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Schools' improvement capacity and responses to the COVID-19 pandemic: Evidence from schools serving disadvantaged communities

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The goal of this paper is to analyze the relationship between six different dimensions of school improvement capacity (*SIC*) and schools' efforts to sustain teaching and learning as well as student well-being during the first lockdown in the context of the COVID-19 pandemic. Based on data from 13 qualitative interviews with principals and data from a standardized teacher survey at schools serving disadvantaged communities in North Rhine-Westphalia, Germany ($N=385$ teachers), we assessed (1) the schools' level of *SIC* shortly before the lockdown, (2) their reported response to the lockdown with regard to sustaining student learning and well-being, and (3) similarities between the schools in terms of the combination of the level of *SIC* and the reported effort to address the challenges of distance learning. Our results suggest that two major groups of schools can be distinguished in terms of level of *SIC*. Furthermore, we identified a range of thematic clusters related to how schools acted during distance learning, each of which can be assigned to one or more dimensions of *SIC*. Finally, we identified four patterns, referring to different combinations of *SIC* and the schools' reported actions. The results indicate that schools with a higher initial *SIC* were more able to find flexible and pragmatic solutions in order to sustain student learning and well-being during distance learning. Our findings stress the importance of school improvement activities at schools serving disadvantaged communities in dealing with sudden challenges for teaching and learning, such as those encountered during COVID-19.

KEYWORDS

school improvement, capacity building, COVID-19, organizational theory, schools serving disadvantaged communities, mixed methods

Introduction

The global outbreak of COVID-19 in 2020 has led governments around the world to enact measures in many areas of societal life aimed at containing the virus. In the wake of these measures, around 95% of the world's student population were affected by school closures (United Nations, 2020). In Germany, the majority of schools had to abruptly change from face-to-face teaching in schools to distance learning for the first time between March and April 2020. Because in Germany, the 16 state governments have sovereignty over primary and secondary education, and municipalities are responsible for the tangible equipment of schools, the regulations and overall conditions for distance learning across the country varied substantially: in some areas school buildings were completely closed, while in others, a small number of students were allowed to attend school under specific circumstances (e.g., emergency care and in-school instruction for children whose parents worked in "system-relevant" jobs). This first phase of distance learning in spring was followed by a series of further temporary school closures, as well as by phases of hybrid models in which students were divided into groups that were taught in rhythmic alternation of face-to-face and distance learning.

Bremm and Racherbäumer (2020) note that a major focus of the discussion around the consequences of COVID-19 in Germany has thus far revolved around a perceived lack in resources for distance learning of families and schools in marginalized contexts (van Ackeren et al., 2020; Middendorf, 2021). In contrast, there has hardly been any discussion around the macro structures of the system, as well as the organizational practices of schools as potential influencing factors of student learning and well-being under school closures (e.g., Klein, 2022). As a consequence, we know little about how processes and practices within schools, or their *school improvement capacity* (SIC), have shaped their responses to the sudden challenges for teaching and learning induced by the pandemic.

While numerous empirical studies from the Anglo-American context have repeatedly pointed to the importance of school capacity building for organizational learning (e.g., Seashore Louis and Lee, 2016), scant knowledge exists for the German-speaking context as to whether similar effects are at work. In particular, there has been very little research in Germany on how organizational practices of schools affected their ability to respond to crises.

The goal of the paper therefore is to analyze the relationship between different dimensions of SIC (shared commitment and collaborative activity, skills and knowledge, leadership, feedback and accountability, participative decision making grounded in teacher empowerment) and the way schools have responded to the challenges of distance learning in the context of COVID-19 with regards to providing instruction and sustaining student learning and well-being. Combining qualitative and quantitative data from schools serving disadvantaged communities (SSDC) in one German state, we aim to (1) assess the schools' level of SIC shortly

before school closures, (2) analyze how and to what extent schools managed the transition to distance learning and sought ways to meet their students' needs, and (3) identify overarching patterns of response across the schools in relation to their SIC.

Theoretical and empirical background

School improvement capacity at schools serving disadvantaged communities

From an organizational theory perspective, schools can be seen as organizations, which means that their members perform tasks in a division of labor to pursue or fulfill a common purpose (Fuchs, 2004). Depending on the general conditions of the individual school, the goals and actions of the school actors may vary and lead to different school-specific organizational cultures (Schönig, 2002; Maag Merki, 2017). Consequently, the organization is not to be understood as a static entity, but is in a constant state of change depending on its members and conditions. For schools to form *learning communities* that are self-reflective and develop collectively, they require certain capacities (Argyris and Schön, 2018). In the past decades, research in the field of school effectiveness and improvement has highlighted various factors characterizing "effective" or "learning" SSDCs in the anglophone context (Muijs et al., 2004; Rutledge et al., 2015). From a theoretical perspective, such factors are presumed to enhance SIC (Maag Merki, 2017), which can be understood as "the capacity of a school to build internal school processes and structures in a targeted and systematic way so that school processes and the quality of teaching and student learning are sustainably improved (translated)" (Maag Merki, 2017, p. 269).

There are several theoretical approaches and models that define and measure school-wide capacity building. All of these explicitly or implicitly take the individual school as the frame of reference and presuppose that schools have a certain degree of autonomy (Feldhoff, 2011). One often cited and empirically validated model was developed by Marks et al. (2000). Referring to a school's "capacity for organizational learning," which can be understood as a collective process and means of increasing the problem-solving capacity with the goal to adapt and improve constantly (Marks and Louis, 1999; Maag Merki, 2017), the model consists of six dimensions: (1) school structure, (2) shared commitment and collaborative activity, (3) knowledge and skills, (4) leadership, (5) feedback and accountability, and (6) participative decision making grounded in teacher empowerment.

In Table 1 the six dimensions of SIC as described by Marks and Louis (1999) and Marks et al. (2000) are briefly outlined. In addition, Table 1 presents empirical findings from the German-speaking context related to the importance of each of the individual dimensions for school improvement in general and for organizational learning in particular.

TABLE 1 Overview of the six dimensions of *SIC* and empirical findings from Germany.

Dimension	Description	Research findings from Germany
School structure	Time, space, and personnel structures to enable learning communities (Feldhoff, 2011, p. 246f.) and work toward a professional culture of continuous reflection and exchange	Institutionalized structures for collaboration can increase teacher collaboration and instructional development (Holtappels, 2002, 2019; Harazd and Drossel, 2011) School improvement committees enhance self-regulation and willingness to innovate / participation of teachers (Feldhoff, 2011)
Shared commitment and collaborative activity	Common goals and values among staff promoting school-wide collaboration (Feldhoff, 2011, p. 115) and generating organizational knowledge through the social processing of information	Professional teamwork among teachers is not significantly related to <i>SIC</i> when considered together with other school organizational characteristics, but teacher commitment and co-constructive collaboration are associated with <i>SIC</i> when considered together with variables related to the working culture of schools (Holtappels and Brücher, 2021) Cooperation among staff is positively associated with change of routines and instructional processes (Feldhoff, 2011) Teacher collaboration enhances student performance, job satisfaction (media-related) school improvement, and willingness to innovate (Gräsel et al., 2006a,b; Drossel and Eickelmann, 2020)
Knowledge and skills	Utilization of internal and external knowledge, encouraging open discussion throughout the organization (Marks and Louis, 1999; Starbuck, 1999) and further development of knowledge as well as the permeability of knowledge (Feldhoff, 2011, p. 120f., 133)	Willingness to innovate promotes change and determines instructional quality (Holtappels and Voss, 2008; Holtappels, 2013) and enhances the change of routines and sustainability of projects as well as instructional processes (Feldhoff, 2011)
Leadership	Decentralized, facilitative leadership exercised at all levels of the organization (Marks and Louis, 1999, p. 714) to increase affective commitment to the school and its goals through the articulation and pursuit of organizational goals and visions (Leithwood et al., 1999, 2006; Klein, 2018)	Effective leadership enhances teachers' willingness to innovate (Feldhoff, 2011), teachers' affective commitment (Harazd and Ophuysen, 2011), teacher collaboration (Harazd and Drossel, 2011), instructional practices of teachers (Pietsch and Tulowitzki, 2017; Holtappels and Brücher, 2021), teachers' data use (Ercan et al., 2021) and the self-regulatory activity of schools (Feldhoff, 2011)
Feedback and accountability	Regular use of data from various information sources (Feldhoff, 2011, p. 135) to monitor and develop student learning based on locally meaningful standards (Marks and Louis, 1999, p. 715)	Teachers and schools only use little data for school improvement, and prefer internal data sources (Demski and Racherbäumer, 2017; Wenger et al., 2018) Perceived relevance and use of external data for school improvement varies (Ramsteck and Maier, 2015; Pietsch et al., 2016; Wurster and Richter, 2016; Behnke and Steins, 2017)
Participative decision making grounded in teacher empowerment	Involving teachers in key decisions and supporting their tasks and learning in and for the school to promote the school's problem-solving capacity and increase teachers' willingness to participate in school improvement activities (Leithwood et al., 1998)	Teacher participation enhances school's self-regulatory activity (Feldhoff, 2011) Effective SSDC apply participative leadership practices (Racherbäumer et al., 2013)

To sum up, schools as learning organizations have structures and routines enabling the educators to collaboratively and continuously learn at all levels (Silins et al., 2002). In their empirical study, Marks et al. (2000) found a statistically significant association between the schools' capacity for organizational learning, and instructional quality as well as student performance, controlling for a set of demographic and socio-economic variables. One attempt to adapt the model to the German context was provided by Feldhoff (2011). His research showed that (goal-oriented) leadership was associated with changed organizational routines as part of a school's self-regulation ability, which was mediated by both collaboration among staff, and teachers' willingness to innovate. Moreover, whether school projects were incorporated in the schools' routines and thus made sustainable was affected by the existence of participatory school improvement

committees. In addition, the perceived leadership skills of the principal were related to the structuredness and comprehensibility of instruction *via* teachers' willingness to innovate.

Building a school-wide *SIC* seems particularly relevant for SSDCs (Holtappels et al., 2017). In Germany, these schools are usually defined by being located in areas characterized by an above-average unemployment rate, an above-average proportion of social welfare recipients, and low educational qualifications and low social mobility among residents (Friedrichs and Triemer, 2008; Bremm et al., 2016). International research has demonstrated that socioeconomically disadvantaged communities are more adversely affected by crises not only because of fewer resources of residents, but also because of the quality of schooling provided to these communities, and the measures taken by schools to handle crises (Vasudevan and Campano, 2009; Barrett et al., 2012).

Compared to schools in more privileged locations, SSDCs in Germany tend to have a less favorable technical infrastructure (OECD, 2020), and research has identified a particularly large gap in digital competencies between socio-economically privileged and disadvantaged students in Germany (Senkbeil et al., 2019). Furthermore, students from disadvantaged communities tend on average to exhibit more difficulties in self-management and a lower level of metacognitive skills enabling them to learn independently and in open learning settings (Artelt et al., 2010; Bremm and Racherbäumer, 2020). These factors may constitute particular challenges for SSDCs in their response to distance learning, and in meeting educational standards as well as students' needs. Due to lower technological equipment as well as both actual and perceived deficits of students in terms of their digital skills and ability to learn independently, teachers at SSDC may be less able or even less inclined to use digital technologies and virtual formats during distance learning (Bremm, 2021). This may, in turn, lead to difficulties in staying in contact with the students in order to maintain educational standards and to address their emotional and learning needs. At the same time, the actual or perceived difficulties students face in their home environments during COVID-19 may lead to a lowering of educational standards at SSDC during distance learning (Bremm, 2021).

Connecting *SIC* and responses to the COVID-19 pandemic

The theoretical and empirical findings outlined above suggest that during crises, schools with a high *SIC* will not only be able to further develop existing strategies, methods, and approaches, but to also analyze the school's overall goals and, if necessary, adapt them to the new challenges (Maag Merki, 2017; Askeil-Williams and Koh, 2020). Prior research has demonstrated that internal conditions are relevant for a school's ability to attend to the well-being of students and enhance educational equity during and after crisis. For example, in the United States, Barrett et al. (2012) followed up on students who had been forced to relocate after Hurricane Katrina and found that whether schools had created a milieu of collaboration and taken proactive steps to make sure the students' needs were addressed had a substantial effect on the students' well-being. Their findings showed furthermore that school leadership that promoted collaboration and consensus was related to the reduction of distress as well as the academic performance of Katrina-evacuated students.

SIC may also be important for managing shocking events, such as the sudden school closures during COVID-19. Ensuring learning and well-being for all students was one of the main challenges for schools around the globe during COVID-19. This is particularly true for SSDCs, because in these, the challenges posed by the external (and often internal) conditions of the schools tend to be perceived as higher than in other schools (e.g., Klein, 2016) even without the additional challenges of the pandemic.

However, the extent to which the discontinuation of face-to-face learning has affected and will continue to affect specifically students from disadvantaged communities is likely to depend on how distance learning was implemented in the schools (Andrew et al., 2020). In the context of COVID-19, evidence suggests that students were affected by the pandemic in heterogeneous ways. In a study from the United Kingdom, for instance, Andrew et al. (2020) demonstrated that differences in the learning time of secondary school students from more disadvantaged and more privileged families could be ascribed to individual and family resources *as well as* school practices. The authors showed that although differences in the total learning time did not increase during school closures, students from less affluent families had less access to active school support for distance learning, such as online classes, online video conferencing, and online chat. Variation in the provision of support accounted for one fifth of the gap in class learning time between the most and least affluent students. These results suggest that school support structures may constitute an important driver of inequalities in learning during school closures (Andrew et al., 2020).

Recent evidence from the German-speaking context suggests that especially SSDCs appeared to have difficulties in maintaining educational standards and providing opportunities for academic learning. In a study from Switzerland, Bremm (2021) showed that SSDCs deliberately lowered standards while increasing their concern for students' emotional well-being. In Austria, Jesacher-Rößler and Klein (2020) found that principals at SSDCs perceived distance learning as less positive. Although they emphasized the goal of securing academic standards, they also stated to a much greater extent than other schools that they had lowered academic requirements during distance learning. Furthermore, the results suggest that organizational capacities of the schools (such as collaboration between staff members, a systematic procedure for distance learning, and professional development) affected how well schools adapted to the challenges of distance learning.

Research questions

Based on the assumption that how schools responded to the challenges of the pandemic was contingent on their prior *SIC*, the goal of the paper is to analyze the relationship between six different dimensions of *SIC* at SSDCs, and the schools' efforts to sustain instruction and learning during the first phase of distance learning in the context of COVID-19. Drawing on the theoretical perspective of organizational learning as well as on prior evidence concerning the relationship between dimensions of *SIC* and schools' responses to crisis, we addressed the following research questions:

1. How did educators at SSDCs evaluate their schools' *SIC* shortly before the beginning of distance learning in the context of COVID-19?

2. What measures did schools develop to implement distance learning and ensure student learning and well-being during the initial phase of COVID-19?
3. Are there systematic patterns in the relationship between schools' initial level of *SIC* and their reported response to the first school closures?

Answering these research questions will allow us to assess the potential relevance of *SIC* in responding to crisis at SSDCs.

Study design

Project context

The data was obtained from a mixed-methods study designed to evaluate the model project “Talent Schools” in North Rhine-Westphalia, Germany. The model project was initiated by the States' Ministry for School and Education and aims at supporting a total of 60 SSDCs (15 vocational schools and 45 general education schools) through the provision of additional resources and the implementation of instructional concepts and strategies designed to enhance students' academic performance, as well as their linguistic and social competence. Each school had to apply for the project with a letter of intent declaring the school's willingness for school improvement and the envisaged activities. All types of secondary schools (*Hauptschule*, *Realschule*, *Sekundarschule*, *Gymnasium*, *Gesamtschule*) as well as vocational schools could apply. Only schools that were confronted with specific challenges due to their geographic location and a correspondingly diverse student body were chosen for the model project by a jury of experts, whereby the selection criteria were not made public. The schools received additional resources for personnel, professional development (PD), and mandatory school improvement consulting. In this context, the participating schools were obliged to develop or expand on a specific profile (STEM or cultural education). The evaluation of the model project was carried out through the University of Duisburg-Essen and the University of Siegen, and comprised the monitoring of the school improvement processes as well as the continuous feeding back of findings to the schools. Apart from this data feedback, the researchers were not involved in any school improvement activities. The 60 schools started in two cohorts on a staggered basis, the first in the 2019/2020 school year ($n = 35$) and the second in the 2020/2021 school year ($n = 25$).

Data source

To answer our research questions, we used a mixed methods approach combining quantitative and qualitative data (see [Creswell and Plano Clark, 2018](#), for a comparable research design, see [Duff, 2021](#)).

Qualitative data source

To explore how schools responded to the school closures, the research team conducted 15 semi-structured interviews with the principals or leadership teams at selected schools in the first cohort of schools ($n = 35$). We selected our subsample of schools based on several criteria that ensured that the heterogeneity of the participating schools was reflected as closely as possible [school type, governmental district, chosen profile (STEM or cultural education)]. The interviews were conducted using a protocol that included questions about the general project context and challenges as well as strategies in dealing with COVID-19. As a first step, we scanned the transcribed interview material for central statements related to the schools' responses to COVID-19. The aim was to work out which topics and sub-topics were addressed in the interviews. Since not all interviewees sufficiently addressed their specific reactions the first school closures, we selected a subsample of 13 interviews in a second step which delivered information about how schools initially responded to the school closures. Orientation for this selection was the thematic relevance of a passage with regard to the research question. More specifically, we selected interviews with passages that included statements about how remote instruction was implemented in the schools and how student learning and well-being was ensured during the first school closures.

Quantitative data source

To analyze the *SIC* in the schools prior to the lockdown, we use data from a standardized online survey carried out in the same cohort of schools (29 general and 6 vocational secondary schools) between February and April 2020. All teachers and other pedagogical staff of these schools were invited to participate in the survey. Participation in the survey was voluntary and the survey was completed individually within a time frame of 9 weeks. Although the survey was timed to coincide with the beginning of the COVID-19 pandemic, the majority of respondents finished the survey before the first school closures. A total of $N = 912$ teachers and other pedagogical staff from all 35 schools participated in the survey (overall response rate: 27.1%).

To reduce the quantitative sample to teachers and other pedagogical staff from the schools of our qualitative study, we deleted all cases that did not belong to either of these 13 selected schools. The final sample thus consisted of $N = 385$ respondents. The following information refers only to this subsample, which consisted of 11 general education and one vocational school(s). All schools can be classified as belonging to a similar type of location characterized, among others, by an above-average proportion of welfare recipients, an above-average unemployment rate, low educational qualifications, and low social mobility among residents in the neighborhood ([Friedrichs and Triemer, 2008](#), 9–15). Responses from the school leader survey showed that the 13 schools widely differed in their percentage of students exempted from co-paying their learning materials (from “1%–5%” to “91%–100%”), the number of German language learners (from “zero” to “41%–50%”), and the percentage of

students who left school without graduating in the 2018/2019 school year (from “zero” to “11%–20%”). The mean staff size was 91.1 ($SD=44.1$, min: 30, max: 190), and 93.6% of the respondents were teachers ($N=352$), while 6.4 percent were other educators ($N=24$). A total of 65.4% of the respondents were female. On average, the respondents had been employed in teaching for 13.1 years ($SD=8.9$), and worked at the particular school for 8.4 years ($SD=6.9$). These percentages roughly correspond to those of the project’s schools as a whole, where 93.1% were teachers ($N=831$) and 6.9% were other educators ($N=62$). In the full sample of SSDC, the respondents had been employed in teaching for 13.6 years ($SD=9.3$), and worked at the particular school for 8.9 years on average ($SD=7.5$). In the whole sample, 66.2% were female and 33.4 were male.

Materials and methods

Quantitative data

In order to first capture the *SIC* of the 13 schools, we asked teachers to assess their schools’ improvement capacity as illustrated in [Table 2](#). It has to be noted that in our teacher survey, we did not assess items referring to the first dimension of school structure. Items relating to the time, space, and personnel structures conducive to a professional culture of continuous reflection and exchange were only assessed in the parallelly conducted school leader survey (e.g., who was the impetus at your school to apply to participate in the project? Which groups of people were involved in creating your school’s concept and to what extent? What percentage of the educational staff at your school is actively involved in the model project?) However, these data are based on the responses of only one or two individuals. For reasons of methodological consistency, we did not aggregate these data at the school level and include them in the *SIC* index. Consequently, we cannot present any empirical data on the first *SIC*-dimension.

In a first step, we carried out descriptive statistical analyses using SPSS version 27. In doing so, we constructed several multiple-item mean scales from the variables belonging to one *SIC* dimension, whereby all items that built one dimension were from the same item sets and therefore identical in metric. Only cases with a minimum number of two valid responses to items that are part of one scale were included. For each scale, we then calculated school-level aggregated means based on the individual teacher ratings, so that all respondents belonging to the same school had identical values on the different *SIC* dimensions.

In a second step, we constructed an overall index of *SIC* for each school. In forming the index, the six composites were first standardized ($M=0$, $SD=1$) to achieve consistency in the response scales, and then combined to a mean scale. The index thus tapped five of the six constituent dimensions outlined above and showed a very good internal consistency (Cronbach’s $\alpha=0.89$). The results of exploratory factor analyses (EFA) showed that all scales and subscales had a one-dimensional structure, loading on one

common factor. All factor loadings were above 0.60. Based on their value on the standardized *SIC* index, we categorized the 13 schools of our subsample into two different groups: (1) Schools with low *SIC* (values below zero, $N=6$) and (2) schools with high *SIC* (values above zero, $N=7$).

Interviews

In preparation for the analysis, the qualitative interviews were transcribed verbatim ([Dresing and Pehl, 2018](#)). To analyze the qualitative interview data, we used structuring content analysis ([Kuckartz, 2018](#); [Mayring, 2000](#)). The statements from the interviewees served as the unit of analysis. The aim of the qualitative analysis was to reduce and structure the existing material in order to be able to systematically describe the measures taken by the principals and leadership teams. For this purpose, we developed an initial category system and revised it in a deductive-inductive approach in accordance with the research interest, the interview protocol, and the material. Our final category system consisted of two main categories, capturing (1) how distance learning was implemented in the individual schools, and (2) how schools aimed to sustain student learning and well-being under school closures. From these categories, we then formed five different sub-categories based on the interview material (see Results chapter for more details).

Triangulation

Following the systematic description of the reported responses to the pandemic and relating them to the quantitative data on *SIC* outlined above, we conducted a typifying content analysis in a second step. In doing so, we identified and grouped the schools with similar patterns depending on both the type and extent of the described responses. We used the reported type, scope, and number of measures taken by the schools in evaluating and assigning them to clusters that were in themselves as uniform as possible. The clusters were then validated and adapted in discursive exchange within the research team. The theoretical framework of capacity building together with empirical evidence related to the school improvement and effectiveness literature guided this step. It has to be highlighted that the classification of measures does not allow for a clear delimitation, but instead reveals tendencies where members of the same group are as homogeneous as possible. In presenting our results, some quotations from the interview material will serve to better illustrate the reported measures taken as well as our assignment of groups. Other aspects are summarized for reasons of space. All direct quotes are translated from German.

Results

Schools’ initial level of *SIC*

The results from the teacher survey showed a considerable amount of heterogeneity in the reported level of *SIC* prior to the

TABLE 2 Operationalization of *S/C*.

Scale	Subscale	N° items	Example item	Response scale	Reliability	Source
2. Shared commitment and collaborative activity						
Collaboration among staff	Overall scale	15			$\alpha = 0.77$	Fussangel (2008), Pröbstel (2008), modified
	Professional exchange	4	“I share important job-related information with my colleagues.”	1 = never; 4 = very often	$\alpha = 0.76$	
	Student-related exchange	3	“I confer with my colleagues when I have difficulties with individual students.”	1 = never; 4 = very often	$\alpha = 0.80$	
	Joint organization of work	4	“I create worksheets together with my colleagues.”	1 = never; 4 = very often	$\alpha = 0.77$	
	Co-construction and Reflection	4	“In order to receive feedback, I conduct classroom observations with my colleagues.”	1 = never; 4 = very often	$\alpha = 0.62$	
Clarity of goals and consensus		9	“I easily understand our school’s goals.”	1 = do not agree at all; 5 = fully agree	$\alpha = 0.95$	Leithwood et al. (2006), translated
3. Skills and knowledge						
Willingness to innovate		6	“In our school, there is usually a lot of reluctance to change.”	1 = does not apply at all; 5 = applies fully	$\alpha = 0.81$	Quellenberg (2009)
Systematic planning of PD		6	“Our school regularly offers formal opportunities for continuing education and professional development (e.g., in the form of internal school PD).”	1 = do not agree at all; 5 = fully agree	$\alpha = 0.84$	Leithwood et al. (2006), translated
4. Leadership						
Transformational leadership practices	Total leadership scale	4			$\alpha = 0.92$	Klein and Bronnert-Härle (2020) translated and adapted from Leithwood et al. (2006)
	Goal-oriented leadership	7	“Leadership at our school gives us a sense of overall purpose.”	1 = do not agree at all; 5 = fully agree	$\alpha = 0.95$	
	Fostering collaboration	4	“Leadership at our school facilitates effective communication among staff.”	1 = do not agree at all; 5 = fully agree	$\alpha = 0.92$	
	Intellectual stimulation	5	“Leadership at our school encourages me to try new practices consistent with my own interests.”	1 = do not agree at all; 5 = fully agree	$\alpha = 0.92$	
	Providing a safe learning and working environment	4	“Leadership at this school fosters a safe learning environment for all in the school.”	1 = do not agree at all; 5 = fully agree	$\alpha = 0.87$	
5. Feedback and accountability						
Feedback culture	Use of feedback	2	Feedback from collegial observation	1 = not at all; 5 = to a high extent	$r = 0.33$	Demski and Racherbäumer (2017), modified
6. Participative decision making grounded in teacher empowerment						
Fostering shared decision-making		4	“Leadership at this school frequently takes our opinion into account when making decisions.”	1 = do not agree at all; 5 = fully agree	$\alpha = 0.93$	Klein and Bronnert-Härle (2020), translated and adapted from Leithwood et al. (2006)

Item examples are translated versions of the German items; α = Cronbach’s alpha

school closures. Table 3 shows the means and standard deviations for the individual SIC measures as well as for the overall index. The results are provided for the entire sample as well as separately for the two groups of schools, referred to in the following as low and high SIC schools. The group means differed by 2.57 standard deviations for the overall SIC index (95%-CI [-4.07; -1.02]). Independent samples *t*-tests showed that the mean scores for all dimensions except “collaboration among staff” (low capacities: $M=2.62$, $SD=0.19$, high capacities: $M=2.75$, $SD=0.11$, $t(11)=-1.55$, $p=0.150$), “systematic planning of PD” (low capacities: $M=3.27$, $SD=0.35$, “high capacities”: $M=3.61$, $SD=0.21$, $t(11)=-2.20$, $p=0.050$), and “feedback culture” (low capacities: $M=2.84$, $SD=0.23$, high capacities: $M=3.20$, $SD=0.40$, $t(11)=-1.98$, $p=0.074$) differed systematically between the two groups.

Figure 1 illustrates the standardized values for the two SIC groups, both for the overall SIC index and the individual dimensions. The standardized mean value for the SIC index across schools with “low SIC” was -0.82 , compared to 0.70 for schools with “high SIC.” While the schools in the “high SIC” group showed comparably high values on the two dimensions of “clarity of goals and consensus” (0.71) and “leadership” (0.70), the first group fared comparably low with regard to these dimensions.

Further group comparisons revealed that there were no statistically significant differences between “high SIC” and “low SIC” schools in terms of their percentage of students exempted from co-paying their learning materials [“low SIC”: $M=6.17$, $SD=2.79$, “high SIC”: $M=7.14$, $SD=2.91$, $t(11)=-0.61$, $p=0.551$], the number of German language learners [“low SIC”: $M=4.17$, $SD=1.94$, “high SIC”: $M=3.43$, $SD=1.62$, $t(11)=0.75$, $p=0.470$], and the percentage of students who left school without graduating in the 2018/2019 school year [“low SIC”: $M=2.75$, $SD=1.50$, “high SIC”: $M=1.57$, $SD=0.54$, $t(3.4)=1.52$, $p=0.215$].

Responses to school closures

In a second step, we took a closer look at the measures that the schools had developed to implement distance learning and ensure student learning and well-being under school closures. According to the qualitative statements of the school leaders, all schools of our sample provided some form of distance learning arrangement at the beginning of the COVID-19 outbreak. Since preparation time was short and the state government and municipalities largely left it to schools and individual teachers to organize distance learning (Andrew et al., 2020), there was considerable heterogeneity in how schools developed solutions for distance learning. Nevertheless, the measures taken at the 13 schools can be grouped into different thematic fields (see Table 4). Each of these fields can be related to one or more dimensions of SIC, however with some overlaps because the dimensions of SIC were often interdependent. Concerning *organizational structure*, some schools built new structures and routines that facilitated institutionalized collaboration and enabled teachers to participate in decision-making processes, including, for example, the formation of new

project groups or teams related to distance learning and digitalization. The principal of one school emphasized the priority to set up school-wide exchange of information and uniform regulations concerning the structuring of distance learning:

“And we deliberately said, we don’t want to just let distance learning run from the beginning and each teacher does what they [...] want, but we called the subject conferences together and said, “Okay, dear teams, so dear subject teacher teams, agree on what should be accomplished this semester and also what can’t be accomplished this semester. [...] So, we have tried very hard to structure and standardize it here so that we can somehow deal with the situation and our students don’t drift off somewhere, but rather we all pull together as much as possible.” (school D, translated)

The second dimension of *shared commitment and collaborative activity* manifested itself empirically in school-wide consensus concerning offerings designed to ensure student learning and well-being, such as joint efforts to sustain as much of the regular classroom instruction as possible, informally exchanging ideas within grade levels and then sending out materials to students where it was not possible digitally, or setting up individual counseling and support structures by class teachers and social workers for disadvantaged students:

“And we also interviewed or visited some of the students that we didn’t reach at all via home visits as a team with the classroom teachers or the school social workers. We are relatively proud of the fact that during the lockdown we only lost two students completely, only two, with whom we had no contact at all during that time.” (school B, translated).

As for the third dimension of *shared skills and knowledge*, several schools reported to have systematically trained the staff in the use of digital tools shortly before or after the school closures, while others largely left it up to the teachers to generate knowledge and explore new forms of instruction. One school implemented both externally organized PD days and low-threshold PD measures within the school while making active use of the staff’s existing skills and experiences:

“We had for March 16, first day of school closure, a PD day, pedagogical day, dedicated to digital learning. [...] We had a team of colleagues, primarily computer scientists, [...] who then offered webinars [...]. And in this context, we, for example, also made use of the knowledge of our trainees, that is, colleagues who are still in training or are about to take their exams.” (school I, translated).

Concerning the dimension of *feedback and accountability*, two schools reported to have recorded the students’ digital possibilities and needs *via* surveys to get an overview of the new situation. Several schools expressed that there had been a high level of

TABLE 3 Group comparison between schools with low and high SIC.

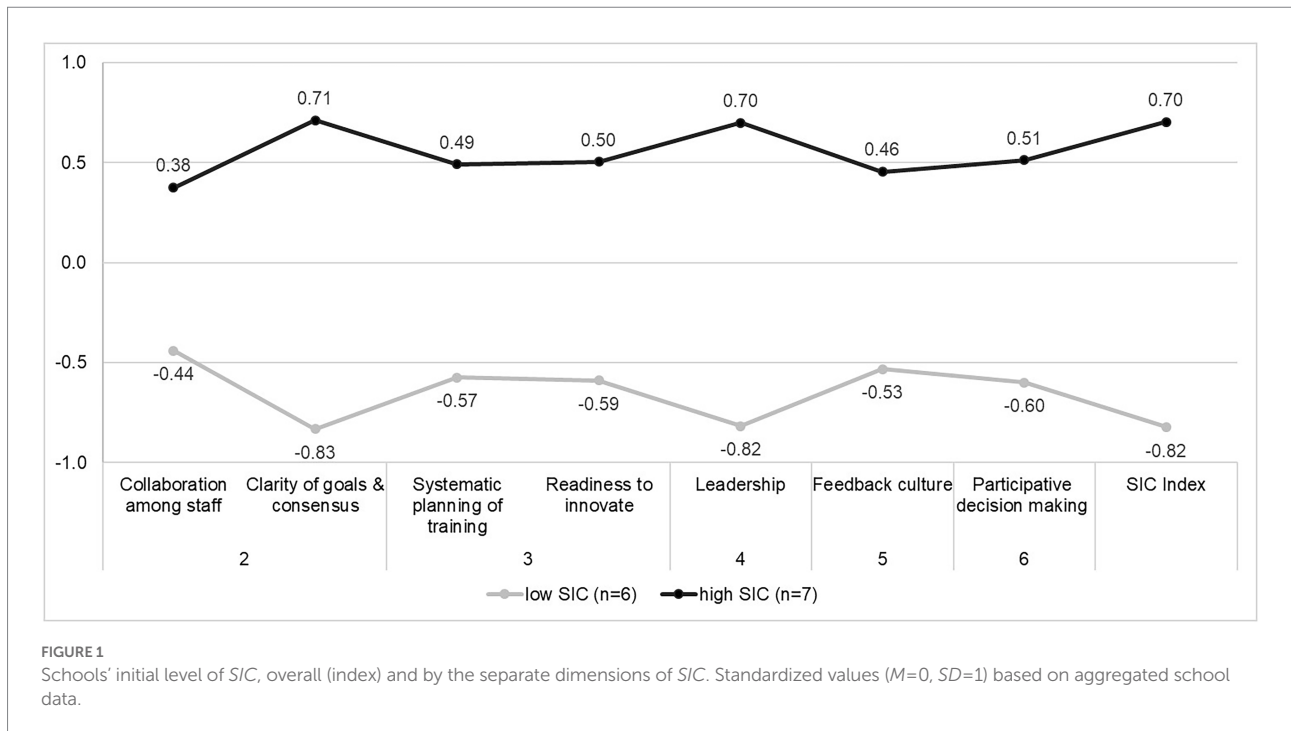
	All schools (n = 13)				Low SIC (n = 6)				High SIC (n = 7)				ES [95%-CI]
	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max	
2. Shared commitment and collaborative activity: Collaboration among staff	2.69	0.16	2.38	2.92	2.62	0.19	2.38	2.92	2.75	0.11	2.62	2.91	-0.86 [-1.99; 0.30]
2. Shared commitment and collaborative activity: Clarity of goals and consensus	3.87	0.34	3.27	4.37	3.59	0.24	3.27	3.87	4.11	0.18	3.77	4.37	-2.48 [-3.94; -0.95]
3. Skills and knowledge: Systematic planning of PD	3.46	0.32	2.62	3.94	3.27	0.35	2.62	3.59	3.61	0.21	3.35	3.94	-1.23 [-2.40; 0.00]
3. Skills and knowledge: Willingness to innovate	3.42	0.25	2.79	3.75	3.27	0.26	2.79	3.54	3.54	0.17	3.31	3.75	-1.27 [-2.46; -0.04]
4. Leadership	3.47	0.47	2.69	4.05	3.08	0.38	2.69	3.72	3.80	0.22	3.47	4.05	-2.35 [-3.78; -0.86]
5. Feedback and accountability: Feedback culture	3.04	0.37	2.50	3.79	2.84	0.23	2.50	3.10	3.20	0.40	2.70	3.79	-1.10 [-2.26; 0.10]
6. Participative decision making grounded in teacher empowerment: Fostering shared decision making	3.40	0.45	2.48	3.95	3.12	0.49	2.48	3.95	3.63	0.27	3.14	3.87	-1.30 [-2.50; -0.06]
SIC index	3.33	0.26	2.78	3.73	3.11	0.18	2.78	3.24	3.52	0.14	3.34	3.73	-2.57 [-4.07; -1.02]

ES, Effect size by Cohen (Cohen's d); 95%-CI, 95%-confidence interval.

motivation and willingness among the staff to support the changes resulting from the school closures. The extent to which schools used feedback from diverse information sources to constantly check whether the taken measures were effective cannot be assessed in detail. However, one school reported that they collected a pool of digital tools, apps, and recommendations based on each teacher's experiences, and then made a ranking "as to which apps can really be used well in the classroom" (school I, translated). This procedure also reflects the dimensions of *organizational structure* and *participative decision making grounded in teacher empowerment*, by creating interdependencies between teachers and granting them the freedom and responsibility to participate in decisions concerning teaching

during the pandemic, such as in the form of newly formed teams. The dimension of *leadership* can be classified as a cross-dimensional aspect, which included in particular promoting collaboration, targeted use of data, and PD of teachers, as well as providing opportunities for teachers to participate and get involved in school-wide decision-making processes.

In order to achieve a further structuring of our qualitative interview data based on the thematic fields outlined above, we categorized the principals' statements at the individual school level. This means that we looked at the principals' qualitative statements about the measures taken during the school closures separately for each of the 13 schools. We then related these statements to the identified thematic fields. Grouping the



individual schools according to the type and extent of the measures taken resulted in three distinct groups of schools: (1) *extensive action*, (2) *visible effort*, and (3) *rudimentary effort* (see Table 5).

Responses to school closures based on SIC

Finally, we matched the level of SIC (high and low SIC schools) to the three groups that we had deduced from the qualitative interviews. All schools that were categorized under “extensive action” also showed above-average values on SIC, while all schools that reported “rudimentary effort” had below-average SIC. Half of the schools that reported some visible effort to sustain student learning and well-being were categorized as high SIC schools, while the other half were low SIC schools. As a result, we distinguished four groups: (A) *Extensive action with high SIC*, (B) *Visible effort with high SIC*, (C) *Visible effort with low SIC*, and (D) *Rudimentary effort with low SIC*. Table 6 displays the means and standard deviations for all of the SIC measures and for the overall SIC-index separately for the four groups of schools.

Figure 2 shows the four standardized group means for the six dimensions of SIC as well as for the overall index. In the following, the four empirical patterns will be described in more detail.

Group A: Extensive action with high SIC

In this first group, schools reported extensive action to provide instruction and sustain student learning and well-being under school closures. In some instances, the schools even reported to

have bent the rules in order to reach their students. All schools in this group were general education schools and—according to the statements of the interviewed principals—well equipped in terms of digital infrastructure.

As can be seen from the mean standardized values in Figure 2, the three schools generally scored above average in all dimensions of SIC, with comparably high ratings for *clarity of goals*, *consensus among staff*, and *transformational leadership*. The qualitative statements of the principals indicated that the measures taken at these schools involved efforts to provide adequate conditions for distance learning for all students, especially those from less affluent families, and—in two cases—prioritizing safe schooling on-site to promote social bonding with the class teachers. Two of the schools used a student survey at the beginning of the school closures to collect data on the students’ digital resources and needs. In addition, one school put a special focus on teacher PD in digital skills, and distributing decommissioned digital devices to those students “where there was nothing at all” (school L, translated).

Group B: Visible effort with high SIC

As Figure 2 shows, the schools in the second group had above-average values on all dimensions of SIC. One school stood out with considerably high values across all scales. The qualitative statements of the principals revealed that this school—like one other of this group—had a rather low digital infrastructure at the time of the interview, while the other half had a quite high equipment with digital technologies.

The schools of this group all showed visible effort to sustain student learning, with clear differences in the effort levels between the schools. As a common element, none of

TABLE 4 Overview of the thematic fields from the qualitative interviews with school leaders.

Ensuring communication among staff and with students	Getting an overview by assessing students' needs	Keeping in view student learning and well-being	Building and strengthening digital competencies	Sharing tasks and responsibilities
<ul style="list-style-type: none"> Setting up digital learning platforms Contact through different channels (video conference, email, WhatsApp, sending out worksheets and home learning packs) 	<ul style="list-style-type: none"> Collecting data on digital resources and student needs (e.g., student surveys) 	<ul style="list-style-type: none"> Distribution of old school digital devices to students In-school self-learning center/learning office with Wi-Fi coverage Individual counseling and support by class teachers and social workers (home visits) Contact beyond pure instruction for teachers and students Unofficial expansion of emergency care On-site teaching for disadvantaged students (against regulations) Effort to follow regular classroom instruction as extensively as possible and to stick to the regular instructional plan 	<ul style="list-style-type: none"> Organization of a PD day dedicated to digital tools Low-threshold support among staff (e.g., PD <i>via</i> webinars) Flexibly arranged micro PD among staff Intensive individual engagement with digital formats Giving teachers and students time and space to get familiar with and implement virtual classrooms 	<ul style="list-style-type: none"> Formation of new teams, e.g., media team, digitalization team, distance learning team Clear structuring of procedures related to distance learning and learning content

these schools had designed special strategies to promote student learning and well-being during the first time of school closures, especially with regard to disadvantaged students. However, all schools tried to ensure communication between staff and students through different channels (e.g., home learning packs, sending out worksheets, photos *via* WhatsApp, online video conferencing), while they actively worked on building and strengthening the digital competencies of teachers and students during this first time of school closures. Facing a low level of digital equipment, one school newly established a digital platform following the school closures, after publishing all the tasks by class and year on the homepage in the first period and then switching to having the students come to school every day, two grades at the same time. Another school with a relatively low level of digital equipment reported that they “made new contingency plans every 3 days or so that our students would be taught German, Math, and English.” The school tried to follow regular classroom instruction as extensively as possible:

“So we really tried until the summer vacations to get as many students as possible into the school on as many days with as many hours as possible. Because that was the only way to keep in touch with the children. That went well in, in, in large parts. There are, of course, about a handful of students in each class who have gone off for three months or so. I think we’ve made

the best of it. We were always within the guidelines of the ministry, what they wanted we had already enforced before mostly. We were also often far enough beyond that.” (school C, translated)

Another school of this group focused on ensuring communication with students *via* their internal school network that “a massive number of students were not yet able to use” (school M, translated):

“So that in addition to [...] implementing hygiene measures and so on and so forth, we set this focus and we made it our goal to get a hundred percent of our students online before the vacations. We didn’t quite manage that, but compared to the thirty or forty percent we had before, we’re now much better.” (school M, translated)

Group C: Visible effort with low SIC

According to the qualitative statements of the principals, the four schools of the third group had varying levels of digital infrastructure at the time of the interview, ranging from rather low to comparably high. None of these schools reported any explicit measures or strategies designed to promote student learning and well-being under school closures. Instead, one school with little digital equipment stressed the need of first

TABLE 5 Response patterns to school closures.

(1) Extensive action (n = 3)	(2) Visible effort (n = 8)	(3) Rudimentary effort (n = 2)
<p>a) Ensuring communication among staff and with students (launch of digital platform, contact through different channels) <i>School B</i>: “So we launched the platform relatively quickly, still in March during the lockdown [...] which had the advantage that it was free, that it did not cost anything for our students either and was relatively easily accessible for our colleagues. [...] And of course, we also had a contact offer beyond the pure teaching offer. Not only for our students, but also for our colleagues.” (translated from German)</p>	<p>a) Ensuring communication among staff and with students (launch of digital platform, contact through different channels) <i>School A</i>: “These were the parallel class levels that exchanged information. They also met in part, sent materials where it was not possible digitally. So really manual work and then copied worksheets and packed them into envelopes. And we also set up team structures that we supported with Zoom conferences for individuals who belonged to a risk group and could not yet come to school.” (translated from German)</p>	<p>a) Ensuring communication among staff and with students (use of digital platform) <i>School K</i>: “The danger I saw then was, okay, they [the colleagues] know now, you can do this [use of digital equipment] from home. But why should I do that? And then came the school closures. And then they were forced to use that.” (translated from German)</p>
<p>b) Getting an overview by assessing students’ needs (student survey) <i>School I</i>: “We evaluated which students even have Wi-Fi at home? Who has an Internet-enabled laptop or tablet?” (translated from German)</p>	<p>b) Getting an overview by assessing students’ needs (student survey) <i>School J</i>: “For example, in the Corona period we surveyed which students, or how many students, have which devices at home to work with. [...] A lot of the tasks we have given out are either nonsense or can only be solved with great difficulty for the students.” (translated from German)</p>	<p>b) Getting an overview by assessing students’ needs</p>
<p>c) Keeping in view student learning and well-being</p> <ul style="list-style-type: none"> – Effort to follow regular classroom instruction as extensively as possible – Opening of a learning office/self-study center with Wi-Fi coverage – Reactivation and provision of old digital devices from school – Individual counseling and support by class teachers and social workers (home visits) – On-site teaching offer for disadvantaged students <p><i>School B</i>: “At that time, we also opened a learning office or self-study center for our upper school, as a meeting place and as a learning office for our students, who had no other place, because we had Wi-Fi coverage there. [...] And we tried to bring as many students as possible to school in small groups on as many days as possible. [...] And we also interviewed or visited some of the students that we did not reach at all via home visits as a team with the classroom teachers or the school social workers. We are relatively proud of the fact that during the lockdown we only lost two students completely, only two, with whom we had no contact at all during that time.” (translated from German)”</p>	<p>c) Keeping in view student learning and well-being</p> <ul style="list-style-type: none"> – Effort to follow regular classroom instruction as extensively as possible – Reorganization of graduations <p><i>School C</i>: “The biggest problem was really, distance learning, because our students do not have appropriate digital devices. [...] So, we really tried until the summer vacations to get as many students as possible into the school on as many days with as many hours as possible. Because that was the only way to keep in touch with the children.” (translated from German)</p>	<p>c) Keeping in view student learning and well-being <i>School H</i>: “It has to be said that we certainly did not reach many students to the extent that we would have liked, simply because the digital prerequisite is, in some cases, completely zero. And that was of course a very, very difficult process, that is true. A lot of the commitment and motivation that was there first went down again. And that now has to be painstakingly rebuilt, so to speak.” (translated from German)</p>

(Continued)

TABLE 5 (Continued)

(1) Extensive action (n = 3)	(2) Visible effort (n = 8)	(3) Rudimentary effort (n = 2)
<p>d) Building and strengthening digital competencies (Giving teachers and students the opportunity to familiarize with digital tools, low-threshold support among staff, prior PD)</p> <p><i>School I:</i> “We had a team of colleagues, primarily computer scientists, but not only, who then offered webinars, who sometimes spent an hour or more with the colleague at the other end thinking, how do you now set up the digital classroom on your laptop? And that was, for example, I would say, a great leap forward in instructional development, which was necessary, but nevertheless very successful. [...] And in this context, we, for example, also made use of the knowledge of our trainees, that is, colleagues who are still in training or are about to take their exams [...] And each colleague now looks for themselves and their subject, what is useful for this? We collect this in a pool and from this a ranking is to be created with recommendations as to which apps can really be used well in the classroom?” (translated from German)</p>	<p>d) Building and strengthening digital competencies (Giving teachers and students the opportunity to familiarize with digital tools, prior PD)</p> <p><i>School E:</i> “At the end of March, we tried to see if we could give all the teachers, including the students, who had not worked with the system [digital learning platform] before, the opportunity to set up virtual classrooms. And that worked. Of course, the teachers did not reach all of our students on a regular basis, but at least they were able to set up access. So that distance learning, at least when the students had someone at home to take care of it, theoretically worked for us. And that’s how we did it.” (translated from German)</p>	<p>d) Building and strengthening digital competencies (prior PD, individual engagement with digital tools)</p> <p><i>School H:</i> “I would say that almost 80 to 90 percent of my colleagues have now really taken a close look at the possibilities in the area of digitization. And I do not think we need to demand any more readiness for this. My colleagues have definitely noticed the opportunities and potential that exist in this area.” (translated from German)</p>
<p>e) Sharing tasks and responsibilities (formation of a large media team following school closures)</p> <p><i>School I:</i> “We formed a media team made up of many colleagues who are interested, which is also relatively large. There are certainly 15 colleagues who have agreed to train other colleagues. On the one hand, via webinars, and on the other hand, here on site, where certain techniques were explained again in small groups once it was allowed again. (translated from German)</p>	<p>e) Sharing tasks and responsibilities (formation of digitalization group and distance learning group, clear structuring of procedures)</p> <p><i>School D:</i> “And we deliberately said, we do not want to just let distance learning run from the beginning and each teacher does what they [...] want, but we called the subject conferences together and said, “Okay, dear teams, so dear subject teacher teams, agree on what should be accomplished this semester and also what cannot be accomplished this semester. [...] So, we have tried very hard to structure and standardize it here so that we can somehow deal with the situation and our students do not drift off somewhere, but rather we all pull together as much as possible.” (translated from German)</p>	<p>e) Sharing tasks and responsibilities</p>

Own emphasis in bold text. Examples from each subgroup are presented for each thematic field.

familiarizing with the schools’ digital platform and corresponding tools during school closures as well as creating organizational conditions for distance learning: “[...] we were first busy looking at exactly how [...] we can create our digital learning in the first place” (school D, translated). At the same time, the principal of this school reported that they had arranged teams that would focus on digitalization and distance learning, while clearly structuring distance learning from the beginning by asking teacher teams to define goals for new learning material during the school term. Similarly, another school of this group with likewise low digital equipment was predominantly occupied with first implementing distance learning and the digital prerequisites: “And the focus was

really on how we can maintain contact with the students in the first place. Because, as I said, the digital learning platform was not available. So, we introduced distance learning from a distance, so to speak” (school F, translated). Another school with a quite high initial level of digital equipment had “tried to see if see if [they] could give all teachers, even those who have not worked with it [digital learning platform] before, including the students, the opportunity to set up virtual classrooms” right after the start of the school closures (school E, translated). At the same time, they “were lucky” to have already installed a digital learning platform at the beginning of the school year. The principal concluded: “And that worked. Of course, the teachers did not reach all the students on a

TABLE 6 Means and standard deviations for the six SIC dimensions by the four groups of schools.

	Group A: Extensive action with high SIC (n = 3)				Group B: Visible effort with high SIC (n = 4)				Group C: Visible effort with low SIC (n = 4)				Group D: Rudimentary effort with low SIC (n = 2)			
	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max	M	SD	Min	Max
2. Shared commitment and collaborative activity: Collaboration among staff	2.76	0.15	2.62	2.91	2.75	0.11	2.64	2.88	2.63	0.24	2.38	2.92	2.61	0.02	2.59	2.62
2. Shared commitment and collaborative activity: Clarity of goals and consensus	4.22	0.14	4.09	4.37	4.03	0.18	3.77	4.17	3.46	0.17	3.27	3.66	3.84	0.04	3.82	3.87
3. Skills and knowledge: Systematic planning of training	3.62	0.30	3.35	3.94	3.61	0.16	3.51	3.86	3.21	0.40	2.62	3.50	3.38	0.29	3.18	3.59
3. Skills and knowledge: Willingness to innovate	3.62	0.12	3.54	3.75	3.49	0.19	3.31	3.66	3.20	0.31	2.79	3.54	3.40	0.10	3.33	3.46
4. Leadership	3.94	0.01	3.92	3.95	3.70	0.26	3.47	4.05	3.14	0.42	2.72	3.72	2.96	0.39	2.69	3.24
5. Feedback and accountability: Feedback culture	3.23	0.34	3.03	3.63	3.18	0.49	2.70	3.79	2.86	0.18	2.68	3.10	2.79	0.41	2.5	3.08
6. Participative decision making grounded in teacher empowerment: Fostering shared decision-making	3.58	0.39	3.14	3.87	3.66	0.20	3.37	3.78	3.21	0.60	2.48	3.95	2.95	0.19	2.82	3.08
SIC index	3.57	0.05	3.51	3.62	3.49	0.18	3.34	3.73	3.10	0.22	2.78	3.24	3.13	0.13	3.04	3.23

regular basis, but at least they were able to set up access. So, distance learning, at least when the students had someone at home to take care of it, theoretically worked for us.” (school E, translated). Finally, the fourth school of this group reported having used their already installed digital learning platform, recognizing at the same time that “there is a problem of equipment with digital end devices” (school G, translated). Having trained all colleagues before the school closures and informed the students about how to use the digital learning platform in advance, the school additionally trained the secretary to be able to assist students during school closures. Furthermore, the school planned “a whole pool of distance tasks in advance.”

Group D: Rudimentary effort with low SIC

The two schools of the last group scored below-average on most dimensions of SIC, both with a negative standardized SIC index value, and were characterized by relatively low ratings of *transformational leadership practices*, *participative decision-making*, and *feedback culture*. In the qualitative interviews, the principal of one school reported: “almost 80%–90% of my colleagues have now really taken a close look at the possibilities in the area of digitization” (school H, translated), stressing that COVID-19 has brought a “great advantage” in advancing the topic of digitization. As far as the school’s reactions under school closures are concerned, the principal merely states that “distance learning [...] is of course very difficult,” adding that

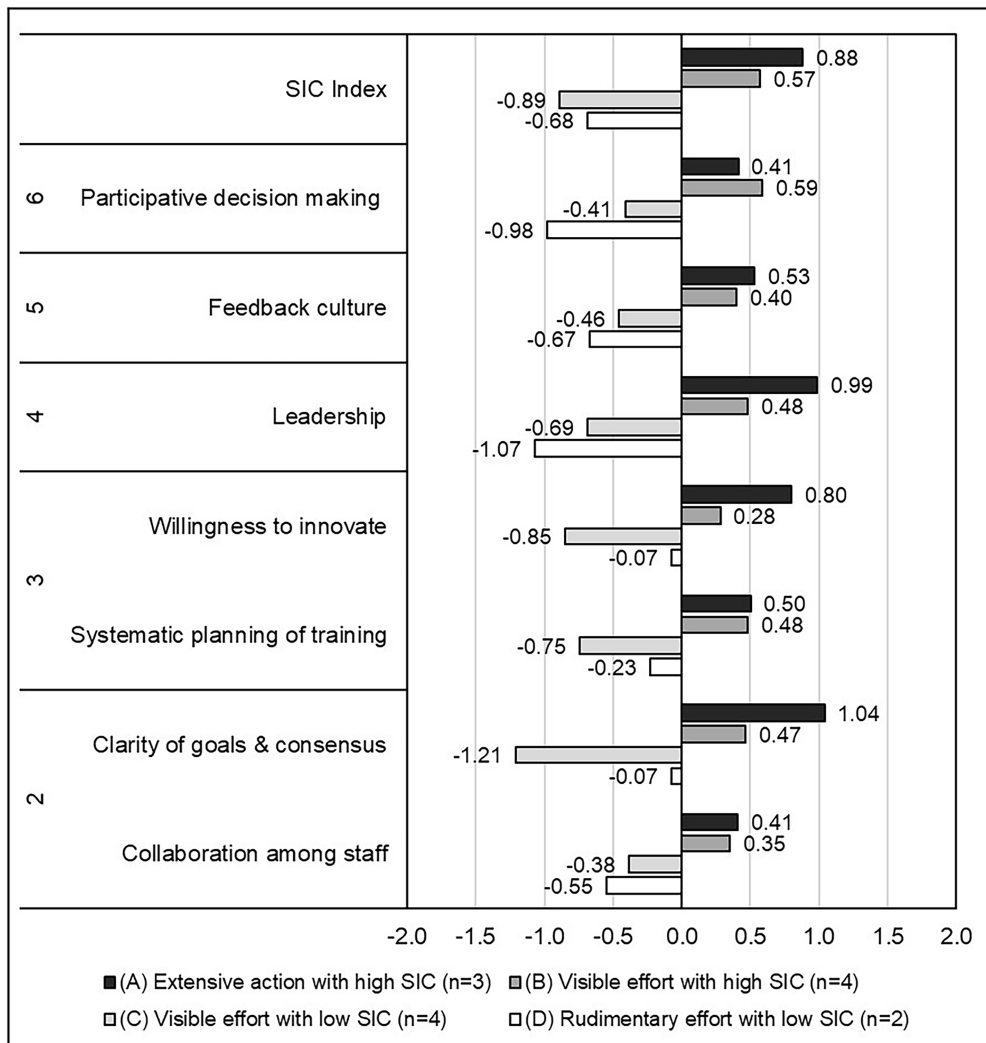


FIGURE 2 Group means of SIC. All variables were standardized ($M=0, SD=1$).

on-site schooling was necessary to re-establish the social bonding with students:

"And yes, now we are returning to on-site teaching with the appropriate protective measures, which is certainly necessary in order to re-establish a bond with the students. It has to be said that we certainly didn't reach many students to the extent that we would have liked, simply because the digital prerequisite is, in some cases, completely zero. And that was of course a very, very difficult process, that's true. A lot of the commitment and motivation that was there first went down again. And that now has to be painstakingly rebuilt, so to speak." (school H, translated)

The principal of the other school reported that the teachers had previously been trained in digital skills, "and the fact that the PD was still fresh, I think, was now a huge opportunity, a super

opportunity to apply the knowledge we had just learned" (school K, translated). When the school closures were enforced, the staff "was forced to use" their newly gained knowledge. The interview material does not contain any information about complementary activities or strategies that ensured the support of socio-economically disadvantaged students.

Discussion

Drawing on the school improvement capacity approach (Marks and Louis, 1999; Feldhoff, 2011), the goal of the paper was to shed light on the relationship between schools' efforts to sustain teaching and learning during the first school closures in the context of COVID-19, and the prior level of SIC in schools serving disadvantaged communities in one German state. To do so, we first assessed each school's level of SIC as perceived by teachers

and other pedagogical staff in the schools. Second, we outlined several thematic fields in the schools' responses to the first school closures, based on data from qualitative interviews with school leaders. Third, we related these thematic fields to the reported level of *SIC* in the individual schools.

Before we discuss the results, some limitations of our research must be addressed. First, our data is based on a small sample of schools that had already been pre-selected for a model project by the States' Ministry for School and Education. As a result, the schools may exhibit certain features (e.g., more contact with educational administration and research) and receive special resources for school improvement. Second, due to the low response rate to the standardized online surveys, the sample and school-level constructs might not validly represent the schools' total personnel. With an average of around 30 responses per school, one should be cautious in assuming that the *SIC* categorizations are robust. Third, our sample consisted only of schools whose principals agreed to participate in the interviews, and who then described their responses to the pandemic, which may lead to further selection bias. In that light, our study must be understood as strictly exploratory without any claim of being representative. Fourth, some of our indicators to operationalize the six *SIC*-dimensions showed rather low internal consistency and were not based on empirically validated scales.

Fifth, our identification of response patterns is based, among other things, on qualitative interview data. In addition to social desirability bias, it is possible that school leaders did not disclose all of the actions they took during the first school closures. This could be because the questions about schools' responses to the pandemic were only some of many other questions in the interviews. Nonetheless, all schools were informed in advance of the interview topics and were given ample time in the interview to talk about their experiences at the beginning of the pandemic. With these limitations in mind, the identified groups must be understood as an exploratory approach to finding common patterns that needs further validation in more in-depth analyses. Ideally, data on (the development of) *SIC* should be collected on a longitudinal basis. Generally, our data needs to be validated with larger samples and schools from different locations to make reliable statements about the relationship between prior *SIC* and responses to crises such as COVID-19.

Keeping these limitations in mind, our results suggest that although we observed a considerable amount of heterogeneity in the reported level of *SIC* across the schools prior to the school closures, we were able to distinguish two groups of schools with relatively low *SIC* and relatively high *SIC* based on their standardized scores on the six dimensions of *SIC*. While all schools in our sample were faced with the challenge of responding to the pandemic and quickly designing, implementing, and sustaining distance learning, we could observe clear differences in the schools' reported efforts. One group of schools was characterized by a highly active and, at some points, pragmatic handling of the crisis, a second group reported considerable efforts to adapt to the new situation, but did not put a special focus on the learning and well-being of students in

particularly precarious situations. Finally, a third group of schools was characterized by rather rudimentary action in response to the school closures, neither focusing on shared tasks and responsibilities, nor on their students' needs. Combining the data from the survey of teachers and further pedagogical staff, and the qualitative interviews with principals, we delineated four distinct groups that were comparable to the three groups outlined above, but further distinguished between low and high *SIC* schools in the second group. This variation in both school improvement capacity as well as in schools' responses to the pandemic has also been documented in prior research and led to the building of a typology of schools. For example, [Duff \(2021\)](#) identified six *SIC* subgroups and found that teachers' and school leaders' perceptions of challenges related to COVID-19 as well as schools' strategies to adapt to these challenges varied, in part, as a function of their *SIC* at the onset of the pandemic.

Interestingly, all schools that reported extensive action and measures as a response to the first school closures (group A) also had an above-average *SIC*, while all schools characterized by rudimentary actions (group D) scored below-average on the *SIC* index, and in five of the six individual dimensions. In the second group, schools with both low and high *SIC* prior to school closures were observable. This indicates that *SIC* might be influential in how schools generally adapt to crisis events, although this association is not deterministic. In particular, some schools with an above-average *SIC* did not report extensive measures to sustain student learning and well-being, while some schools with below-average *SIC* showed visible efforts to deal with the school closures. Looking at the individual dimensions of *SIC*, we found that the more "active" schools of our sample were generally characterized by a higher clarity of goals and consensus regarding the schools' mission, higher ratings of transformational leadership practices, and an above-average willingness to innovate.

While all schools provided some form of distance learning during the first school closures, not all started from the same position. In fact, the extent to which schools sought ways to meet their students' needs and to continue instruction under school closures appeared to also depend on the digital infrastructure available to the schools: Schools that had already developed technical and digital capacities prior to the school closures appeared to deploy distance learning more easily by using existing resources. This result is in line with other research from Germany, which shows that technically more advanced schools were able to facilitate motivating, effective distance learning, and support the learning processes of their students over a longer period of time, as compared to schools with fewer digital resources ([Eickelmann and Drossel, 2020](#); see also [Eickelmann and Maaz, 2021](#)). In contrast, some of the schools in our sample had a lower digital infrastructure, and therefore were predominantly occupied with first implementing the digital prerequisites for distance learning.

However, although all three schools in the extensive action pattern were characterized by a comparably high level of digital infrastructure at the time of the interview and probably already at

the beginning of the school closures, our results suggest that the digital infrastructure alone did not determine how the schools responded to the pandemic. For instance, two schools with relatively low digital infrastructure showed a comparably high effort to deal with the new situation. At the same time, the two schools with rudimentary effort, as well as several that were categorized into group 2, reported a rather high level of digital infrastructure. To sum up, good digital prerequisites in the schools helped them design appropriate measures and strategies to continue teaching and learning remotely, but digital equipment was not the single factor that determined low and high efforts under school closures. Whether schools with a better digital infrastructure before school closures were generally better able to adjust to the new situation cannot, however, be fully addressed in this paper.

Our results further demonstrate that one of the most active schools of our sample had established a concept of professionalization that involved short (both in-school and digital) micro PD in which the teachers organized and made use of knowledge and expertise within the school. This PD, however, which went beyond the mere exchange of ideas and materials, involves strong leadership and may further be used predominantly by those teachers who have a certain affinity to digital techniques (Eickelmann and Maaz, 2021). The importance of teacher professional culture in establishing a capacity for organizational learning (Seashore Louis and Lee, 2016) as well as the formation of teacher teams for the purpose of innovating organizational practices (Palumbo and Manna, 2019) has been stressed in prior studies. Assessing the potential of such micro PD to train as many teachers as possible should be a matter of further research.

Besides providing opportunities for academic learning, it was vital for schools to monitor student needs and emotional health during the school closures, especially at SSDCs (Bremm, 2021). Our results suggest that while all schools focused on academic learning, only those in the most active group also reported to have reinforced their efforts to reach out to their students, for instance by making home visits, providing a self-learning center with access to WiFi, expanding emergency care and in-school instruction to students who needed it but officially were not eligible, while trying to hold on to the regular curriculum as best as possible. These schools were characterized by high *SIC* in general, but especially regarding transformational leadership practices and shared goals; this suggests that these capacities are especially important for building structures and routines enabling educators to collaboratively and continuously learn under challenging circumstances. This is in line with school improvement research stressing the importance of both shared goals among staff (e.g., Muijs et al., 2004; Hemmings, 2012) and leadership enabling collective routines for improvement (e.g., Hemmings, 2012; Herman, 2012) at SSDCs. In a recent study, Meyer et al. (2022) developed four assumptions of how principals can support teacher collaboration and, hence, processes of organizational change: through creating a clear,

long-term vision for the school and developing a strategy for implementing innovations, through involving other school staff in this decision-making process, through fostering structural prerequisites for collaboration, and through fostering the overall motivation of school staff to participate in implementing these innovations. Furthermore, Rikkerink et al., 2016 stressed distributed leadership and collective sense-making as important prerequisites for the incorporation of digital learning materials in teaching practice. Finally, Day et al. (2016) showed that for schools to not only develop, but also sustain effectiveness, principals must understand their school's situational needs and foster clear, context-sensitive values that are shared within the school and progressively embedded in the school's work and culture.

While our results illustrate the range of initial strategies taken by SSDCs to cope with the challenges of the COVID-19 pandemic, and suggest a general, though not a deterministic association between these strategies and the *SIC* of the schools prior to the pandemic, the scope of our study does not provide any insight into whether the strategies chosen by the more active schools could prevent the achievement gap between schools in different social situations from opening further in the context of distance learning. In addition to the six dimensions of *SIC* discussed here, teachers' beliefs and attitudes (e.g., deficit thinking) may also play a role at SSDCs (Bremm and Racherbäumer, 2020; Bremm, 2021). For instance, qualitative data show that a high sensitivity for the heterogeneity and diversity of the student body, the cultivation of an appreciative school culture and a distancing from common attributions of deficit thinking are related to successful school improvement (Racherbäumer, 2017; Klein and Bremm, 2019). Future studies should systematically examine the processes in schools that may lead to the reproduction of social inequality and systematically analyze teachers' orientations and practices as well as their effects. Furthermore, a more detailed analysis of the interconnections between leadership practices, school capacities and responses to the first school closures under COVID-19 appears warranted but is beyond the scope of this study. Further research should especially look at how school organizational practices like teacher engagement or school leaders' responsiveness to student and teacher needs evolved from the beginning to the end of the pandemic. This would allow to systematically trace the development and impact of initial capacities from a longitudinal perspective. It also appears useful for future studies to incorporate a larger amount of schools in order to allow for a more fine-grained typology and subgroup classification of *SIC* (e.g., Duff, 2021).

Finally, in light of these findings, it needs to be discussed whether and how traditional school improvement and school effectiveness research needs to adapt to reflect the adaptive challenges represented by the pandemic. Prior research has indicated, for example, that COVID-19 has created an unprecedented crisis with numerous and ongoing challenges to

educational systems around the world (Rincones et al., 2021). These challenges required both adaptive and contingent leadership, including targeted responses to the social, emotional, mental health and academic needs of students and school staff (e.g., Moss et al., 2020; Cordeiro et al., 2021; Greany et al., 2022). In this sense, schools can be understood as developing “organizational conditions that enable them to continuously learn and adapt to meet the needs of their students” (Duff, 2021: 224), rather than simply achieving effectiveness. Focusing on school improvement capacity—particularly in the context of the pandemic—can help policy makers and researchers take a contextually sensitive approach to identifying and addressing school improvement needs at SSDC.

Conclusion

Our findings lend support for the idea that a school’s *SIC* is indicative of their reactions to events of crisis suddenly affecting teaching and learning situations. Building a capacity for improvement, including effective leadership practices and a high clarity of goals and consensus, appears to be relevant not only to further develop existing strategies, methods, and approaches, but also to quickly adapt to new challenges. For SSDC in particular, a high level of *SIC* is likely to buffer the impact of sudden changes induced by crises that are added to the already existing external (and often internal) challenges. Our results also showed that schools with higher levels of *SIC* shortly before the beginning of distance learning in the context of the pandemic tended to focus on both continuing teaching and learning as well as securing the well-being of students. Thus, the ability to manage change—e.g. by keeping in view student learning and well-being without falling behind the standards—appears to be a distinctive feature of schools that had been able to build up a relatively high capacity for improvement.

Data availability statement

The datasets presented in this article are not readily available because in the privacy statement for the surveys, we assured participants that all data collected would not be accessible to third parties and that only those involved in the research project would have access to it. Requests to access the datasets should be directed to laura.beckmann@uni-due.de.

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Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors conceived and designed the study. LB and SK-M performed the data analyses and interpretation. LB and SK wrote the first draft of the manuscript. EK, NB, and IA reviewed the draft and added important ideas. EK critically revised and edited the draft. LB did the final writing of the version to be published. EK, NB, and IA acquired the financial support for and supervised the project leading to this publication together with Kathrin Racherbäumer, who is mentioned in the Acknowledgments.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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