scholarship of teaching and learning in higher education* (pp. 319–383). Springer.

Marsh, H. W., Hau, K.-T., & Grayson, D. (2005). Goodness of fit in structural equation models. In A. Maydeu-Olivares & J. J. McArdle (Eds.), *Contemporary psychometrics: A festschrift for Roderick P. McDonald* (pp. 275–340). Lawrence Erlbaum Associates Publishers.

Marsh, H. W., Lüdtke, O., Nagengast, B., Trautwein, U., Morin, A. J., Abduljabbar, A. S., & Köller, O. (2012). Classroom climate and contextual effects: Conceptual and methodological issues in the evaluation of group-level effects. *Educational Psychologist, 47*(2), 106–124. https://doi.org/10.1080/00461520.2012.670488

McCrae, R. R., & Costa, P. T., Jr. (2008). The five-factor theory of personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (pp. 159–181). The Guilford Press.

McDonald, R. P., & Ho, M. H. R. (2002). Principles and practice in reporting structural equation analyses. *Psychological Methods, 7*(1), 64 –82. https://doi.org/10.1037/1082-989X.7.1.64

Metsäpelto, R.-L., Poikkeus, A.-M., Heikkilä, M., Husu, J., Laine, A., Lappalainen, K., Lähteenmäki, M., Mikkilä-Erdmann, M., Warinowski, A., Iiskala, T., Hangelin, S., Harmoinen, S., Holmström, A., Kyrö-Ämmälä, O., Lehesvuori, S., Mankki, V., & Suvilehto, P. (2022). A multidimensional adapted process model of teaching. *Educational Assessment, Evaluation and Accountability, 34*(2), 143-172. https://doi.org/10.1007/s11092-021-09373-9

Meyer, J., Thoma, G. B., Kampschulte, L., & Köller, O. (2023). Openness to experience and museum visits: Intellectual curiosity, aesthetic sensitivity, and creative imagination predict the frequency of visits to different types of museums. *Journal of Research in Personality, 103*, 104352. https://doi.org/10.1016/j.jrp.2023.104352

Montuoro, P. & Lewis, R. (2015). Student perceptions of misbehavior and classroom management. In E. T. Emmer & E. J. Sabornie (Eds.), H*andbook of classroom management* (2nd ed., pp. 344–362). Routledge.

Morin, A.J.S., Marsh, H.W., Nagengast, B., & Scalas, L.F. (2014). Doubly latent multilevel analyses of classroom climate: An illustration. *Journal of Experimental Education, 82*(2), 143-167. https://doi.org/10.1080/00220973.2013.769412

Morin, A. J., Blais, A. R., & Chénard-Poirier, L. A. (2022). Doubly latent multilevel procedures for organizational assessment and prediction. *Journal of Business and Psychology, 37*, 47–72. https://doi.org/10.1007/s10869-021-09736-5

Mount, M. K., Barrick, M. R., & Stewart, G. L. (1998). Five-factor model of personality and performance in jobs involving interpersonal interactions. *Human Performance, 11*(2-3), 145-165. https://doi.org/10.1080/08959285.1998.9668029

Muijs, D., & Bokhove, C. (2017). Postgraduate student satisfaction: A multilevel analysis of PTES data. *British Educational Research Journal, 43*, 904-930. https://doi.org/10.1002/berj.3294

Muijs, D., & Reynolds, D. (2018). *Effective teaching: Evidence and practice* (4th edition). SAGE.

Murray, H. G., Rushton, J. P., & Paunonen, S. V. (1990). Teacher personality traits and student instructional ratings in six types of university courses. *Journal of Educational Psychology, 82*, 250–261. https://doi.org/10.1037/0022-0663.82.2.250

Muthén, B., & Asparouhov, T. (2011). Beyond multilevel regression modeling: Multilevel analysis in a general latent variable framework. In J. Hox, & J. K. Roberts (Eds.), *Handbook of advanced multilevel analysis* (pp. 15-40). Taylor & Francis.

Muthén, L. K., & Muthén, B. O. (1998–2017). *Mplus user's guide* (8th ed.). Muthén & Muthén.

Perera, H. N., Granziera, H., & McIlveen, P. (2018). Profiles of teacher personality and relations with teacher self-efficacy, work engagement, and job satisfaction. *Personality and Individual Differences*, *120*, 171-178. https://doi.org/10.1016/j.paid.2017.08.034

Pianta, R. C., & Hamre, B. K. (2009). Conceptualization, measurement, and improvement of classroom processes: Standardized observation can leverage capacity. *Educational Researcher, 38*(2), 109-119. https://doi.org/10.3102/0013189X09332374

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879 –903. https://doi.org/10.1037/0021-9010.88.5.879

Praetorius, A.-K., Klieme, E., Herbert, B., & Pinger, P. (2018). Generic dimensions of teaching quality: The German framework of three basic dimensions. *ZDM: The International Journal on Mathematics Education*, *50*(3), 407–426. https://doi.org/10.1007/s11858-018-0918-4

Rammstedt, B., Danner, D., & Soto, C. J. (2018). Validation of the short and extra-short

forms of the Big Five Inventory-2 (BFI-2) and their German adaptations. *European Journal of Psychological Assessment, 36*(1), 149–161. https://doi.org/10.1027/1015-5759/a000481

Roloff, J., Kirstges, J., Grund, S., & Klusmann, U. (2022). How strongly is personality associated with burnout among teachers? A meta-analysis. *Educational Psychology Review*, *34*(3), 1613-1650. https://doi.org/10.1007/s10648-022-09672-7

Roloff, J., Klusmann, U., Lüdtke, O., & Trautwein, U. (2020). The predictive validity of teachers' personality, cognitive and academic abilities at the end of high school on instructional quality in Germany: A longitudinal study. *AERA Open*, *6*(1), 1-17. https://doi.org/10.1177/2332858419897884

Roloff Henoch, J., Klusmann, U., Lüdtke, O., & Trautwein, U. (2015). Who becomes a teacher? Challenging the "negative selection" hypothesis. *Learning and Instruction*, *36*, 46-56. https://doi.org/10.1016/j.learninstruc.2014.11.005

Roorda, D. L., Jorgensen, T. D., & Koomen, H. M. (2019). Different teachers, different relationships? Student-teacher relationships and engagement in secondary education. *Learning and Individual Differences*, *75*, 101761. https://doi.org/10.1016/j.lindif.2019.101761

Salgado, J. F. (2003). Predicting job performance using FFM and non-FFM personality measures. *Journal of Occupational and Organizational Psychology, 76*(3), 323-346. https://doi.org/10.1348/096317903769647201

Saucier, G., & Ostendorf, F. (1999). Hierarchical subcomponents of the Big Five personality factors: A cross-language replication. *Journal of Personality and Social Psychology, 76*(4), 613–627. https://doi.org/10.1037/0022-3514.76.4.613

Savage, C., Ayaita, A., Hübner, N., & Biewen, M. (2021). Who chooses teacher education and why? Evidence From Germany. *Educational Researcher*, *50*(7), 483-487. https://doi.org/10.3102/0013189X2110007

Scherzinger, M., & Wettstein, A. (2019). Classroom disruptions, the teacher–student relationship and classroom management from the perspective of teachers, students and external observers: a multimethod approach. *Learning Environments Research*, *22*(1), 101-116. https://doi.org/10.1007/s10984-018-9269-x

Soto, C. J., & John, O. P. (2017). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology*, *113*, 117–143. https://doi.org/10.1037/pspp0000096

Soto, C. J., Napolitano, C. M., & Roberts, B. W. (2021). Taking skills seriously: Toward an integrative model and agenda for social, emotional, and behavioral skills. *Current Directions in Psychological Science*, *30*(1), 26-33. https://doi.org/10.1177/0963721420978613

Soto, C. J., Napolitano, C. M., Sewell, M. N., Yoon, H. J., & Roberts, B. W. (2022). An integrative framework for conceptualizing and assessing social, emotional, and behavioral skills: The BESSI. *Journal of Personality and Social Psychology, 123*(1), 192–222. https://doi.org/10.1037/pspp0000401

Stewart, R. D., Mõttus, R., Seeboth, A., Soto, C. J., & Johnson, W. (2022). The finer details? The predictability of life outcomes from Big Five domains, facets, and nuances. *Journal of Personality, 90*, 167– 182. https://doi.org/10.1111/jopy.12660

Terracciano, A., McCrae, R. R., & Costa Jr, P. T. (2010). Intra-individual change in personality stability and age. *Journal of Research in Personality*, *44*(1), 31-37. https://doi.org/10.1016/j.jrp.2009.09.006

Wagner, W., Göllner, R., Werth, S., Voss, T., Schmitz, B., & Trautwein, U. (2016). Student and teacher ratings of instructional quality: Consistency of ratings over time, agreement, and predictive power. *Journal of Educational Psychology*, *108*(5), 705-721. https://doi.org/10.1037/edu0000075

Wisniewski, B., Zierer, K., Dresel, M., & Daumiller, M. (2020). Obtaining secondary students' perceptions of instructional quality: Two-level structure and measurement invariance. *Learning and Instruction, 66*, 101303. https://doi.org/10.1016/j.learninstruc.2020.101303

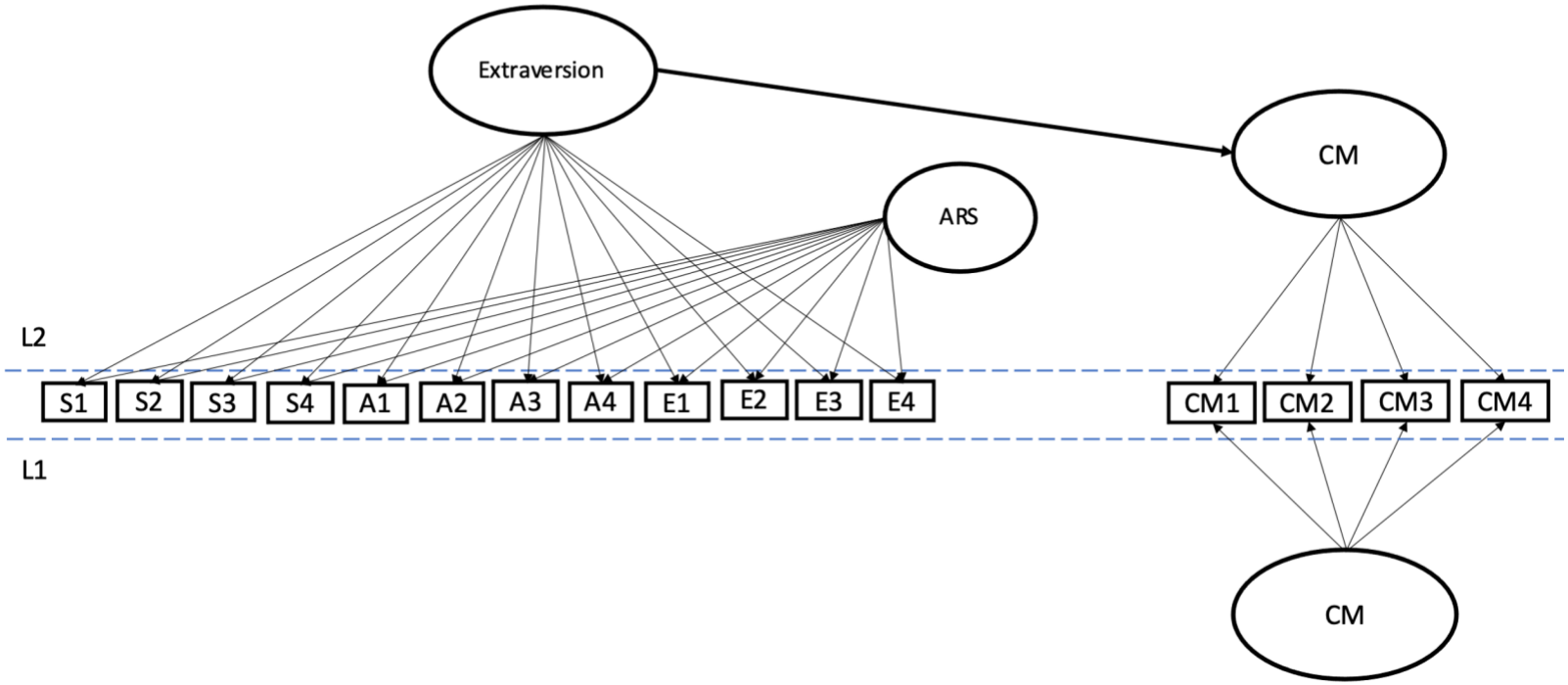
Worrell, F. C., & Kuterbach, L. D. (2001). The use of student ratings of teacher behaviors with academically talented high school students. *Journal of Secondary Gifted Education*, *12*(4), 236-247. https://doi.org/10.4219/jsge-2001-67

Wubbels, T., Brekelmans, M., & Hooymayers, H. P. (1992). Do teacher ideals distort the self-reports of their interpersonal behavior? *Teaching and Teacher Education*, *8*(1), 47-58. https://doi.org/10.1016/0742-051X(92)90039-6

Zell, E., & Lesick, T. L. (2022). Big five personality traits and performance: A quantitative synthesis of 50+ meta-analyses. *Journal of Personality, 90*(4), 559-573. https://doi.org/10.1111/jopy.12683

Figure 1

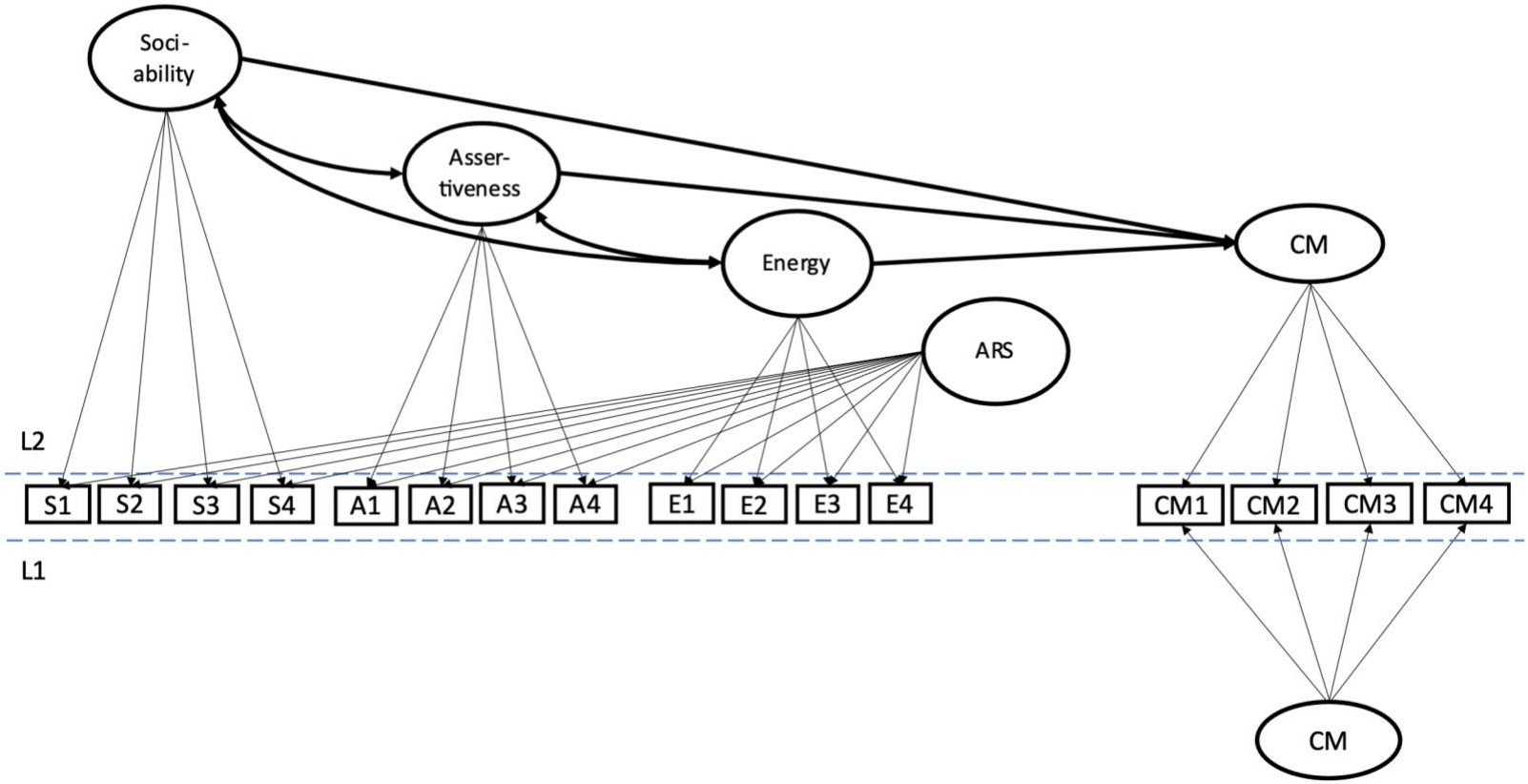
Predictive Single Domain Multilevel Structural Equation Model for Extraversion and Classroom Management



Notes. ARS – Acquiescence Response Style; CM – Classroom Management; S – Sociability; A – Assertiveness; E – Energy Level; For the sake of clarity, only one dimension of teaching quality is depicted and the covariates (i.e., years of teaching experience and academic achievement) are omitted from the figure.

Figure 2

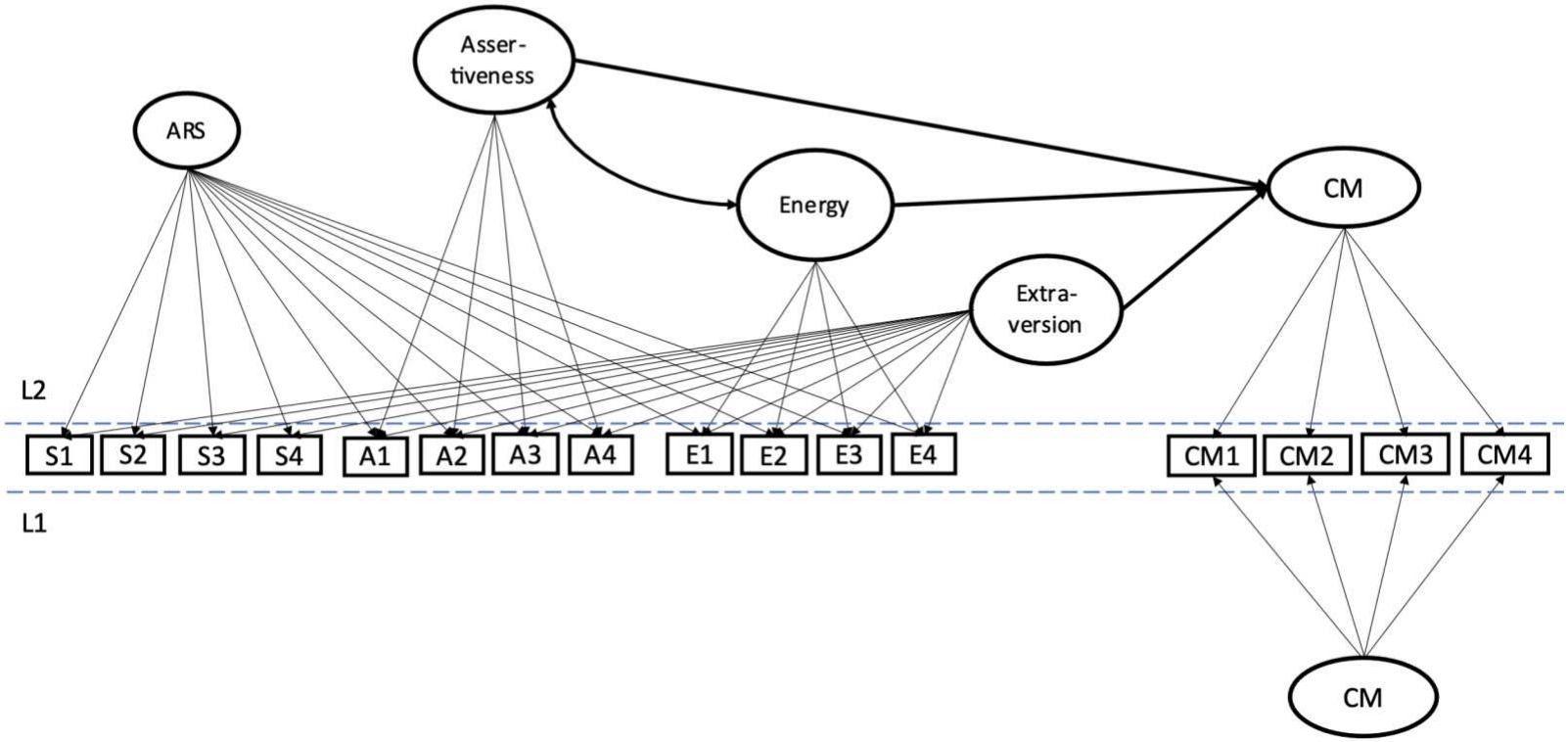
Predictive Three Facets Multilevel Structural Equation Model for Extraversion and Classroom Management



Notes. ARS – Acquiescence Response Style; CM – Classroom Management; S – Sociability; A – Assertiveness; E – Energy Level; For the sake of clarity, only one dimension of teaching quality is depicted and the covariates (i.e., years of teaching experience and academic achievement) are omitted from the figure.

Figure 3

Predictive Bifactor Multilevel Structural Equation Model for Extraversion and Classroom Management



Notes. ARS – Acquiescence Response Style; CM – Classroom Management; S – Sociability; A – Assertiveness; E – Energy Level; For the sake of clarity, only one dimension of teaching quality is depicted.

Table 1

Descriptive Statistics for the Teaching Quality Dimensions

	M_B	SD_B	SD_W	Ω_B	Ω_W	ICC1	ICC2
Cognitive Activation	3.98	0.32	0.54	.98	.87	.279	.91
Classroom Management	3.91	0.33	0.57	.95	.79	.222	.85
Student Support	3.63	0.64	0.67	.99	.86	.347	.94
Teacher Enthusiasm	3.96	0.55	0.67	.83	.89	.329	.92

Notes. B – denotes values obtained at L2 or between-person level; W – denotes values obtained at L1 or within-person level.

Table 2

Descriptive Statistics and L2 Bivariate Manifest Correlations

	M	*SD*	Ω	Cognitive Activation	Classroom Management	Student Support	Teacher Enthusiasm
Extraversion	3.67	0.59	.85	.046	.143***	.086*	.095**
Sociability	3.73	0.67	.79	.050	.131**	.102**	.084*
Assertiveness	3.29	0.70	.68	.044	.125**	.052	.064
Energy Level	4.00	0.64	.74	.004	.081*	.046	.071*
Agreeableness	4.16	0.46	.83	.022	.043	.110**	.076*
Compassion	4.23	0.57	.68	.078*	.096*	.136***	.104**
Respectfulness	4.39	0.52	.75	-.012	.012	.057	.027
Trust	3.86	0.61	.65	-.005	.016	.069*	.050
Conscientiousness	4.17	0.55	.88	-.080*	.028	-.060	-.065
Organization	4.19	0.68	.79	-.070*	.023	-.062	-.071*
Productiveness	4.16	0.63	.73	-.055	.041	-.041	-.029
Responsibility	4.16	0.58	.71	-.061	.036	-.037	-.048
Negative Emotionality	2.55	0.60	.86	-.005	-.050	-.009	-.017
Anxiety	3.10	0.71	.56	-.032	-.058	-.022	-.037
Depression	2.04	0.73	.79	.004	.051	-.014	-.015
Emotional Volatility	2.52	0.69	.70	.041	.012	.027	.039
Open-Mindedness	3.80	0.56	.80	.006	-.020	.071*	.090**
Intellectual Curiosity	3.80	0.65	.59	.000	-.049	.027	.042
Aesthetic Sensitivity	3.64	0.83	.72	-.016	-.046	.055	.082**
Creative Imagination	3.97	0.65	.76	.029	.047	.087**	.082*
Teacher Gender[1]	-	-	-	-.054	-.040	.000	-.049
Teaching Experience	15.85	9.13	-	-.132***	-.108**	-.135***	-.069*
Class Achievement	4.13	0.65	-	.269***	.163***	.335***	.285***
School Type[2]	-	-	-	-.078*	-.005	-.008	-.126***

Notes. [1]Male teachers were coded as 0 and female teachers were coded as 1; [2]Gymnasium programs were coded as 0 and vocational programs as 1; *$p < .05$, **$p < .01$, ***$p < .001$

Table 3

Model Fit Statistics for the Predictive Big Five Multilevel Structural Equation Models

	χ^2 (*df*)	CFI	TLI	RMSEA	$SRMR_W$	$SRMR_B$	AIC
Extraversion							
Single domain model	13626.217 (667)	.934	.926	.032	.035	.047	775667.971
Three facets model	13197.788 (656)	.936	.928	.032	.035	.042	775211.363
Bifactor-(S-1) model	13189.563 (650)	.936	.927	.032	.035	.041	775199.859
Bifactor-(S-1) model with controls	13675.570 (726)	.935	.926	.031	.034	.043	817662.851
Agreeableness							
Single domain model	13548.684 (667)	.934	.927	.032	.035	.054	771232.110
Three facets model	13326.180 (656)	.935	.927	.032	.035	.049	771000.032
Bifactor-(S-1) model	13337.775 (650)	.935	.926	.032	.035	.050	770975.887
Bifactor-(S-1) model with controls	13775.664 (726)	.934	.925	.031	.034	.050	813438.746
Conscientiousness							
Single domain model	13437.851 (667)	.934	.927	.032	.035	.044	771164.914
Three facets model	13300.612 (656)	.934	.926	.032	.035	.042	771023.324
Bifactor-(S-1) model	13306.659 (650)	.934	.926	.032	.035	.040	770947.722
Bifactor-(S-1) model with controls	13776.341 (726)	.934	.925	.031	.034	.044	813415.063
Negative Emotionality							
Single domain model	13488.127 (667)	.934	.927	.032	.035	.044	775950.996
Three facets model	13251.595 (656)	.935	.927	.032	.035	.041	775712.821
Bifactor-(S-1) model	13208.290 (650)	.936	.927	.032	.035	.040	775638.189
Bifactor-(S-1) model with controls	13627.289 (726)	.935	.926	.031	.034	.041	818100.623
Open-Mindedness							
Single domain model	13909.774 (667)	.932	.925	.032	.035	.049	777256.161
Three facets model	13341.563 (656)	.935	.927	.032	.035	.042	776643.932
Bifactor-(S-1) model	13327.960 (650)	.935	.926	.032	.035	.041	776608.432
Bifactor-(S-1) model with controls	13796.531 (726)	.934	.925	.031	.034	.043	819076.862

Note. In all tested models, a method factor of acquiescence response style was included.

Table 4

L2 Standardized Regression Coefficients (STDYX) from the Bifactor-(S-1) Multilevel Structural Equation Models

	Cognitive Activation	Classroom Management	Student Support	Teacher Enthusiasm
Extraversion Sociability	.065 / .073*	.167*** / .174***	.123** / .132***	.099** / .104**
Assertiveness	-.009 / .020	.021 / .045	-.083 / -.049	-.073 / -.045
Energy Level	-.018 / -.021	-.016 / -.017	.032 / .028	.085 / .077
Agreeableness Compassion	.040 / .040	.055 / .055	.129** / .129**	.068 / .067
Respectfulness	-.070 / -.063	-.080 / -.069	-.073 / -.054	-.066 / -.047
Trust	.048 / .043	.069 / .066	.084 / .076	.120* / .109*
Conscientiousness Organization	-.097** / -.057	-.008 / .029	-.082* / -.036	-.083* / -.048
Productiveness	.014 / .013	.020 / .020	.050 / -.015	.052 / .049
Responsibility	.016 / .029	.051 / .062	-.014 / .065	-.010 / .003
Negative Emotionality Anxiety	-.029 / -.044	-.079† / -.091*	-.050 / -.068 †	-.052 / -.064
Depression	-.004 /-.006	-.050 / -.052	.000 / -.003	.001 / -.001
Emotional Volatility	.098† / .095†	.106† / .104†	.085 / .089	.112* / .108*
Open-Mindedness Intellectual Curiosity	.019 /.004	-.014 / -.025	.053 / .035	.062 / .045
Aesthetic Sensitivity	-.057 / -.047	-.048 / -.037	.023 / .035	.033 / .034
Creative Imagination	.008 / .010	.075 / .079	.074 / .077	.040 / .037
Years of Teaching Experience	[-.125, -.116] ***	[-.126, -.115] ***	[-.137, -.123] ***	[-.074, -.061] ***
Class Average Achievement	[.278, .284] ***	[.232, .239] ***	[.343, .350] ***	[.291, .297] ***

Notes. †$p \sim .06$; *$p < .05$, **$p < .01$, ***$p < .001$; Regression coefficients from models after adding the covariates are presented after the slash; Lower and upper bounds of regression coefficients for years of teaching experience and class average achievement obtained across five models are presented in parentheses.

Table S1

Items Measuring Teaching Quality and Teacher Enthusiasm

	English translation
	Our teacher….
Cognitive Activation	gives tasks and asks questions that make us think.
	wants us to understand our work, not just memorize it.
	gives us time to really explore and understand new ideas.
	stimulates us to think about the learning material.
	makes sure that tasks really encourage us to think.
	encourages us to persist until we figure the problem out.
Student Support	shows warmth to the students.
	is aware of students' feelings.
	wants us to enjoy learning new things.
	cares about the problems of his/her students.
	is empathetic towards students.
Classroom management	always knows exactly what is going on in the classroom.
	makes sure that we pay attention in class.
	immediately notices if we get distracted.
	manages to hold our attention during a lesson.
Teacher Enthusiasm	seems like (s)he enjoys teaching.
	teaches with great enthusiasm.
	is enthusiastic about the subject (s)he teaches.
	enjoys teaching us new things.
	seems like (s)he likes the subject (s)he teaches.

Table S2

Manifest Correlations Between Analyzed Variables at L1 and L2

	E	As	En	So	A	Co	Re	Tr	C	Pr	Or	Rp	N	An	De	Em	O	Ae	Im	In	CA	CM	SC	TE
E	-																							
As	.82	-																						
En	.80	.51	-																					
So	.85	.51	.50	-																				
A	.36	.16	.45	.31	-																			
Co	.39	.17	.42	.34	.81	-																		
Re	.16	*.02*	.29	.10	.81	.50	-																	
Tr	.31	.15	.37	.26	.83	.48	.51	-																
C	.38	.25	.52	.22	.45	.38	.47	.26	-															
Pr	.45	.29	.58	.28	.43	.36	.40	.30	.89	-														
Or	.22	.14	.34	.09	.28	.22	.34	.15	.87	.64	-													
Rp	.33	.23	.43	-.19	.51	.42	.52	.33	.87	.69	.62	-												
N	-.50	-.47	-.42	-.34	-.37	-.21	-.34	-.38	-.32	-.34	-.19	.31	-											
An	-.37	-.36	-.26	-.27	-.23	-.09	-.18	-.27	-.11	-.16	*-.01*	-.11	.85	-										
De	-.56	-.50	.50	-.40	-.34	.27	-.30	-.36	-.35	-.38	-.22	-.32	.86	.60	-									
Em	-.28	.31	-.27	-.16	-.33	-.15	-.37	-.30	-.34	-.32	-.26	-.33	.83	.53	.57	-								
O	.33	.29	.39	.17	.30	.35	.20	.21	.20	.24	.11	.18	-.13	-.07	.19	-10	-							
Ae	.11	*.06*	.17	*.03*	.22	.24	.13	.14	.10	.09	*.05*	.08	*.03*	*.06*	*.01*	*.03*	.81	-						
Im	.46	.37	.52	.26	.36	.36	.24	.24	.34	.37	.20	.32	-.25	-.11	-.31	-.18	.75	.35	-					
In	.25	.29	.26	.10	.15	.19	.08	.09	.07	.13	*.01*	*.06*	-.15	-.10	-.16	-.11	.80	.47	.47	-				
CA	*.05*	*.04*	*.01*	*.05*	*.02*	.08	*-.01*	*-.01*	-.08	*-.06*	-.07	*-.06*	*-.01*	*-.03*	*.01*	*.04*	*.01*	*-.02*	*.03*	*.00*	-	.75	.75	.76
CM	.14	.13	.08	.10	*.04*	.10	*.01*	*.02*	*.03*	*.04*	*.02*	*.04*	*-.05*	*.06*	*-.05*	*.01*	*-.02*	*-.05*	*.05*	*-.05*	.89	-	.67	.65
SC	.09	*.05*	*.05*	.13	.11	.14	*.06*	.07	*-.06*	*-.04*	*-.06*	*-.04*	*-.01*	*-.02*	*-.01*	*.03*	.07	*.06*	.09	*.03*	.90	.78	-	.74
TE	.10	*.06*	.07	.08	.08	.10	*.03*	*.05*	*-.07*	*-.03*	-.07	*-.05*	*-.02*	*-.04*	*-.02*	*.04*	.09	.08	.08	*.04*	.91	.77	.90	-

Notes. E – extraversion, A – agreeableness, C – conscientiousness, N – negative emotionality, O – open-mindedness, As – assertiveness, En – energy level, So – sociability, Co – compassion, Re -respectfulness, Tr – trust, Pr – productiveness, Or – organization, Rp – responsibility, An – anxiety, De – depression, Em – emotionality, Ae – aesthetic sensitivity, In – intellect; Nonsignificant correlations are presented in italic; L1 correlations are shown above diagonal and L2 correlations are shown below diagonal

Table S3

Standardized Factor Loadings (STDYX) from the Bifactor Multilevel Structural Equation Models with Covariates

Item No.	Domain Label	Facet Label	E	A	C	N	O	Facet	ARS
1	E	Sociability	.596						.134
16	E		.466						-.109
31	E		.303						-.107
46	E		.726						.135
6	E	Assertiveness	.551					.432	.150
21	E		.727					.408	.112
36	E		.413					.312	-.131
51	E		.441					.526	-.128
11	E	Energy	.363					.422	-.137
26	E		.368					.419	-.142
41	E		.736					.503	.145
56	E		.396					.635	.160
2	A	Compassion		.590					.204
17	A			.419					-.152
32	A			.631					.227
47	A			.673					-.165
7	A	Respectfulness		.525				.370	.258
22	A			.395				.528	-.201
37	A			.503				.426	-.161
52	A			.533				.398	.253
12	A	Trust		.457				.246	-.161
27	A			.426				.334	.187
42	A			.327				.487	-.151
57	A			.391				.552	.179
3	C	Organization			.727				-.135
18	C				.710				.160
33	C				.272				.168

48	C		.682			-.169
8	C	Productiveness	.390		.164	-.144
23	C		.702		.307	-.129
38	C		.707		.413	.194
53	C		.551		.361	.196
13	C	Responsibility	.429		.595	.211
28	C		.535		.116	-.132
43	C		.587		.565	.236
58	C		.618		.216	-.152
4	N	Anxiety		.749		-.151
19	N			.612		.144
34	N			.579		.143
49	N			.650		-.119
9	N	Depression		.462	.113	-.170
24	N			.685	.264	-.168
39	N			.420	.615	.141
54	N			.622	.453	.149
14	N	Emotional Volatility		.329	.285	.145
29	N			.281	.316	-.160
44	N			.680	.589	-.181
59	N			.376	.328	.135
5	O	Aesthetic Sensitivity			.306	.224	-.110
20	O				.464	.532	.107
35	O				.462	.588	.160
50	O				.459	.464	-.128
10	O	Intellectual Curiosity			.562		.190
25	O				.510		-.135
40	O				.425		.130
55	O				.596		-.135
15	O	Creative Imagination			.378	.558	.175
30	O				.507	.517	-.155
45	O				.462	.172	-.152
60	O				.518	.615	.167

Notes. E – extraversion, A – agreeableness, C – conscientiousness, N – negative emotionality, O – open-mindedness, As – assertiveness; ARS – acquiescence response style;

Exemplary M*plus* Syntax

```
TITLE: Extraversion – Bifactor-(S-1) model with the Acquiescence method
factor + teaching quality dimensions

  DATA: FILE IS teacher.dat;

  VARIABLE:
  NAMES ARE ID SEX AGE EXP VOCAT MIXED LEVEL
  L1-L60 SEXS AGES GRADE PROG ACH TQ1-TQ24;

  USEVARIABLE ARE EXP
  L1 L6 L11 L16 L21 L26 L31 L36 L41 L46 L51 L56 ACH
  TQ1 TQ3 TQ12 TQ14 TQ17 IQ20
  TQ6 TQ9 TQ10 TQ16 TQ22
  TQ4 TQ7 TQ13 TQ19
  TQ5 TQ11 TQ15 TQ18 TQ21 TQ23;

  BETWEEN = L1 L6 L11 L16 L21 L26 L31 L36 L41 L46 L51 L56;

  CLUSTER IS ID;

  MISSING ARE all (999);

  DEFINE: CENTER L1 L6 L11 L16 L21 L26 L31 L36 L41 L46 L51 L56(GRANDMEAN);

  ANALYSIS:

  TYPE IS TWOLEVEL;
  ITERATIONS = 10000;
  H1ITERATIONS = 10000;

  MODEL:

  %WITHIN%

  CAW BY TQ1 TQ3 TQ12 TQ14 TQ17 TQ20;
  SCW BY TQ6 TQ9 TQ10 TQ16 TQ22;
  CMW BY TQ4 TQ7 TQ13 TQ19;
  ENTW BY TQ5 TQ11 TQ15 TQ18 TQ21 TQ23;

  %BETWEEN%

  CAB BY TQ1 TQ3 TQ12 TQ14 TQ17 TQ20;
  SCB BY TQ6 TQ9 TQ10 TQ16 TQ22;
  CMB BY TQ4 TQ7 TQ13 TQ19;
  ENB BY TQ5 TQ11 TQ15 TQ18 TQ21 TQ23;

  TQ1(vb1); TQ3(vb2); TQ12(vb3); TQ14(vb4); TQ17(vb5); TQ20(vb6);
  TQ6(vb7); TQ9(vb8); TQ10(vb9); TQ16(vb10); TQ22(vb11);
  TQ4(vb12); TQ7(vb13); TQ13(vb14); TQ19(vb15);
  TQ5(vb16); TQ11(vb17); TQ15(vb18); TQ18(vb19); TQ21(vb20); TQ23(vb21);

  !domain
  extra by L1 L6 L11 L16 L21 L26 L31 L36 L41 L46 L51 L56;
```

```
!facets
asse by L6 L21 L36 L51;
ener by L11 L26 L41 L56;

!acquiescence
ars by L6@1 L21@1 L36@-1 L51@-1 L11@-1 L26@-1 L41@1 L56@1
L1@1 L16@-1 L31@-1 L46@1;
ars*;

!orthogonal factors
extra WITH asse@0;
extra WITH ener@0;

ars WITH extra@0;
ars WITH asse@0;
ars WITH ener@0;

ars WITH CAB@0;
ars WITH SCB@0;
ars WITH CMB@0;
ars WITH ENTB@0;

ener WITH asse;

CMB CAB SCB ENTB ON extra asse ener soci;

MODEL CONSTRAINT:

vb1>0; vb2>0; vb3>0; vb4>0; vb5>0; vb6>0;
vb7>0; vb8>0; vb9>0; vb10>0; vb11>0;
vb12>0; vb13>0; vb14>0; vb15>0;
vb16>0; vb17>0; vb18>0; vb19>0; vb20>0; vb21>0;

OUTPUT: STDYX;
```