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School quality and COVID-19-related compensatory measures

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Abstract In response to the proven negative effects of COVID-19-related school closures on students' learning, Germany launched a 2-billion-euro catch up program that provides financial resources for a variety of compensatory measures. However, many schools had already reacted to the pandemic beforehand and implemented appropriate measures. Against the background of the many funded initiatives as well as the individual initiatives that have been implemented in German schools, this paper examines what determines whether schools offer compensatory measures. Exploiting data from a teacher survey ($N = 1648$ teachers in 104 schools) in Germany, we tested the predictive power of various school aspects for the degree of compensatory measures realized at the school site to help students make up for possible learning losses due to COVID-19-related distance learning. Our findings from latent regression analyses and relative weight analyses, both at teacher and at school level, confirm the significant role of the existing culture of inclusion at a school for predicting a school's degree of compensatory measures offered. At the same time a range of other investigated school aspects only indirectly predicted compensatory measures, particularly via the culture of inclusion at school. We discuss the findings against the background of the theoretical foundation and the methodological limitations of the present study.

Keywords School closures · Compensatory measures · School quality · Structural equation modelling

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1 Introduction

The COVID-19 pandemic led to repeated periods of school closures worldwide. Many studies document negative effects of school closures on students' learning time (e.g., Huber et al. 2020), academic achievement (e.g., Betthäuser et al. 2023), and psycho-social well-being (e.g., Schlack et al. 2020). In contrast, little is known about corresponding compensatory measures initiated and implemented by actors of the school system such as educational policy, administration, and schools. More specifically, Helbig et al. (2022) point out the lack of studies on effects of compensatory measures. In addition, empirical studies on predictors that explain whether schools did offer compensatory measures to students or not are missing. This situation is unsatisfactory as knowledge about predictors of compensatory measures offered at the school site is needed in several respects. Firstly, this knowledge could help education policy makers and administrators to support individual schools in their development so that in future crises schools possess necessary features (e.g., lived inclusion at the school site) and resources (e.g., teacher collaboration, multiprofessional teams) to best support (disadvantaged) students who are particularly suffering from crises. Secondly, this information reflects knowledge about comparatively innovative and (crisis-)resilient schools. Those schools that have been proactive in offering support during the challenging times of the pandemic may well be considered progressive schools.

This study aims to satisfy the outlined need for information. We do so by analyzing teacher data from a study which was conducted in North Rhine-Westphalia, Germany. Before presenting the method, design, and findings of the study, in the next section we review the theoretical framework.

2 Theoretical framework

2.1 Compensation measures in Germany "Aktionsprogramm Aufholen nach Corona"

In response to the widely feared negative effects of COVID-19-related school closures on students, particularly in the areas of academic learning and psychological stress, and as documented in international studies (Betthäuser et al. 2023; Schlack et al. 2020), the 2-billion-euro catch up program "Aufholen nach Corona" was initiated in Germany (https://www.bmfsfj.de/bmfsfj/themen/corona-pandemie/aufholen-nach-corona, 26.11.2022). The program provided the German federal states with access to financial resources to implement compensatory measures. About half of this money was earmarked for offers to reduce learning deficits. The focus of support was to be on the main subjects (i.e., Mathematics, German, English) and to be manifested organizationally in individual lessons or lessons in small groups. Furthermore, it was explicitly emphasized that corresponding measures should reach children with a migration background. The measures were to take place during the summer vacation (e.g., in summer camps and study workshops) as well as during lessons at the beginning of the new school year. The implementation was in the responsibility of the

federal states, as each federal state was to take measures tailored to its specific needs while at the same time linking up with existing support programs in the federal state. The state of North Rhine-Westphalia, whose schools are examined in this study, used the funding to expand its previously initiated catch up program "Ankommen und Aufholen" (https://www.schulministerium.nrw/ankommen-aufholen, 26.11.2022).

By means of comprehensive document analyses and interviews with representatives of regional unions for educational and science staff (Gewerkschaft Erziehung und Wissenschaft), Helbig et al. (2022) recently presented an in-depth analysis of the measures implemented in each of the 16 German federal states. With regard to the question of the effectiveness of the initiated catch up programs, the proclaimed goals were manifold. A central goal was addressing pandemic-related learning gaps in core subjects. For the vast majority of the goals, Helbig et al. (2022) caution that no or only very inadequate information on goal achievement (e.g., student participation figures, student performance) has been documented or published to date.

2.2 Compensatory measures in other countries

Like the German federal states and many other countries, Austria relied on remedial offers (e.g., additional teaching and summer school) to compensate for learning losses. Postlbauer et al. (2022) took a closer look at which parents are particularly attracted by remedial measures (i.e., summer school, additional teaching) by using cross-sectional data from a parent survey ($N = 3590$ parents) in Austria. The findings, illustrated via a series of latent mediation models, indicate that parents' intention to use remedial measures is predicted by parents' attitudes towards the implementation of remedial measures, parents' assessment of their child's learning engagement, and of the quality of distance learning during school closures. Moreover, the intention to use remedial measures is significantly influenced by the family's socioeconomic status. This finding contrasts with that of the parent survey by Wößmann et al. (2021) who reported that low-achieving children did not attend summer schools or remedial classes more often than high-achieving children, although these offers were intended primarily for them. In addition, children from educationally disadvantaged families received very little support in terms of remedial measures such as tutoring. As in Germany, Austria has yet to conduct a valid scientific study on the measures' compensatory effects regarding the students' learning losses. Sailer and colleagues from the University of Passau are undertaking the first such attempt on behalf of several education directorates (Bildungsdirektionen) of Austria and are investigating the effects of summer school in some of the federal states of Austria (see Sailer et al. in this issue).

Our research colleagues in Italy have already made much more progress in this regard. In the context of COVID-19, potential remediation strategies were first discussed and compared by Pan and Sass (2020). They concluded that lengthening the school year by two weeks produced only moderate improvements, while lengthening school days and summer school programs could reduce learning losses substantially. In Japan, too, a first study shows very beneficial effects of compensation measures (Asakawa and Othake 2021, p. 36): "[T]he drastic shortening of the summer break

to compensate for the decrease in school days due to school closure and the introduction of ICT terminals significantly recovered and improved math scores."

2.3 Assumed predictors of compensatory measures at school site

In addition to the question of effectiveness, Helbig et al. (2022) also raised the question of the conditions necessary for a successful implementation of catch up programs. In their analyses, they focused on four conditions (1) needs-based funding, (2) human resources, (3) rapid access to funding, and (4) legal and organizational frameworks for reducing learning gaps. While the latter two are conditions at the system level and thus irrelevant for our single-system study, condition 1 (Sect. 2.3.2) and 2 (Sect. 2.3.3–2.3.8) do play a role in the present study. In addition, below we derived further conducive or obstructive conditions from the findings reported by Helbig et al. (2022).

2.3.1 Social composition of the school

Several studies on COVID-19-related learning loss (Gore et al. 2021; Maldonado and de Witte 2021; Patarapichayatham and Locke 2021; Schult et al. 2022) showed that socioeconomically disadvantaged students suffered from greater learning loss than other students. Thus, one could expect that especially schools with a challenging student body (i.e., socioeconomically disadvantaged students, heterogeneous students in terms of performance, students that were difficult to reach during distance learning) would face a significantly greater need for compensatory measures. In line with this, the Standing Conference of the Ministers of Education and Cultural Affairs of the states in the Federal Republic of Germany points out "that the funds of the catch up program cannot be used efficiently if they are not clearly focused on the most disadvantaged groups" (Helbig et al. 2022, p. 275). Therefore, in some federal states (e.g., Hamburg, North Rhine-Westphalia, or Hesse) the funding of compensatory measures was based on the schools' social index. Thus, it is reasonable to assume that there is a relationship between the proportion of students perceived as challenging at a school and the extent of compensatory measures offered at the school site.

2.3.2 Culture of inclusion at the school

Helbig et al. (2022, p. 8) argue that schools are quite stable and "difficult to change" systems, which is why the implementation of catch up programs cannot be realized in the short term. Compensatory measures are therefore most likely to succeed where structures already exist to which new measures can dock and into which new measures can be integrated. Existing structures are not to be thought of in purely organizational terms, but rather in terms of the instructional culture lived out at the school site. One of the goals of the catch up program in North-Rhine Westphalia (NRW) is integrated cognitive support, i.e., during class time individualized and differentiated learning support adapted to the needs of the students should be provided. Schools with an established culture of individualization and differentiation

should find it much easier—than schools that have not yet focused on inclusive education—to adopt and implement new measures. An example of such new measures in NRW is "Extra-Blick," an online platform of QUA-LiS (https://www.qua-lis.nrw.de), where a variety of diagnostic tools and support materials are available. However, based on the existing research, it cannot be assumed that the provision of diagnostic tools and support material alone is sufficient to establish a culture of inclusion. Rather, the relevant literature (Ainscow and Sandill 2010; Carrington and Robinson 2006; Kugelmass 2001; Lambrecht et al. 2022; Zollers et al. 1999) has identified, among others, the following aspects as particularly beneficial:

- An inclusive, distributed, transformational, and instructional leadership that is committed to inclusive values
- A broad vision of school community, shared language, and values; commitment to a central philosophy and belief system
- (Structures that support) social learning and collaboration among multi-professional teams; valuing and collaborating with parents and the broader community
- Support for continuous improvement and developing a learning community (capacity building at the school level)
- Support of student participation and engagement of students as citizens in school review and development
- Support for teachers' critical engagement with inclusive ideals and practices

We assume that the culture of inclusion already existing at a school significantly predicts the degree of compensatory measures offered at the school site.

2.3.3 School as a living space

An inclusive culture, as indicated in the previous section, is seen as a prerequisite for a learning environment that focuses not only on academic goals but also on socio-emotional well-being, which is also a central goal of the catch-up program in North Rhine-Westphalia. In addition to students' learning progress, the North Rhine-Westphalian catch up program also focuses on the socio-emotional well-being of students. The program website states that schools should offer "opportunities and freedom to design school as a learning and living space again and to grow together again as a school community" (MSB NW 2021b). According to Grosche and Lüke (2020, p. 33), an inclusive culture can be understood as "inclusion as meeting the social/academic needs of all pupils—including those with and without special educational needs." However, this requires a departure from a focus on averages towards a focus on potential (Veber 2019). This is a central requirement at the school culture level from an inclusive education perspective, in order to consider learning progress and socio-emotional development together. Furthermore, the school climate reflects school as a culture that places high value on social interaction. It can therefore be assumed that schools with such a culture also place more emphasis on student achievement and catching up on learning. As was argued for the existing culture of inclusion at the school site, we also propose a positive correlation with the compensation offer for the culture of the school climate.

2.3.4 Staff capabilities at the school

To implement compensation measures and programs, additional staff resources are needed, since measures to recover learning losses, such as the individual learning support, cause additional pedagogical and organizational effort. For this reason, additional staff was financed in the catch up program of NRW through the "extra staff" pillar. According to the ministry, additional staff members "provide students with additional support in catching up on learning deficits caused by the pandemic. This can be done by supporting and supervising groups, by assisting the regular teacher in regular classes, by providing support outside of regular classes, or by other supplementary teaching measures. Persons without teaching qualifications support the teachers and assist in the education, teaching, and counseling of the students" (MSB NW 2021a; translated by the Authors). Hence, sufficient qualified (educational) staff represent a prerequisite for offering compensatory measures. Especially in times of teacher shortage (Maaz et al. 2022), this prerequisite does not seem to apply in many schools.

2.3.5 Teacher stress and teachers' affective commitment

Another aspect of staff capability relates to psychological resources, such as experienced occupational stress (e.g., stress, time pressure) or the commitment of the school staff. Helbig et al. (2022) argue that teachers suffer from too many tasks and a chronic lack of time. Along with this, studies show that the teaching profession is one of those with a comparably high burnout rate (Schaarschmidt and Kieschke 2007). All this hardly allows the assumption of new tasks such as those associated with the implementation of compensation measures. Previous research has shown that teachers often feel overwhelmed from responding to their students' emotional needs, especially after catastrophic events (Pfefferbaum et al. 2004). Moreover, it has been documented that after a crisis, symptoms of posttraumatic stress disorder are significantly higher in teacher samples than in the general population (Zhang et al. 2016).

The COVID-19 pandemic has posed significant challenges and burdens for teachers. The transition from in-person to remote learning has created unprecedented challenges for schools and teachers, including preparing students to learn in a non-traditional setting, acquiring digital skills, compensating for learning losses, and fostering new forms of teacher cooperation. Huber et al. (2020) found that four out of ten teachers reported high perceived stress. Early studies on the first lockdown in German-speaking countries (e.g. Huber et al. 2020; Dreer and Kracke 2021; König et al. 2020) and international studies (e.g. Beltman et al. 2022; Darling-Hammond and Hyler 2020) cite various reasons for increased teacher burden during the pandemic, including:

- The distance itself, i.e., the absence of social/personal contacts, exchange, and closeness; in short, students and colleagues were missed.
- Teachers were also subjected to multiple professional roles (working from home, childcare, and household chores) and constant availability to students.

- The pandemic was accompanied by great uncertainty in general. In addition to the general lack of planning security, there was a lack of clear information, regulations, and standards for schools at the beginning of the pandemic (e.g., guidelines regarding duty of care, attendance, and structure of distance learning, or regarding final exams and grades).
- There was a lack of technical equipment in schools (e.g., digital devices and software solutions, stable digital infrastructure). However, the lack of technical possibilities in the home office (data volume, printer, copier, etc.) also posed challenges for teachers. Moreover, data protection issues were unclear at the beginning of the pandemic.
- The acquisition of digital competence was also reported as challenging (with a simultaneous lack of offers for further education and training).
- Finally, the fear of infection in schools (e.g., during emergency care and reopening of schools) was also burdensome.

Thus, particularly in times of crises, teachers seem vulnerable to psychological stress, which can lead to emotional exhaustion. Scholars argue that teachers' positive emotions like well-being, job satisfaction, and affective commitment provide a vital resource for the successful fulfillment of their professional role (Deci and Ryan 2008; Hascher et al. 2021). "Given the high workload and professional responsibilities that teachers face, their well-being is a precious resource for high quality teaching and supports teachers' professional ability. Also, for schools as organizations, teacher well-being is of the utmost importance" (Hascher et al. 2021, p. 12). This is likely to be especially true during challenging times, such as distance learning and the remedial phase thereafter.

2.3.6 Collective teacher efficacy

The results of an extensive literature review by Zee and Koomen (2016) spanning 40 years of research on teacher self-efficacy (TSE) suggest that TSE shows positive links with students' academic achievement, instructional quality, and various aspects of teachers' psychological well-being (including reduced burnout risks). In addition, several studies on distance learning also indicate that TSE was a significant resource for coping with the difficult situation (i.e., Hascher et al. 2021; Rabaglietti et al. 2021; Weißenfels et al. 2022). Both Weißenfels et al. (2022) and Rabaglietti et al. (2021) argue that the quick implementation of distance learning caused by COVID-19 represented a great technological challenge to many teachers, especially to those with limited experience in digital learning environments. Feelings of being overwhelmed were most likely for teachers with low TSE—especially if teachers felt inadequate in implementing digital learning material. Indeed, both studies showed that TSE helped to reduce teachers' stress and indicators of burnout. Thus, TSE—in the present study, we focus on collective teacher efficacy—is considered a key resource in dealing with new challenges and tasks, as is the implementation of compensatory measures.

2.3.7 Coherent leadership team

Whether to what extent and in what quality compensatory measures are implemented at the school site also depends on the school management. Although in the case of the German catch up program, the ministries of the federal states specify the quality standards, the school leader bears a strong responsibility for the realization of the measures (Helbig et al. 2022, p. 218). School principals and leadership teams likely had a special role to play here, as against the backdrop of teacher shortages, the multiple ongoing responsibilities of school principals, and the time pressures for planning and coordinating catch-up programs, school principals had to overcome several hurdles (Helbig et al. 2022, p. 263). Therefore, coordination within the extended school leadership team (e.g., arrangements in the subject teams, in the grade level teams, and among all teachers of a class) is likely to be of central importance. Literature on effective school leadership (e.g., Hulpia et al. 2009) shows, that if teachers believe that their leadership team works cooperatively (i.e., all leaders work toward the same goals, each member has clear roles, there is a cohesive team), teachers are more strongly committed to the school as an organization. A central characteristic of organizational commitment is involvement and a willingness to exert effort on behalf of the organization. Furthermore, research on inclusive school development assigns a central role to school leadership (e.g., Badstieber and Amrhein 2021; Preis and Wissinger 2021) by supporting, among other things, cooperation among teachers and collaboration in multi-professional teams and promoting changes in school culture with regard to student heterogeneity (e.g., Kugelmass and Ainscow 2004). In doing so, school leadership must perform a balancing act between guidance (shared goals, work structure) and autonomy for teachers, while always keeping supportive conditions such as financial and time resources for school development in mind (Preis and Wissinger 2021). Thus, we argue that higher levels of coherent leadership lead to higher cooperation and commitment which is associated with higher degrees of compensatory measures at the school site.

2.3.8 Teacher cooperation at the school

Likewise, teacher cooperation is considered another key resource in times of change. Cooperative work among teachers is a basic prerequisite for fulfilling the educational mission even in times of crisis (Bremm et al. 2021; Demski et al. 2021). The shift from face-to-face teaching to distance learning made the coordination of learning opportunities within individual schools central. In addition, media concepts had to be developed at schools. The COVID-19-related school closures and corresponding remedial measures made it necessary to implement new concepts and regulations. Moreover, teachers had to be trained in digital skills. All this happened at the schools mostly through intensive teacher cooperation (Bremm et al. 2021, p. 119; Demski et al. 2021). Hence, scholars (Bremm et al. 2021; Demski et al. 2021; Huber et al. 2020) argue that change in schools, i.e., school development, only works if teachers cooperate. Given the high relevance of teacher cooperation in times of crisis, we assume that teacher cooperation is positively related to a school's compensatory measures.

2.3.9 *Multi-professional teams*

The catch up programs in Germany provided for the possibility of increasing working hours. In their report, Helbig et al. (2022) point to the fact that this option has been adopted by non-teaching, pedagogical staff such as social workers, educators, pedagogical assistants, and inclusion facilitators, and less by teachers, as teachers often worked part-time on a voluntary basis. From the literature and research on teacher cooperation in the context of multi-professional teams (e.g., Lütje-Klose and Urban 2014), scholars argue that the cooperation between teachers and specialists with special education training represents the central condition for success in inclusive school development (Lütje-Klose and Urban 2014). This assumption made for special education can be extended to inclusive education in a broader sense (e.g., dealing with heterogeneity in the classroom). For instance, multi-professional cooperation creates innovation by questioning previous routines, a more differentiated view of problems, and an expansion of professional action, as well as division of labor, and more support (Maykus 2009). Against this background, we argue that innovations in the system such as the implementation of compensatory measures are realized more often at schools with a strong existing multi-professional cooperation.

2.3.10 *Cooperation with external partners*

Increased collaboration between schools and external partners has been shown to improve the quality of services, to improve the understanding of stakeholders from different educational institutions about each other, and to improve the use of existing resources or attract additional resources (Bauer et al. 2017; Rolff 2014). Thus, similarly to teacher cooperation, teacher-parent cooperation, and multi-professional cooperation, scholars argue (e.g., Helbig et al. 2022) that cooperation with experts outside the school represents a significant resource for school development in general and for the implementation of compensatory measures in particular. For example, Helbig et al. (2022) observe that the recruitment of support staff funded through the catch up programs was particularly successful in schools with existing cooperative relationships with external partners, such as associations, foundations, and individuals. Against this background, we assume cooperation with external partners to represent a positive predictor of compensatory measures at the school site.

2.3.11 *School-parent partnership*

Paseka and Killus (2022) analyzed the role of parents before, during, and after the COVID-19 pandemic. They summarize that while parents had to take over responsibility for learning at home during school closures, parents were widely not considered when setting up the catch up programs, although they very likely had gained lots of expertise for teaching and learning during the months of distance learning. The authors find it “astonishing” not to utilize this resource. However, according to initiators of the catch up program in NRW, teachers are called on to consult parents to organize tailored individual support measures for students. Helbig et al. (2022, p. 166) argue that whether this happens in practice depends largely on

the existing quality of communication between the individual school/teachers and the parents. Already during distance learning, the teacher-parent cooperation was of importance for the quality of distance learning as well as for the students' learning progress (Huber et al. 2020; Paseka and Killus 2022). It stands to reason that teacher-parent cooperation at the school site also influences the implementation of catch up programs. Schools that are in close contact with parents have a more comprehensive and valid picture of their students' needs. Moreover, it can be assumed that at such schools, parents are also more likely to articulate the needs of their children and demand appropriate measures. We therefore hypothesize that teacher-parent cooperation is predictive for offering compensatory measures.

3 The present study

Against the background outlined in the theoretical framework and literature review, our study aims to investigate predictors of compensatory measures that were initiated by schools to tackle students' learning losses that occurred because of the COVID-19-related school closures. More specifically, in a first step, we test the hypothesis that the compensatory measures offered at the individual school are statistically significantly predicted by characteristics of a school. In a second step, we investigate the indirect effects of the predictors mentioned via the mediator "culture of inclusion at the school." The second step was inspired on the one hand by the assumption that schools are quite stable and "difficult to change" systems, which is why compensatory measures are most likely to succeed where similar structures already exist (see Sect. 2.3.1). On the other hand, correlational analyses (see the supplementary material) as well as relative weight analyses (see Table S3 in the online supplementary material) pointed to particularly strong correlations and therefore the explanatory power of a culture of inclusion. Thus, culture of inclusion is, both theoretically and empirically, closer to the construct of compensatory measures than other predictors.

4 Method

4.1 Sample and data collection

To test our hypotheses, we use data of a 3-cohort longitudinal online survey conducted in North-Rhine Westphalia, Germany. The data on the predictors was collected in 2018 (cohort 1), 2019 (cohort 2), and 2020 (cohort 3). Data on compensatory measures was collected after the second lockdown in 2021 for all three cohorts. Self-reported data is available from 1648 teachers in 104 schools.

4.2 Measurements

Measurements Teachers were asked to rate the degree of compensatory measures at their school site as well as different aspects of their school that were assumed to predict whether a school offers compensatory measures (see Sect. 2.3). Established scales were used to capture the school constructs (see Tables 1 and 2 as well as the online supplementary material). Compensatory measures were rated with yes or no. All other items were rated on a 5-point scale where low values indicate low agreement or levels. A full list of all items can be provided by request to the first author.

4.3 Analytical approach

Information on the specification, estimation, and evaluation of the statistical models as well as on the handling of missing values is provided in the online supplementary material.

5 Results

5.1 Predicting compensatory measures by school quality aspects (RQ/H 1)

The model at teacher level (259 par, X2: $p < 0.001$, CFI 0.937, TLI 0.929, RMSEA 0.016 [0.014, 0.017], WRMR 0.993) fitted the data reasonably well. That is, 39.6% of the dependent variable compensatory measures were explained. For the school-level analysis, a saturated model with manifest variables was specified, thus only R^2 is reported: 32.3%. At teacher level, the point estimates of the structural paths predicting the compensatory measures offered at the school site proved to be statistically significant and of relevant magnitude only for culture of inclusion at school (INS: std. Beta = 0.581, $p < 0.001$); see Table 3 (left part). Table 3 (right part) provides the coefficients for the school-level analysis. Similarly, when aggregating the data at school level, again the culture of inclusion was of importance (INS: std. Beta = 0.245), however with a higher alpha error rate ($p = 0.097$). In contrast to teacher-level analysis, quality of teacher-parent relations and the heterogeneity of the student body at school represented further relevant positive school-level predictors of compensatory measures (QPR: std. Beta = 0.386, $p = 0.009$; SCS: std. Beta = 0.222, $p = 0.065$).

5.2 The indirect effect of school quality on compensatory measures (RQ/H 2)

Both the model at the teacher level (246 par, X2: $p < 0.001$, CFI 0.939, TLI 0.931, RMSEA 0.015 [0.013, 0.017], WRMR 1.009, R^2: 7.8% for compensatory measures and 42.9% for culture of inclusion) and at the school level (122 par, X2: $p = 0.084$, CFI 0.976, TLI 0.804, RMSEA 0.013, SRMR between 0.053, R^2: 33.7 and 58.2%) fitted the data reasonably well. In line with results from RQ1 (see Table 3), RQ2 (see Table S3 and Table 4) again confirmed that culture of inclusion (INS) was a relevant determinant of compensatory measures, both at the

Table 1 Scale information of the study measures

Construct	#	Sample item
Compensatory measures	4	Um die Leistungsdefizite abgehängter, schwer erreichbarer Schülerinnen und Schüler aufzufangen, bieten wir Kompensationsangebote an. [To address the learning losses of disconnected, hard-to-reach students, we offer compensatory measures.]
Social composition of the school	2	An unserer Schule haben wir eine ausgesprochen heterogene Schülerschaft hinsichtlich des Migrationshintergrunds. [At our school, we have a decidedly heterogeneous student body in terms of migration background.]
School climate		
Culture of inclusion at the school	6	An unserer Schule achten wir sehr darauf, dass die leistungsschwächeren Schülerinnen und Schüler leichtere Aufgaben bekommen als leistungsstarke Schülerinnen und Schüler. [At our school, we take great care to ensure that the lower-performing students are given easier tasks than high-performing students.]
School as a living space	4	An unserer Schule gibt es ein vielfältiges kulturelles Angebot (Schul- und Sportfeste, Theater- und Musikaufführungen etc.). [There is a wide range of cultural activities at our school (e.g., school and sports festivals, theater, and music performances).]
Staff capabilities at the school		
Teacher shortage	1	Teachers rated the staff shortage at their school
Teacher stress	4	Der Zeitdruck, unter dem ich arbeite, ist zu groß. [The time pressure under which I work is too great.]
Affective commitment	5	Ich bin stolz darauf, unserer Schule anzugehören. [I am proud to be a part of our school.]
Collective teacher efficacy	4	Ich bin zuversichtlich, dass unser Kollegium auch unerwartete Herausforderungen bewältigen kann. [I am confident that our faculty can meet unexpected challenges.]
Coherent leadership team	6	Das Leitungsteam unterstützt die Ziele, die wir an unserer Schule erreichen wollen. [The leadership team supports the goals we want to attain in our school.]
Cooperation		
Teacher cooperation at the school	4	Wir haben eine fachübergreifende Zusammenarbeit, die sich an gemeinsamen Themen orientiert. [We have a multidisciplinary collaboration based on common themes.]
Multi-professional teams	1	Teachers rated the cooperation of teachers with special needs teachers or social workers at their school
Cooperation with external partners	3	Unsere Schule bezieht außerschulische Partner in die Gestaltung ihres Angebots (Betriebspraktika, Arbeitsgemeinschaften, Kurse etc.) mit ein. [Our school involves extracurricular partners in the design of its instructional offers (internships, working groups, courses, etc.).]
School-parent partnership		
Parental engagement	6	Eltern unterstützen die Schule. [Parents support our school.]
Time spent for parental work	1	Teachers rated the time spent for parental work
Quality of teacher-parent relationship	1	Teachers rated the quality of the teacher-parent relationship

Table 2 Descriptive statistics and reliability of the study measures

Construct	Abbr.	Mean	SD	Alpha
Compensatory measures	COM	0.577	0.308	0.513
Social composition of a school	SCS	4.345	0.930	0.750
School climate				
Inclusion at our school	INS	3.423	0.776	0.819
School as a living space	SLS	3.686	0.812	0.701
Staff capabilities at the school				
Teacher shortage	TSH	2.987	1.280	–
Teacher stress	TST	2.892	0.915	0.812
Affective commitment	AFC	3.471	0.579	0.865
Collective teacher efficacy	CTE	3.798	0.832	0.913
Coherent leadership team	CLT	3.751	0.969	0.945
Cooperation				
Teacher cooperation	TCO	3.676	0.871	0.804
Multi-professional teams	MPT	3.556	1.262	–
Cooperation with external partners	CEP	4.172	0.716	0.617
School-parent partnership				
Parental engagement	PEN	3.421	0.620	0.795
Time spent for parental work	TSP	4.031	1.031	–
Quality of teacher-parent relationship	QPR	3.647	0.952	–

The references of the scales assessing the constructs are provided in the online supplementary material

Table 3 Latent regression coefficients predicting compensatory measures (Hypothesis 1)

Predictor	Dependent Variable	Teacher-level analysis				School-level analysis			
		Est.	S.E.	Est./S.E.	*p*	Est.	S.E.	Est./S.E.	*p*
SCS	COM	0.009	0.061	0.153	0.879	0.222	0.121	1844	0.065
INS	COM	0.581	0.102	5701	0.000	0.245	0.148	1659	0.097
SLS	COM	–0.047	0.108	–0.440	0.660	0.053	0.095	0.557	0.577
TSH	COM	–0.050	0.065	–0.767	0.443	–0.214	0.132	–1622	0.105
TST	COM	0.120	0.064	1880	0.060	–0.010	0.164	–0.060	0.952
AFC	COM	–0.027	0.123	–0.217	0.829	–0.245	0.170	–1444	0.149
CTE	COM	–0.082	0.106	–0.772	0.440	0.099	0.190	0.523	0.601
CLT	COM	–0.037	0.100	–0.366	0.714	0.160	0.159	1001	0.317
TCO	COM	–0.020	0.090	–0.228	0.819	0.133	0.159	0.839	0.402
MPT	COM	0.018	0.056	0.325	0.745	0.036	0.119	0.303	0.762
CEP	COM	0.224	0.148	1512	0.131	0.066	0.141	0.470	0.638
PEN	COM	0.004	0.121	0.031	0.975	–0.148	0.171	–0.861	0.389
TSP	COM	0.071	0.056	1277	0.202	–0.033	0.134	–0.243	0.808
QPR	COM	0.058	0.057	1025	0.305	0.386	0.148	2613	0.009

See Table 2 for the abbreviations of the variable names
Est. Estimate, *S.E.* Standard Error, *p* p value

Table 4 Indirect effects predicting compensatory measures via culture of inclusion (Hypothesis 2—a and b paths)

Predictor	Dependent Variable	Teacher-level analysis				School-level analysis			
		Est.	S.E.	Est./S.E.	*p*	Est.	S.E.	Est./S.E.	*p*
INS	COM	0.574	0.059	9.658	0.000	0.279	0.117	2.393	0.017
SCS	INS	–0.013	0.032	–0.398	0.691	–0.052	0.099	–0.522	0.602
SLS	INS	0.001	0.068	0.020	0.984	–0.272	0.097	–2.799	0.005
TSH	INS	0.034	0.049	0.689	0.491	0.314	0.106	2.966	0.003
TST	INS	–0.119	0.043	–2.777	0.005	–0.188	0.085	–2.204	0.028
AFC	INS	0.120	0.067	1.789	0.074	0.029	0.128	0.223	0.824
CTE	INS	0.134	0.059	2.265	0.024	0.446	0.105	4.261	0.000
CLT	INS	0.051	0.071	0.716	0.474	–0.106	0.112	–0.943	0.346
TCO	INS	0.354	0.058	6.113	0.000	0.247	0.108	2.286	0.022
MPT	INS	0.106	0.048	2.228	0.026	0.005	0.117	0.045	0.964
CEP	INS	0.027	0.094	0.292	0.770	0.058	0.106	0.549	0.583
PEN	INS	0.066	0.084	0.792	0.428	–0.027	0.139	–0.192	0.848
TSP	INS	0.174	0.046	3.810	0.000	0.076	0.104	0.726	0.468
QPR	INS	0.060	0.043	1.386	0.166	0.227	0.113	2.007	0.045

See Table 2 for the abbreviations of the variable names
Est. Estimate, *S.E.* Standard Error, *p* p value

teacher level (std. Beta = 0.581, $p < 0.001$) and at the school level (std. Beta = 0.279, $p = 0.017$). Regarding the determinants of culture of inclusion itself, the findings reveal both common and different predictors at both levels of analysis. While teacher stress (TST: std. Beta = –0.119/–0.188[1], $p = 0.005/0.028$), collective teacher efficacy (CTE: std. Beta = 0.134/0.446, $p = 0.024/0.001$), and teacher cooperation (TCO: std. Beta = 0.345/0.247, $p = 0.001/0.022$) proved to be predictive at both levels, affective commitment (AFC: std. Beta = 0.120, $p = 0.074$), parental work (std. Beta = 0.174, $p < 0.001$), and multi-professional teams (MPT: std. Beta = 0.106, $p = 0.026$) were found to be significant only in the teacher-level analysis. Moreover, school as a living space (SLS: std. Beta = –0.272, $p = 0.005$), teacher shortage (TSH: std. Beta = 0.314, $p = 0.003$), and quality of teacher-parent relations (QPR: std. Beta = 0.227, $p = 0.045$) were significant only in the school-level analysis. Given the significant relationships (a) between predictors and culture of inclusion (in mediation analyses termed "a-path") and (b) between culture of inclusion and compensatory measures (in mediation analyses termed "b-path"), indirect effects of the predictors via culture of inclusion on compensatory measures at the school site were expected. Indeed, several indirect effects could be observed (see Table 5). The teacher-level analysis revealed a negative indirect effect of teacher stress (std. $\text{Beta}_{\text{indirect}} = -0.071$, [–0.134, –0.022]) and positive indirect effects of teacher cooperation and parental work (std. $\text{Beta}_{\text{indirect}} = 0.219$, [0.145, 0.316]; std. $\text{Beta}_{\text{indirect}} = 0.097$, [0.031, 0.196]). In contrast to the findings at the teacher-level analysis, the school-level analysis revealed positive indirect effects for collective teacher efficacy and staff resources

[1] Numbers in front of the slash refer to the teacher-level analysis, numbers after the slash to the school-level analysis.

Table 5 Indirect effects predicting compensatory measures via culture of inclusion (Hypothesis 2—a * b paths)

Predictor	Mediator	Dependent Variable	Teacher-level analysis			School-level analysis			
			Est.	Lower 95%-CI	Upper 95%-CI	Est.	S.E.	Est./S.E.	*p*
SCS	INS	COM	–0.006	–0.055	0.041	–0.014	0.028	–0.514	0.607
SLS	INS	COM	–0.004	–0.109	0.094	–0.076	0.039	–1.926	0.054
TSH	INS	COM	0.023	–0.045	0.100	0.088	0.035	2.509	0.012
TST	INS	COM	–0.071	–0.134	–0.022	–0.052	0.031	–1.690	0.091
AFC	INS	COM	0.078	–0.006	0.174	0.008	0.035	0.225	0.822
CTE	INS	COM	0.078	–0.009	0.162	0.125	0.059	2.115	0.034
CLT	INS	COM	0.025	–0.062	0.135	–0.030	0.032	–0.912	0.362
TCO	INS	COM	0.219	0.145	0.316	0.069	0.043	1.620	0.105
MPT	INS	COM	0.057	–0.032	0.146	0.001	0.033	0.044	0.965
CEP	INS	COM	0.023	–0.142	0.161	0.016	0.031	0.531	0.595
PEN	INS	COM	0.010	–0.096	0.162	–0.007	0.039	–0.190	0.850
TSP	INS	COM	0.097	0.031	0.196	0.021	0.031	0.683	0.494
QPR	INS	COM	0.043	–0.027	0.136	0.063	0.044	1.427	0.154

See Table 2 for the abbreviations of the variable names
Est. Estimate, *S.E.* Standard Error, *p* p value, *CI* Confidence interval

(std. $\text{Beta}_{\text{indirect}} = 0.125$, $p = 0.034$; std. $\text{Beta}_{\text{indirect}} = 0.088$, $p = 0.012$) and a negative indirect effect for school as a living space (std. $\text{Beta}_{\text{indirect}} = -0.076$, $p = 0.054$), which is at the borderline of statistical significance. The effects of teacher stress and teacher cooperation are still statistically significant at the 10%-alpha error level (std. $\text{Beta}_{\text{indirect}} = -0.052$, $p = 0.091$; std. $\text{Beta}_{\text{indirect}} = 0.069$, $p = 0.105$), confirming the findings from the teacher-level analysis.

6 Discussion

6.1 Embedding the findings to existing research

6.1.1 Scientific and practical significance of the present study

The present study aimed to contribute to filling the research gap regarding empirical studies on compensatory measures implemented by schools to tackle students' learning losses caused by COVID-19-related school closures and distance learning. In doing so, we sought to expand research on education during and after COVID-19. In particular, our quantitative study on predictors of compensatory measures at the school site complements studies that investigate COVID-19-related compensatory measures based on document analyses and qualitative interviews (e.g., Helbig et al. 2022) and studies that focus on how these measures help to lift students' learning outcomes again (Asakawa and Othake 2021; Pan and Sass 2020; and Sailer et al., Groß-Ophoff et al., and Lenz et al. in this issue). Thus, the findings of our

study—in combination with existing research—inform practitioners such as school administrators and teachers, as well as education policy makers and administrators, about whether and which features of schools are particularly relevant for the implementation of measures aimed at helping students catch up on their learning. The findings provided represent a valuable basis for related school development projects and measures.

6.1.2 Discussion of findings

We collected data from 104 schools and 1648 teachers to test the predictive power of a variety of school characteristics for the offer of compensatory measures at the individual school. The predictors were selected based on the work of Helbig et al. (2022). However, the data confirmed our assumptions only to a limited extent. That is, mainly the culture of inclusion and the teacher-parent relation at the school proved predictive, confirming Helbig et al.'s (2022) statement that compensatory measures are most likely to succeed in schools that already have structures into which new measures can be integrated. Furthermore, these findings are also in line with research beyond COVID-19. The observed positive effect of the inclusive school culture is in line with quantitative studies showing that a positive school culture (including a focus on student-centered teaching) is a characteristic of schools that show positive development, for instance in student achievement (Lee and Louis 2019). Moreover, positive school culture is also associated with organizational learning among teachers (Seashore Louis and Lee 2016), which can be considered a favorable condition for school development. Regarding the observed effect of teacher-parent relation, studies further show that a stronger school-based parental involvement is associated with a more positive school climate (e.g., Park et al. 2017) and contributes to school effectiveness (Täschner et al. 2021). In general, school-parent cooperation is regarded a central dimension of school quality (Ditton 2000). Individual schools can significantly increase parental engagement and accessibility by creating opportunities for participation, providing transparent information and communication with parents, and through an empathetic approach to addressing parents' fears and concerns (Paseka 2014). This is particularly relevant during the pandemic (Killus and Paseka 2021).

In contrast to the positive effects of school culture and teacher-parent cooperation, no direct correlations were observed between the remaining predictors (i.e., social composition, staff shortage, teacher stress, commitment, collective teacher efficacy, cooperation, coherent leadership team, parent work, multi-professional teams, external cooperation, and school as a living space) and the extent of compensatory measures at a school. Rather, teacher stress, commitment, collective teacher efficacy, cooperation, parent work, teacher resources, and school climate proved to be indirectly predictive, via the culture of inclusion. Possible reasons for the missing direct link between the assumed predictors and the compensatory measures may be found in the limitations of the present study.

6.2 Limitations

6.2.1 Theoretical approach

We based our present study on a very in-depth study by Helbig et al. (2022) documenting the implementation of Germans' comprehensive catch up program that was launched in response to the negative impact that the COVID-19 pandemic had on students. Based on qualitative data, Helbig et al. (2022) suspected certain conditions to be conducive/obstructive to the implementation of the program in the German federal states. In our study, we tried to put these assumptions to an empirical test. It is important to note, however, that the compensation measures analyzed in our study were not collected with a focus on the German catch up program, but rather measures that the research team found to be significant in supporting "left-behind" students independent of the catch up program. A more tailored assessment of the catch up program would possibly yield different findings.

Moreover, from a theoretical point of view, we focused on school aspects that are regarded as conducive or obstructive (such as existing structures, staff shortage) and thus followed an approach that is anchored in school effectiveness research. Other obvious theoretical approaches are provided, for example, by motivational psychology. Thus, the question of the implementation of compensation measures could also have been addressed against the background of expectancy-value theory (Wigfield and Eccles 2000). Since compensation measures always represent individual decisions (e.g., of the school leader), we could also have analyzed individual expectations and values regarding the feasibility and importance of compensation measures at the school site.

6.2.2 Methodological approach

Firstly, although the predictors were assessed prior to the dependent variable, no causal statements can be made as our study design is not experimental and thus does not account for possible confounding variables that could provide alternative explanations of our findings. Secondly, regarding the generalizability of our findings, we must admit that we do not know to what extent our sample investigated is representative of the teacher population in NRW. For instance, we lack detailed information on the social compositions of the schools. Future studies should be grounded on representative data. Thirdly, since our analyses are based on data from only one source, i.e., teachers, we cannot rule out that observed associations also represent, at least in part, a methodological artifact (e.g., common method bias, Podsakoff et al. 2003). Thus, future studies should make use of different informants, for instance, teachers and school leaders.

6.3 Implications for educational policy and practice

We initiated our study with the unfortunate circumstance that there is scarce empirically supported knowledge about the predictors of compensatory measures offered at the school site. However, this is necessary for evidence-based decision-making

by education policy makers, administrators, and practitioners, especially to prevent future crises. Our study served this goal by providing rich findings accordingly. Our study emphasizes the significant role of established structures, i.e., a long-standing practice of inclusion and school-parent partnership at the school site, for the implementation of compensatory measures. This raises the question, what can teachers, school leaders and education policy/administration do to establish or foster such a culture? Our study points to several supportive measures:

Support of the schools' social capabilities Results from our study most centrally, points to the fact that individual schools need seek to strengthen their social capabilities. That is, school leaders should support teacher cooperation. Notably, school leaders guide their staff, it has been shown that they have a strong influence on whether or not cooperative structures are established among teaching staff which in turn are favorable for inclusive education at the school site (e.g., Warwas et al. 2019; Preis and Wissinger 2021).

Preventing teacher stress Next to teacher cooperation, teacher stress is predictive of the degree of inclusion at school. Since teachers in particular complain about high workloads and time pressure, it is necessary for school administrations, educational policy makers, and administrators to, on the one hand, reduce the task spectrum of teachers to the core task of teaching and school development (e.g., by providing additional personnel for administrative tasks) and, on the other hand, to create support measures for coping with challenging tasks (e.g., installing multi-professional teams, clear work structures and instructions).

Fostering collective teacher efficacy These actions may also be beneficial for CTE (another predictor of inclusion at school). Literature (e.g., Fancera and Bliss 2011) suggests that school leaders can foster CTE by providing teachers with mastery experiences, such as celebrating the school's performance on various outcome measures and encouraging them to pursue advanced degrees. School leaders can also arrange for teachers to observe successful instructional practices implemented in classrooms of high achieving students. Moreover, modeling exemplary classroom instruction, communicating the school's goals, increasing the availability of professional development opportunities, providing constructive feedback, monitoring student progress, and maintaining high visibility in the school are examples of leadership tasks that principals can use as forms of verbal persuasion to improve individual teacher efficacy and CTE.

Establishing school-parent partnerships As our study highlights the importance of the school-parent partnership, corresponding measures that help to establish and foster contact with students' parents are needed. In this sense, schools should consider the following quality criteria for home-school cooperation established by the National Parent Teacher Association (PTA 2008): (1) welcoming all families into the school community, (2) diverse and respectful communication, (3) educational cooperation, and (4) creating possibilities for parents to participate.

Tackling teacher shortages Finally, staff shortage is predictive for the degree of inclusion at the school. In a time where all industries, not only the education sector, are affected by a shortage of skilled labor, good advice is expensive. Monocausal solutions are unlikely to be successful in the competition for skilled professionals. Rather, a diverse package of measures is needed, as exemplified by Huber et al. (2023). In addition to increasing the attractiveness of the teaching profession through higher salaries, innovative approaches such as flex-time accounts are also discussed.

Moreover, the relevant literature (e.g., Feyerer 2021) contains many additional indications and recommendations for teachers, school administrators, and educational policy makers based on the findings of numerous quantitative and qualitative studies (not least from the German-speaking educational space) towards establishing inclusive school development that—as this study has shown—provides a conducive framework for offering compensatory measures during times of crisis.

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