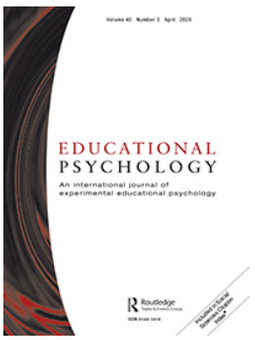

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Exploring associations between supervisory support, teacher burnout and classroom emotional climate: the moderating role of pupil teacher ratio

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ABSTRACT

In previous studies on classroom emotional climate (CEC), factors related to teacher's working conditions have rarely been included. Thus, in the current study, we examined associations between supervisory support, teacher burnout and CEC, and whether pupil teacher ratio (PTR) moderated this association, applying a randomised-control trial design. Participants were students from 300 classes at the end of grade 1, and 300 teachers. Structural equation modelling (SEM) revealed significant relations between supervisory support and teacher burnout and between teacher burnout and CEC. Supervisory support was indirectly related to CEC through teacher burnout. Finally, PTR moderated the association between teacher burnout and CEC.

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Teacher burnout; classroom emotional climate; supervisory support; pupil teacher ratio

Introduction

Researchers have increased their focus on studying the social processes that take place in the classroom to understand the determinants of student academic outcomes (e.g. Patrick, Ryan, & Kaplan, 2007; Pianta, La Paro, & Hamre, 2008). 33 years ago, Fraser (1986) asserted that "*the classroom environment is such a potent determinant of student outcome that it should not be ignored by those wishing to improve the effectiveness of the schools*" (p. 1), and it is now well recognised that a positive classroom climate promotes the child's well-being and academic achievements (see Haertel, Walberg, & Haertel, 1981 for a meta-analysis; Mashburn et al., 2008; Pianta, Belsky, Vandergrift, Houts, & Morrison, 2008). Hattie (2009) certainly confirms this view in his review and synthesis of 800 meta-analyses concerned with predictors of student learning and achievement. Specifically, Hattie (2009) concluded that the most powerful effects of the school do not relate to structural issues, but rather relates to features *within* the school, including the climate of the classroom, the influences of peers, and the lack of disruptive students in the classroom (p. 107). Specifically, classroom behavioural influences were ranked

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number 6 out of 138 variables with regard to effect size (Cohen's d 0.80), implying that these are of great significance for student's academic outcomes.

In previous conceptual frameworks developed to understand the specific determinants of classroom climate, teacher characteristics have been given great emphasis (e.g. Moos, 1979; MacAulay, 1990). Moreover, in the more recent prosocial classroom model, developed by Jennings and Greenberg (2009) teacher well-being is considered to be one of the most important antecedents of classroom climate If we consider teacher well-being as the most significant antecedent of classroom climate, it seems obvious that researchers also need to consider factors that might interfere with teachers' well-being when studying classroom climate. Within the field of occupational health psychology, an extensive amount of research has found evidence for associations between teachers' psychosocial work environment and teachers' health and well-being in specific (e.g. Fernet, Guay, Senécal, & Austin, 2012; Kokkinos, 2007; Schaufeli, Bakker, & Van Rhenen, 2009; Skaalvik & Skaalvik, 2009; Unterbrink et al., 2007). However, in the study of classroom climate within the educational field, factors related to teachers' working conditions are seldom included. To expand our current knowledge of classroom climate, we argue that there is a need for a more integrated approach between the educational field and the field of occupational health psychology. The current study design makes a significant contribution to this matter.

Classroom emotional climate

Generally, there are three domains which are essential with regard to learning and social development in the classroom; emotional support, classroom organisation and instructional support (Ruzek & Pianta, 2015). The emotional support dimension consists of three dimensions, one of which is referred to as positive climate. The positive climate is concerned with the nature and quality of relationships within the classroom, both among teacher and students, and among students. The quality of these social and emotional interactions in the classroom has also been referred to as the *classroom emotional climate* (CEC) (Daniels & Shumow, 2003; Pianta, La Paro et al., 2008), which is the notion applied in the current study. Specifically, our focus is on measuring positive relations among students.

One essential question we could ask ourselves, is why maintaining positive relationships between students in classroom can be considered important? We would claim there are mainly two reasons for this. First, positive relationships with classmates can potentially create a climate of emotional support (Wentzel, 2006), in addition to a feeling of emotional security and sense of belonging (Brown, Eicher & Petrie, 1986). According to self-determination theory (Ryan & Deci, 2000), relatedness and sense of belonging are basic psychological needs which are essential for constructive social development and well-being.

Second, Wentzel, Jablansky and Scalise (2018), found in their meta-analysis that friendship at school is associated positively with academic performance. Specifically this includes both working with a friend, in addition to having a friend. Wentzel et al. (2018) conclude from their meta-analysis that the nature of relationships with peers, in

addition to the social interaction taking place among students are important aspects that needs to be included in educational studies.

Teacher burnout and supervisory support

Research indicates that teaching is one of the professions with the highest level of job stress (Stoeber & Rennert, 2008). Stress occurs when demands exceed resources, and over time, this may result in burnout (Bakker & Demerouti, 2007). Burnout consists of three components referred to as emotional exhaustion, reduced personal accomplishment and depersonalisation (Maslach, Jackson, Leiter, Schaufeli, & Schwab, 1986), where the emotional exhaustion component is considered to be the core component of burnout (Cordes, Dougherty, & Blum, 1997). Emotional exhaustion manifests itself by lack of energy. Lack of energy occurs because the individual's emotional resources available are being fully spent on work (Maslach et al., 1986). Causes of job stress for teachers can be several, including high workload, students with behavioural problems, lack of support from colleagues and superiors, problems in the parent-teacher relationship and lack of autonomy (Skaalvik & Skaalvik, 2007). As a result of high levels of job stress, teachers have an increased risk for burnout compared to other occupations (Babad, 2009).

Social support has been defined broadly as "*the availability of helping relationships and the quality of those relationships*" (Leavy, 1983, p. 5). Concerning work-related social support, teachers might be extra vulnerable. For instance, it has been pointed out that although teachers spend several hours a day interacting with children in the classroom, they are still largely isolated from their teaching colleagues (Dorman, 2003). Moreover, work-related sources of social support are considered important antecedents of teacher burnout (Maslach & Leiter, 1999). This also applies to social support from supervisors, which has demonstrated a mitigating effect on burnout (for meta-studies, see Viswesvaran, Sanchez, & Fisher, 1999; Skakon, Nielsen, Borg & Guzman, 2010). Babad (2009) claims that because of the loneliness related to teachers' work in the classroom, the support system from staff and administration is especially important. Still, teachers seem to lack appreciation from their supervisors (Babad, 2009).

Teacher burnout and supervisory support as antecedents of CEC

A great variety of emotions are present in the classroom setting, and both students and teachers can experience emotions ranging from enjoyment and excitement, to frustration and anger (Becker-Kurz & Morris, 2015). In the classroom, teachers often need to suppress and conceal their negative feelings (Babad, 2009). Still, although teachers try to hide their negative feelings, there is evidence that this negativity might leak into the classroom. This phenomenon has been referred to as "non-verbal leakage" (Ekman & Friesen, 1969), and is based on the assumption that individuals have more difficulty in controlling their non-verbal behaviour, compared to their verbal behaviour (Babad, 2009). For instance, individuals are not able to fully control their facial expressions, eyes, body language and gestures, whereas spoken words and verbal contents is easier to control. Conclusively, when a teacher experiences negative emotions, and tries to conceal these emotions from his/her students, the negative

emotions will still leak through the non-verbal channels, and influence both the academic and social climate (Babad, 2009). Evidence for the existence of non-verbal leakages has been confirmed in research (e.g. Babad, Bernieri & Rosenthal, 1989; Rosenthal & DePaulo, 1979). Moreover, Babad (2005) found that young students were better at detecting nonverbal expressions of teachers compared to adults, and concluded that students are experts at decoding teacher's non-verbal behaviour.

Teacher who are burned out experience negative emotions. As noted above, trying to hide negative emotions can be challenging. Consequently, when teachers are burned out, students may observe leakages of teacher's negative emotions through their non-verbal behaviour, which might again affect the CEC negatively. The manifestation of teacher burnout on their respective students have been explored, and Maslach and Leiter (1999) developed a model of teacher burnout, implying that burnout is conducive not only to teachers' behaviours, but also to students' behaviour. Moreover, Evers, Tomic, and Brouwers (2004) discovered that students recognise teachers' symptoms of burnout. Additionally, teacher burnout was found to be associated with higher cortisol levels among elementary school students (Oberle & Schonert-Reichl, 2016). Burnout has also been found to be associated with student misbehaviors, with the emotional exhaustion dimension of burnout demonstrating the largest effect (for meta-study, see Aloe, Shisler, Norris, Nickerson, & Rinker, 2014). Moreover, teachers who reported high levels of burnout assigned less value to their relationships with students (Cano-García, Padilla-Muñoz, & Carrasco-Ortiz, 2005). Thus, to ensure a positive classroom climate, preventing teachers from burnout seems to be especially important (Collie, Shapka, & Perry, 2012). In summary, the abovementioned research implies that teacher burnout may affect the CEC in a negative manner.

Theoretically, it does not necessarily make sense that supportive management affects CEC directly, as school management in general is distant from the classrooms and is not involved in the daily teaching of students. Still, as previously noted, support from supervisor and burnout are associated (Skakon et al., 2010; Viswesvaran et al., 1999). Thus, when teachers experience lack of support from their leaders, they may be more at risk of burnout, which might influence the CEC in a negative manner. Conclusively, school management may have an indirect association with CEC through the teacher, as teachers are present in the classrooms and interact with students directly.

The moderating role of pupil teacher ratio (PTR)

Hattie (2009) concluded from his review, that reducing PTR (referred to as class size in Hattie's work) does not influence student's learning outcomes directly. One explanation for this is that teachers do not necessarily change their teaching strategies just because classes are smaller. Although evidence is small for a direct effect of PTR on learning outcomes, there is still evidence that lower PTR relates to teacher and student work-related conditions (Hattie, 2009). Wang and Eccles (2016) suggested that a high PTR likely increases teachers' work-load; therefore, it may become more difficult for the teacher to manage the class. Increased work-load might again relate to teacher burnout, and when burnout increases, the teachers' involvement in the classroom declines (Maslach & Leiter, 1999). Moreover, the negative effects of a high PTR on class-management might

again affect the CEC in a negative manner. For instance, a high PTR has been found to be associated with a greater likelihood of witnessing bullying (Waasdorp, Pas, O'Brennan, & Bradshaw, 2011), and negative and aggressive behaviours between children were also more prevalent (Finn, Pannozzo, & Achilles, 2003).

Teachers also report better relationships with students in small classes (Finn et al., 2003). Increased individualised attention from teachers might again relate positively to CEC. Based on the above, it is important to further understand the relationship between PTR, teacher burnout and CEC. Previous research on relations between PTR and classroom processes, including Hattie's (2009) research, have been dominated by investigations of class size reduction. However, PTR could also be decreased by deploying an additional teacher in some or all lessons (Solheim & Opheim, 2019), and to our knowledge, previous research has been scarce with regard to investigating the effects of increasing the teacher-ratio, rather than reducing the class size.

The present study

The current research on the antecedents of CEC within the educational field has been limited in that factors related to teachers' working conditions have seldom been included. Thus, in the current study, we aimed to explore the associations among supervisory support, teacher burnout and CEC, and whether PTR moderated the relation between teacher burnout and CEC at the end of Grade 1. Our four hypotheses were as follows. First, as leaders' behaviours have been found to relate to burnout, we expected supervisory support to be negatively associated with teacher burnout. Second, given that previous research has found that burnout affects not only the individual, but also the relations at the intrapersonal level, we expected teacher burnout to be negatively associated with CEC. Third, based on an assumption that a supportive school management can have an indirect association with CEC through the teacher, we expected supportive leadership to relate indirectly to CEC through teacher burnout. Fourth, we assumed that having an additional teacher in the class might reduce negative consequences of teacher burnout on CEC, and we hypothesised that the negative relationship between teacher burnout and CEC is weaker in classes in which an extra teacher is present.

Potentially, student reports are considered to be the most reliable when measuring CEC. The reason is that it is likely that a student's behaviour in the classroom is affected by his or her interpretation of the classroom climate to greater extent, than by any objective indicator of that environment (Lüdtke, Robitzsch, Trautwein, & Kunter, 2009). Hence, in the current study we applied student reports of CEC. Another issue concerns the unit of analysis when measuring classroom climate. Theoretically, classroom climate relates to how students evaluate the climate in their respective classes, and should therefore be measured at the class level (see Marsh et al., 2012 for a through discussion with regard to measurement of classroom climate). Marsh et al. (2012) further point out that; "Although the students in a class represent a sample from a larger population of students, the contextual effects is based on the average value of students actually in the class, not some hypothetical group of students who might have been in the class." (p. 119). However, in a review of classroom goal structures (Miller & Murdock, 2007) it was revealed that 16 out of 31 studies did not apply

analyses at the class level. In the current study the classroom climate construct refers to the classroom, as each individual student was asked to rate characteristics of the CEC that was common for all students. Thus, to overcome the limitations of some previous studies, and in order to grasp student's shared perceptions with regard to CEC, we aggregated student reports of CEC to the class level. Based on suggestions by Mitchell, Bradshaw and Leaf (2010), we also included teacher reports on CEC, which makes it possible to explore discrepancies in CEC between student reports and teacher reports more closely. Finally, Friedman-Krauss, Raver, Morris, and Jones (2014), suggested that future research investigate relations between teacher stress and classroom climate using structural equation modelling. Thus, in the present study we follow this call.

Method

Context

The present study was a part of an intervention project, "Two Teachers", which investigated the effects of decreased PTR on student outcomes. Overall, 150 schools participated in the project, and the schools were located in 53 different municipalities in 9 counties located in the Southern part of Norway. Two classes at each school were assigned to the project, yielding a total number of 300 classes. The study used a randomised control trial design in that two classes from each school were randomly assigned to a treatment or a control condition with regard to PTR. In treatment classes, PTR was decreased by having an additional teacher present during Norwegian lessons, 8×45 min per week, during the first year of school. The control class received no additional teaching resources. The Two Teachers project also included interventions related to professional development, which is not part of the current study. Still, we controlled for the effects of these when conducting our analyses. The Norwegian Social Science Data Service, which is a third party ethical agency in Norway, approved the study. Finally, the project followed the Ethical guidelines, which have been developed by the National Committee for Research Ethics in the Social Sciences and Humanities. See Solheim, Rege, and McTigue (2017) for more detailed information about the Two Teachers study,

Sample

The student sample comprised first graders who started Grade 1 in August 2016. At school entry, 6014 students were enrolled in the study, and parental consent was achieved from 95.2% of the sample, yielding a total sample of 5830 students (47.8% girls). The average age of the students was 7 years old when we collected the data.

The teacher sample included 300 teachers who were class teachers for the 300 respective classes in the Two Teachers-study. All invited teachers participated in the study (a response rate of 100%). The teachers in the included sample were 96.7% females, and they had been teaching for an average of 14 years. Approximately 27% had earned master's degrees, and 68% had earned bachelor's degrees. Furthermore, 2% of the teachers were under 25 years old, followed by 25–29 years old (11%),

30–39 years old (24.1%), 40–49 years old (34.4%), 50–59 years old (21.4%) and over 60 years old (7%).

The extra teachers who were part of the intervention were not included in this study's sample. This was primarily related to the fact that the extra teachers were part of the intervention, and therefore not considered as part of our "main sample." Moreover, the extra teachers were present in classrooms for only a small amount of the time (8 × 45 min per week), whereas the class teachers had the main responsibility for teaching in their respective classes.

Procedure

All children were assessed on CEC. A trained research assistant assessed the students individually at their respective schools in a private location outside their classrooms. All tests were administered on tablet computers. Teachers received self-report questionnaires assessing factors related to their perceptions of supervisory support, burnout and CEC. Identity codes were given to both student and teacher data, which made it possible to identify and link class teachers to their respective classes when running the analyses.

Measures

Supervisory support was assessed as teachers' feeling of having cognitive and emotional support from the school leadership. The scale consists of five items, and example of sample items are: *In educational matters, I can always seek help and advice from the school management* (Skaalvik & Skaalvik, 2010). The responses were measured on a 5-point Likert-type scale scale ranging from 1 = strongly disagree to 5 = strongly agree.

Teacher Burnout was measured by applying the emotional exhaustion dimension from a translated version from the Maslach Burnout Inventory, General Survey (MBI-GS) (Maslach, Jackson, & Leiter, 1996). Work-related sources of social support are more closely related to the emotional exhaustion component of burnout compared to the depersonalisation and personal accomplishment component (see Halbesleben, 2006, for a meta-study). Considering that the measure of social support in the current study is work-related, the emotional exhaustion component of burnout appears to be the most relevant. The original version was translated to Norwegian in a previous study, and it demonstrated good validity (see Jensen, 2014). The scale comprises 5 items on a Likert-type scale such as, *I feel emotionally drained from my work*. The items are measured on a 7-point scale ranging from 0 = never to 6 = every day.

In the current study, we assessed both students and teachers in CEC. Student reports of CEC included seven items (Cronbach's alpha = .87) based on an adapted version of the Social Integration Classroom Climate and Self Concept of School Readiness designed by Rauer and Schuck (2003). In the current study we only applied the sub-scale on classroom climate, as this was the most relevant for our research question. There were two main reasons why we chose this particular sub-scale. First, the items are class-oriented, implying that the questions asked relates to students

perceptions of the class as *a whole*, which is essential in order to measure CEC. For instance, other studies measuring student perceptions of CEC have been more concerned with applying items related to student's personal perspectives (e.g. Rowe, Kim, Baker, Kamphaus, & Horne, 2010). Second, the current measure is the only one previously applied and validated in a sample of Norwegian first graders (Holen, Waaktaar, Lervåg, & Ystgaard, 2013). The items are intended to capture the students' emotional and social experience in the class. To reduce cognitive response bias, we decided to alter the items from statements to questions (Bentler, Jackson, & Messick, 1971). Sample questions were: *Is everybody in the class good friends? Do you stick together and look after each other in the class?* The task was introduced by the research assistant, and the students were informed that their answers were anonymous. The research assistant then read each item aloud, and the students responded by pressing one of four smileys on the tablet, corresponding to a 4-point Likert-type scale ranging from 1 = many are not good friends/many don't look after each other in the class to 4 = everybody is good friends/everybody looks after each other in the class. The most negative response was visualised by the saddest smiley, whereas the most positive response was visualised by the happiest smiley.

Teacher-reported CEC included five items (Holen et al., 2013). Teachers were asked to indicate on a 5-point Likert-type scale scale ranging from 1 = very seldom or never to 5 = very often or always, the extent to which they agreed with items such as; *All pupils in the class stick together.*

Statistical analysis

First, the intraclass correlation (ICC) was calculated for student-reported CEC to determine whether it was acceptable to apply this variable at the class-level. The *ICC(1)* gives an indication with regard to what extent class belongingness influences students' ratings of classroom climate The *ICC(2)* is a calculation of the reliability of the class-mean ratings (Lüdtke et al., 2009). *ICC(2)* values between .70 and .85 indicate acceptable reliability (LeBreton & Senter, 2008; Lüdtke, Trautwein, Kunter, & Baumert, 2007). Second, to validate the model shown in Figure 1, confirmatory factor analysis (CFA) with maximum likelihood estimation was applied using AMOS version 25 (Arbuckle, 2017). When applying CFA we can test relationship among observed variables and their associated latent constructs. Third, guidelines developed by Hair and colleagues (Hair, Black, Babin, & Anderson, 2010) were applied to determine the criteria related to validity and reliability of constructs. Specifically, the reliability of

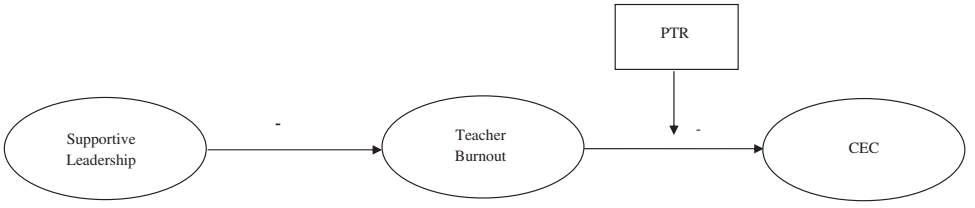

Figure 1. Theoretical model of the study. PTR: pupil teacher ratio; CEC: Classroom emotional climate.

constructs was determined by applying the Composite Reliability (CR) and Cronbach's alpha, the values of which should be > .70 (Hair et al., 2010). Convergent validity was based on Average Variance Explained (AVE > .50), whereas discriminant validity was tested with Maximum Shared Variance (MSV) and the criteria that the square root of AVE should be greater than inter-construct correlations (MSV < AVE). Fourth, structural equation modelling (SEM) was utilised to test the structural model of the relationships among supervisory support, teacher burnout and CEC. Fifth, to test the significance of the indirect association of teacher burnout on the relation between supervisory support and CEC, we applied the bias-corrected bootstrap mediation in AMOS version 25.0. The bias-corrected bootstrap approach has been suggested as the most favourable approach, as it controls for skewness in the population (MacKinnon, Lockwood, & Williams, 2004), and 1000 bootstraps and 95% confidence intervals were applied. Sixth, a multi-group path analysis using SEM was utilised to examine whether model parameters varied between classes with one teacher and classes with two teachers. To determine whether the parameters differed by classes, the critical ratio difference test was applied. We followed the criteria suggested by Arbuckle (2017), where the critical ratio that exceeds 1.96 in magnitude is significant at the 0.05 level. Finally, AMOS version 25 was applied to calculate the means, standard deviations, and correlations of measures.

CFA and SEM rely on several statistical tests to determine the model fit to the data. In the current study, we evaluated the comparative fit index (CFI), root means square error of approximation (RMSEA), normative fit index (NFI), incremental fit index (IFI) and Tucker Lewis Index (TLI). A CFI value of .90 or greater and RMSEA value of .06 or less indicate acceptable model fit (Hu & Bentler, 1999). Values of .90 or above, are recommended values of NFI and IFI (Bentler & Bonett, 1980). For full statistical equations of model fit indices see Hu and Bentler (1999), and Bentler and Bonett (1980).

Results

Preliminary analysis

As previously noted, we considered the class to be an appropriate level of analysis, from a theoretical viewpoint. However, Lüdtke et al. (2009) advise that in addition to identifying the level of analysis theoretically, the psychometric content of responses should also be identified. The evaluation of *ICC(1)* and *ICC(2)* should be a starting point for all multilevel contextual or climate studies (Marsh et al., 2012). Thus, we calculated the *ICC(1)* and *ICC(2)* for student-reported CEC on the aggregated ratings in each of the 300 classes. The results showed that *ICC(1)* for student-reported CEC was .15, whereas the *ICC(2)* was .78. This implies that 15% of the variance in students' ratings of CEC can be attributed to the fact that students are nested in different classes. Regarding *ICC(2),* values between .70 and .85 indicate acceptable reliability values (LeBreton & Senter, 2008; Lüdtke et al., 2007), and the *ICC(2)* value of .78 for student-reported CEC is therefore acceptable. Thus, we applied the class mean as the unit of analysis.

Table 1. Means (M), standard deviations (SD), correlations and reliability (Cronbach's α on the diagonal) for the study variables.

Variable	*n*	*M*	*SD*	CR	AVE	MSV	1.	2.	3.	4.
1. SS	293	3.37	0.79	.909	.667	.909	**(.82)**			
2. TB	293	3.04	1.07	.901	.645	.901	.40***	**(.80)**		
3. TC	293	4.06	0.50	.818	.529	.818	.27***	.19**	**(.73)**	
4. SC	300	3.37	0.20	.877	.505	.021	.07	.13*	.29**	**(.71)**

CR: Composite Reliability; AVE: Average variance explained; MSV: Maximum shared variance; SS: supervisory support; TB: teacher burnout; TC: teacher reported classroom emotional climate; SC: student reported classroom emotional climate.
***$p < .001$; ** $p < .01$; * $p < .05$.

Table 2. Means (M) and standard deviations (SD) on teacher burnout and teacher and student reported classroom emotional climate between groups of teachers and students in control and intervention classes with one and two teachers.

Variable	*n*	*M*	*SD*
1. TB 1T	147	3.03	1.03
2. TB 2T	146	3.06	1.09
3. TC 1T	147	4.01	0.51
4. TC 2T	146	4.12	0.48
5. SC 1T	150	3.39	0.19
6. SC 2T	150	3.35	0.21

TB 1T: teacher burnout one teacher; TB 2T: teacher burnout two teachers; TC 1T: teacher reported classroom emotional climate one teacher; TC 2T: teacher reported classroom emotional climate two teachers; SC 1T: student reported classroom emotional climate one teacher; SC 2T: student reported classroom emotional climate two teachers.

Reliability and validity of constructs and confirmatory factor analysis

First, we validated our measurement concepts. To test whether our data fit the hypothesised measurement model, two separate confirmatory factorial analyses (CFA) were conducted with both teacher and student-reported CEC as the output variable, referred to as measurement model of teacher-reported CEC (MmTC) and measurement model of student-reported CEC (MmSC) respectively.

The mean, standard deviations, reliability and validity of constructs are shown in Table 1. The reliabilities of constructs, measured by Composite reliability (CR) and Cronbach's alpha, were found to be acceptable, all exceeding a cut-off value of .70. Moreover, the values of average variance explained (AVE) for all constructs were above .50, whereas maximum shared variance (MSV) was greater than the inter-construct correlations for all constructs. Further, the correlations among items of teacher CEC assessment and student CEC assessment were positive and significant, indicating that the constructs were related.

In addition to calculating the means and standard deviations for the entire teacher sample, we also calculated the means and standard deviations for teacher burnout and teacher-reported CEC between groups of classroom teachers in control and intervention classes comprising one and two teachers, respectively. The results are shown in Table 2. The results revealed marginal and non-significant differences in reported burnout and teacher-reported CEC between the control classes comprising one teacher and the intervention classes comprising two teachers.

The second step was to evaluate the fit of our two measurement models. Evidence of misfit can be captured by the modification indices, which can be conceptualised as a χ^2 statistic with one degree of freedom (Jøreskog & Sørbom, 1988). Concerning our first model (MmTC), further inspection of the modification indices suggested adding a correlation between two error terms in the burnout factor and two error terms in the supervisory support factor to enhance model fit. Considering the error terms with the highest modification indices were found within the same factor, we concluded that correlating these could be theoretically justified (Hooper, Coughlan, & Mullen, 2008). A chi-square difference test revealed that correlating the mentioned error terms significantly improved the fit of our measurement model (TEACHER χ^2 difference $=$ 85,8, $df = 2$, p $<$ .001). In our second measurement model, referred to as MmSC, we allowed an additional correlation between two error terms in the student-reported CEC factor, due to high modification indices. The modifications significantly improved model fit (χ^2 difference $=$ 146, $df = 3$, $p < .001$). As shown in Table 3, after the modification of our measurement model, the results indicated that both MmTC and MmSC provided an acceptable fit to our data.

Testing of structural relationships

The next step involved the development of two structural models, referred to as structural model of teacher-reported CEC (SmTC) and structural model of student-reported CEC (SmSC). The fit indices shown in Table 3 indicate that both structural models fitted the data well. As expected, we found a significant negative relationship between supervisory support and teacher burnout ($\beta = -.40$, $p < .001$). Thus, Hypothesis 1 was supported.

Moreover, teacher burnout was negatively associated with both teacher-reported CEC ($\beta = -.20$, $p < .001$), and student-reported CEC ($\beta = -.13$, $p < .05$), also supporting Hypothesis 2.

Finally, we also wanted to test the indirect relation of supervisory support on CEC through teacher burnout. As shown in Table 3, the indirect effect models (ImTC and ImSC) provided good fit to the data, and the results of the bias-corrected bootstrap test demonstrated an indirect relation between supervisory support and CEC through teacher burnout. An indirect relation was demonstrated for both teacher-reported CEC ($\beta = .07$, 95% CI [.02, .14,] $p < .01$) and student-reported CEC ($\beta = .05$, 95% [CI, .002, .10] $p < .05$), supporting Hypothesis 3.

Testing of group differences

Multi-group path analysis was conducted to determine whether the structural path coefficients for teacher burnout and CEC differed between classes with one and two teachers. However, prior to testing the differences in structural relations, we tested whether the factor structure in our model held in both groups with one and two teachers. As shown in Table 4, the fit indices indicated that the data fit well the multi-group model that included teacher-reported CEC (MgmTC) and the multi-group model that included student-reported CEC (Mgm SC). These results tell us that separating the data into two groups is still an appropriate way to assess our models and that configural invariance

Table 3. Fit statistics for the different models ($n = 300$).

Model	Model description	χ^2	df	CFI	NFI	TLI	IFI	RMSEA	SS → TB R^{2TB}	TB → CEC R^{2CEC}	Indirect effect of TB	CI 95%
Mm TC	Measurement model teacher reported CEC	131.890	72	.974	.945	.962	.974	.053				
Mm SC	Measurement model student reported CEC	222.082	113	.962	.926	.948	.962	.057				
Sm TC	Structural model teacher reported CEC	141.644	73	.970	.941	.957	.971	.056	−.40***	−.20***		
									.16	.04		
Sm SC	Structural model student reported CEC	222.163	114	.962	.926	.949	.963	.056	−.40***	−.13*		
									.16	.02		
Im TC	Indirect effect model teacher reported CEC	141.643	73	.972	.944	.965	.972	.056	−.37	−.20	.07**	[.02,.13]
									.14	.04		
Im SC	Indirect effect model student reported CEC	224.610	114	.963	.928	.956	.963	.057	−.37	−.13	.05*	[.002,.10]
									.14	.02		

CFI: Comparative fit index; NFI: Normative fit index; TLI: Tucker Lewis Index; RMSEA: Root Means Square Error of Approximation; CI: Confidence interval; SS: Supervisory support; TB: Teacher burnout; CEC: Classroom emotional climate, R^2 = R square.
*$p < .05$; **$p < .01$; ***$p < .001$.

Table 4. Fit statistics for the different multi-group models ($n = 300$).

Model	Model description	χ^2	df	CFI	NFI	TLI	IFI	RMSEA	TB → CEC $R^{2\ CEC}$	CR
Mgm TC	Multigroup measurement model teacher reported CEC	230.031	144	.963	.909	.946	.964	.045		
Mgm SC	Multigroup measurement model student reported CEC	351.576	226	.956	.900	.941	.957	.043		
Mgs SC	Multigroup structural model student reported CEC	352.404	228	.956	.905	.942	.958	.043	1T: −.26** .08 2T: *ns*	1.97

TB: Teacher burnout; CEC: Classroom emotional climate; CR: Critical ratio difference test; 1 T: One teacher; 2 T: Two teachers.
*$p < .01$; **$p < .001$.

holds. The next step was to examine structural associations among teacher burnout and CEC in classes with both one and two teachers and further to compare to see whether differences in the structural relations were significant. As before, two separate models were tested, one model with teacher-reported CEC (Mgs TC) as the outcome variable, and one model with student-reported CEC as the outcome variable (Mgs SC). First we constrained the path between CEC and teacher burnout to be equal, and compared this to a model where the path was allowed to vary, applying the χ^2 difference test. The χ^2 difference test confirmed that the unconstrained model provided significantly better fit to the data compared to the constrained model, (χ^2 difference $= 3.932$, $df = 1$, $p < .05$) for the model including student-reported CEC. However, the χ^2 difference test proved to be insignificant for the model including teacher-reported CEC. This implies that the structural path between teacher burnout and student-reported CEC differ among classes with one and two teachers, whereas this was not the case for the model including teacher-reported CEC. Thus, we preceded with further analysis only for the model including student-reported CEC. The results shown in Table 4 demonstrated that whereas the path between teacher burnout and student-reported CEC was significantly and negatively associated for the classes with only one teacher, the path was non-significant for the classes with two teachers. However, to examine whether the differences between classes with one and two teachers moderated the association among teacher burnout and student-reported CEC we applied the critical ratio (CR) difference test. The results demonstrated that for the Mgs SC model, the path between teacher burnout and student-reported CEC was significantly different for classes with one and two teachers (CR = 1.97). This implies that whereas the association between teacher burnout and student-reported CEC was significant for the classes with only one teacher, the same relation was non-significant for classes with two teachers. The final multi-group structural model is shown in Figure 2. Additionally, ad hoc analyses were performed, where we controlled for class size in our models. However, the results remained the same also when class size was included in our analyses. Conclusively, Hypothesis 4 was partly supported.

Discussion

In the current study, we investigated both direct and indirect associations between supervisory support, teacher burnout and CEC. Additionally, we investigated whether

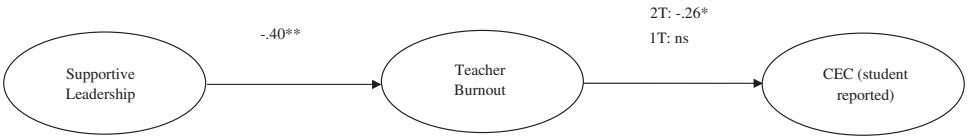

Figure 2. Multigroup structural model student reported CEC. χ^2: 352.404; df: 228; CFI: .956; NFI: .905; TLI: .942; IFI: .958; RMSEA: .043; n: 300; PTR: pupil teacher ratio; CEC: Classroom emotional climate; 2 T: two teachers; 1 T: one teacher; ns: non-significant. *p <.01; ** i <.001.

PTR moderated the association between teacher burnout and CEC. In line with previous research (e.g. Skakon et al., 2010; Viswesvaran et al., 1999) and our suggested hypothesis, our results supported a strong and negative relation between supervisory support and teacher burnout, indicating that supervisors play an important role in burnout among teachers in their respective schools. Further, and according to expectations, we found evidence that teacher burnout was negatively associated with both teacher-reported CEC and student-reported CEC. These findings are in line with the prosocial classroom model (Jennings & Greenberg, 2009), suggesting that teacher characteristics are associated with CEC.

In the current study, CEC was measured as a dimension referring primarily to the interaction between students (Holen et al., 2013). Still, it seems obvious that when teachers are burned out, they are inclined to show less interest and emotional affection towards their students, which again might have a spill-over effect on the interactions between students, and influence the CEC in a negative manner. This is also in line with theory and research related to "non-verbal leakages" (Babad et al., 1989; Rosenthal & DePaulo, 1979). Although we did not measure non-verbal expressions of teachers specifically, the negative association found between teacher burnout and CEC might still suggest that teacher's negative emotions leak into the classroom when teachers are burned out. Moreover, previous research has found that managing the classroom while remaining focussed on lessons and goals can drain teachers' cognitive and execution function skills (Downer, Jamil, Maier, & Pianta, 2012). Friedman-Krauss et al. (2014) further suggested that this cognitive load may aggravate under stress and interfere with teachers' ability to preserve a high-quality emotional climate in their classrooms. Thus, based on our findings, to maintain a sound CEC, it is important to help teachers prevent burnout.

In addition to the direct associations between supervisory support and teacher burnout, and between teacher burnout and CEC, our results also demonstrated an indirect association between supervisory support and CEC through teacher burnout. However, as can be seen in Table 3, although significant, the indirect relation between both teacher-reported CEC and student-reported CEC were found to be small. Still, the results support our assumptions that when teachers perceive low social support from their supervisor, this will relate to a negative CEC through teacher burnout. To our knowledge, previous studies have not investigated the indirect associations between teachers' perceived support from supervisor and CEC through teacher burnout. Thus, the current finding is valuable and sheds light on the importance of including factors related to teachers' working conditions to obtain an accurate picture of the antecedents and underlying processes that lead to CEC.

PTR, teacher burnout and CEC

In the final part of our study, we investigated whether PTR moderates the association between teacher burnout and CEC. Our findings suggest that this association shows a different pattern for classes with one teacher and classes with two teachers. Whereas teacher burnout and CEC were negatively and significantly related in classes with one teacher, the same association proved to be non-significant in classes with two teachers. However, the difference in association was significant only for the relation between teacher burnout and student-reported CEC, and not between teacher burnout and teacher-reported CEC. Still, the measure of teacher burnout and student-reported CEC are from different sources, which again reduces common method bias (Podsakoff & Organ, 1986). Thus, we could claim that applying student reports of CEC has higher credibility compared to teacher reports of CEC in our study. In light of this, we can conclude from our findings that when classes have an extra teacher, the negative association among teacher burnout and CEC diminishes. This is an interesting finding for which we can offer several explanations. First, when PTR is low, teachers have more time for each student (Bennett, 1996). The extra time given to each student will most likely make the student feel valued and appreciated, which again might have implications for the association between teacher burnout and CEC. A second explanation could be that the class-teacher's negative behaviour resulting from burnout may become less pronounced in classes where an extra teacher is present. In other words, the negative relations between the class teachers' burnout symptoms and the class milieu, could be counterbalanced by the presence of a second teacher. Third, one could assume that our finding relates to the class-teachers' perception of being monitored. For instance, if a second teacher is present in the classroom, class teachers who suffers from burn out might feel he/she is "under surveillance" and therefore regain composure to behave nicely and respectfully towards students. This again might relate positively to the interaction between students. Finally, as with all interventions, students and teachers exposed to the intervention might provide more positive reports as a result of the so-called Hawthorn effect (Roethlisberger & Dickson, 1939), which is the tendency to report more positively due to the enjoyment of a new and novel experience.

The main focus of the current study is not on student's academic outcomes, but rather on antecedents of CEC. Still, as it is raised above any doubt that a sound CEC is a significant determinant of student's learning outcomes (e.g. Hattie, 2009; Patrick et al., 2007; Pianta, Belsky, et al., 2008), we consider it valuable to also touch upon how our findings might be relevant for students learning. As referred to previously, Hattie (2009), concluded from his review that reducing class size has systematically small effects on student's learning outcomes. However, one limitation of Hattie's (2009) work is perhaps that he is primarily occupied with studying which factors relate *directly* to student's academic outcomes, whereas he pays less attention to the study of more complex effects, including indirect effects, mediators and moderators. Another limitation concerns that previous studies on PTR have been concerned with studying class size reduction, rather than increasing the number of teachers in the class. Specifically, with regard to our findings, there is evidence that deploying an extra teacher in the class, diminishes the negative association between teacher burnout and

CEC. Further, if we take into account that a sound CEC is significantly related to student's academic outcomes, it can be concluded that although PTR might not associate directly with students learning outcomes, it might very well have significance for students' academic performance by reducing the negative relation between teacher burnout and CEC.

Finally, we believe it is important to emphasise that our results do not indicate that teachers in classes where two teachers are present experience less burnout or perceived the CEC as better compared to teachers in classes with only one teacher. Rather, the results tell us that having an extra teacher in the classroom influenced the *association* between teacher burnout and CEC. Thus, it is not possible to conclude from our study that having an extra teacher in the class reduces the class teachers' feeling of being burned out, nor that such an intervention has a direct and positive influence on CEC. Nevertheless, we can conclude that in classes with two teachers in the class, the negative association between teacher burnout and CEC is weaker compared to classes with two teachers.

Discrepancies between teacher ratings and student ratings on CEC

Earlier studies found discrepancies between student and teacher ratings in factors related to CEC (e.g. Fisher & Fraser, 1983; Konold & Pianta, 2007; Mitchell et al., 2010; Wang & Eccles, 2016). Thus, it was interesting to see that similar associations were revealed between teacher burnout and CEC for both teacher-reported CEC and student-reported CEC. However, as shown in Table 3, the association between teacher burnout and teacher-reported CEC was slightly stronger compared to the association between teacher burnout and student-reported CEC. Still, the association was not that large in magnitude, and both coefficients were significant and moved in the same direction. These results suggest that the discrepancies between teacher ratings and student ratings of CEC were not of considerable importance. Based on our results in general, it seems as if both constructs gauged a common phenomenon, which can be referred to as CEC.

Conclusion and practical implications

Conclusively, supervisory support plays a significant role in CEC, as it relates to teacher burnout, and teacher burnout may influence the CEC in a negative manner. Moreover, the results of our study suggest that decreasing the PTR might diminish the negative association between teacher burnout and CEC. The current study may have several practical implications. First, school management needs to become aware of the importance of supporting their employees to prevent burnout and maintain well-being among teachers. Second, considering classroom climate promotes the students' well-being and academic achievements (Mashburn et al., 2008; Pianta, Belsky, et al., 2008), support from supervisors may also be important for the students' well-being, as supervisory support was found to relate indirectly to CEC through teacher burnout. Finally, school supervisors and school politicians should keep in mind that decreasing

PTR, by deploying an additional teacher resource, might reduce the negative association between teacher burnout and CEC.

Limitations, strengths and future research

The current study has several limitations. First, the study was cross-sectional, meaning we cannot draw causal inferences concerning the hypothesised relationships. It is worth noting that the cross-sectional design of our study did not allow us to determine whether teacher burnout *causes* bad CEC. An alternative explanation could be that bad CEC causes teachers to become burned out. One might also expect associations to be reciprocal. For instance, it has been suggested that "bad" classroom compositions place additional stress on teachers, resulting in burn out. According to Babad (2009), the major predictors of burnout can be found in the classroom setting, and relates to the fact that teachers need to cope with low student motivation, disturbances, discipline problems, and frequently teachers experience failure with several of their student. This may again result in teachers behaving more negatively towards all children in the class (e.g. Rimm-Kaufman, Pianta, & Cox, 2000), making the CEC even worse, and resulting in an even higher increase in teacher burnout. Conclusively, longitudinal studies are required to make more solid conclusions about the studied relations.

Second, a major part of our study is based on self-reports, which can increase the problem of common method variance. One suggested approach in order to diminish the problem of common method variance, is to make sure the dependent and independent variables are from different sources (Podsakoff & Organ, 1986). Consequently, the strength of our study was that both teacher and student reports were used to measure the CEC construct and that the measure of PTR was based on an objective intervention. Third, PTR was measured by deploying an extra teacher in the classroom. Still, we consider it a strength that we also controlled for class size, and hence the present study provides a valuable contribution to this field of research.

Fourth, the study was conducted on children in a Norwegian school context; therefore, caution should be taken when generalising the results. Further, all schools were recruited from the Southern Part of Norway, and schools and students participated voluntarily. Thus, the schools may not be representative of the entire country. Still, the randomised control trial design of the study in which the different classes were randomly assigned to the intervention or control groups according to PTR, must be considered a strength of our study. Additionally, the large sample enhances the generalizability of the findings. However, we would recommend that future studies examine the same associations also in different contexts.

Finally, the results of previous studies that applied both teacher and student reports of classroom climate have been ambiguous. Specifically, there were discrepancies between student and teacher ratings in factors related to CEC (Fisher & Fraser, 1983; Mitchell et al., 2010; Wang & Eccles, 2016). In our view, previous results on this matter were inconsistent primarily due to the content of items and the level of analysis. Thus, future research needs to put more effort into developing constructs that

can gauge the CEC phenomenon, in addition to determining the correct level of analysis.

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