



Comparison of Parent-Rated Teaching Activities During the First and Second School Lockdowns and Its Association With Students' Learning Outcomes During Distant Teaching

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Abstract: Due to the COVID-19 pandemic, schools were closed twice in Germany for several months. The aim of the present study was to investigate whether distant teaching activities increased from the first school lockdown to the second school lockdown and whether the frequency of distant teaching activities were related to students' outcomes (motivation, competent and independent learning, perceived learning progress) during distant learning. To this end, $N = 3,480$ legal guardians filled in an online questionnaire during the second lockdown (see Steinmayr et al., 2021). Distant teaching activities greatly increased from the first lockdown to the second lockdown. Besides communication with a parent, all other distant teaching activities were more frequent at secondary schools. However, in both elementary and secondary schools, distant teaching activities varied greatly. Distant teaching activities as well as children's characteristics and social background were independently important for students' outcomes. The results are discussed with regard to their practical implications for realizing distant teaching.

Keywords: COVID-19, distant teaching, teaching quality, motivation, perceived competencies

The two school lockdowns in Germany due to COVID-19 in 2020 and 2021 faced students, parents, and teachers with new challenges. During the first lockdown in Germany, the prerequisites for distant teaching were not given at most schools (e.g., König et al., 2020), which resulted in an undesirable realization of distant teaching (Steinmayr et al., 2021). Before the second lockdown in Germany (December 2020), the government had time and financial investments to prepare schools better (May & Hoerl, 2022). In both lockdowns, the Ministries of Education of all federal states completely allocated the realization of distant teaching to the schools (see also Fickermann & Edelstein, 2020). Thus, the quality of distance teaching greatly varied between schools in the first lockdown (see Steinmayr et al., 2021). As teaching quality is an important prerequisite for students' academic achievement, motivation, and emotion (e.g., Lazarides & Buchholz, 2019), the teaching activities during the first school lockdown and their respective quality (in the following labeled as distant teaching activities) were related

to students' motivation, learning behaviors, and academic achievement (Steinmayr et al., 2021). The aim of this study thus is to compare the frequency of teaching activities during the first and second school lockdowns and to replicate the results by Steinmayr and colleagues.

Effects of Infection Control Interventions on Children and Adolescents

Overall, the pandemic-caused school closures and disruption of family routines had massive consequences on the children worldwide (for a review, see Panchal et al., 2021). The results of the German COPSYP study, which surveyed students between 12 and 17 years, showed that school closures were associated with an increase in mental health impairment and the perception that the school situation is burdensome, whereas the school openings in the fall of 2021 were associated with improvements in those factors

(Ravens-Sieberer et al., 2022). In a longitudinal study, Steinmayr and colleagues (2022) demonstrated a decline in affective subjective well-being by testing an elementary school sample before and during the pandemic.

As teachers were unprepared when schools closed the first time and digital equipment was insufficient at German schools (Lorenz et al., 2020), the government invested a lot of money to equip teachers with digital teaching and communication devices. In the end, most teachers had a laptop or tablet by which they were able to realize distant teaching. However, having the means to teach in distance does not equal that distant teaching is realized on a frequent basis. Thus, one aim of the present study was to check whether the realization of distant teaching changed from the first lockdown to the second lockdown.

Distant Teaching Activities During the COVID-19 Pandemic

Students' motivational and cognitive development in learning settings is shaped by the teaching practices they experience in class (Pianta & Hamre, 2009). The Three Dimensions of Teaching Quality framework of Klieme and colleagues (2009) describes three basic dimensions of effective teaching. *An effective classroom management* is defined, for example, by actions of the teacher to establish order or to elicit cooperation among students. *Cognitive activation* refers, for example, to the encouragement of students to develop their own solutions, to try out multiple solution paths, and to critically evaluate their own solutions. *Learning support* is particularly important for students' motivational development and is characterized, for example, by emotional supportive teacher-student relationships and adaptive learning support. Against this background, research has emphasized that distant teaching during the COVID-19-related school lockdown also needs to consider the implementation of teaching quality (Voss & Wittwer, 2020). As the recently published meta-analysis by Betthäuser and colleagues (2023) has shown, studies on distance education during the school closures display generally negative effects on students' learning outcomes, especially when belonging to marginalized groups (see also Darling-Aduana et al., 2022). Huber and Helm (2020) report that the feedback that students reported to have received from their teachers was positively associated with their self-reported learning success and with time spent with learning activities. The student-reported quality of the contact between students and their teachers during the school closures was negatively associated with learning success but positively associated with students' positive emotions and time spent with learning activities. The level of self-reported self-directed learning was positively associated with positive emotions,

learning activities, and learning success. Similarly, Steinmayr and colleagues (2021) showed that distant teaching activities that involve direct forms of interpersonal feedback and communication particularly contributed to elementary and secondary school students' academic outcomes during school lockdown. Furthermore, more recent findings showed that instructional quality during distance education contributed little to explaining students' learning effort and intrinsic motivation (Helm & Huber, 2022).

Student and Family Characteristics

Family and students' characteristics are important for students' motivation (e.g., Steinmayr et al., 2012). Therefore, students' achievement motivation and their academic achievement during homeschooling should be substantially related to students' abilities, personality/temperament, and school engagement. In line with Steinmayr and colleagues (2021), we included the following student characteristics as possible confounding factors in our study: parents' perceptions of students' abilities in the domains of math and German, students' negative emotionality (as a facet of their personality/temperament), and students' school engagement. We chose school engagement as well as math and language art competencies as they had the highest relative importance for school achievement in previous studies (e.g., Steinmayr et al., 2018). As homeschooling requires a lot of emotional self-control, we also assessed negative emotionality. The findings demonstrated substantial relations between these factors and students' motivation and achievement in elementary and secondary schools (e.g., Steinmayr et al., 2018, 2021). This was also true for students' motivation, independent and competent learning, and perceived learning progress during the first lockdown (Steinmayr et al., 2021). The findings also demonstrated the association between social background variables and academic achievement as well as learning motivation during the pandemic (e.g., Heyder et al., 2020). Furthermore, learning losses were especially pronounced for socially disadvantaged students (Ludewig et al., 2022). Thus, we also included variables assessing students' socioeconomic background, e.g., parents' highest school leaving certificate. Moreover, we asked for the child's and parent's age, migration background, and gender. Gender was related to both students' learning outcomes during the first lockdown (Steinmayr et al., 2021) and a decrease in academic achievement after the first lockdown (Breux et al., 2021).

Aims of the Present Study

Only few studies investigated distant teaching realization in the second lockdown (e.g., Alves et al., 2022; Wößmann

et al., 2021). We are not aware of a study that systematically compared the first and second school lockdowns concerning the realization of distant teaching in different subjects in elementary and secondary schools.

Therefore, the first aim of the present study was to investigate how distant teaching was realized in different subjects during the second school lockdown in schools in Germany. In line with Steinmayr and colleagues (2021), we expected that different forms of distant teaching (e.g., grading, sending tasks vs. task-related feedback, provision of solutions, direct communication with students and parents) would differ across school types and would be differentially associated with students' motivation, learning behaviors, and achievement during the school lockdown. Furthermore, studies indicated that students' individual characteristics and family-related socioeconomic resources were substantially associated with students' motivation, their behavior, and achievement during the school lockdown (e.g., Huber & Helm, 2020; Sliwka & Klopsch, 2020).

Against this background, we investigated the following hypotheses:

Hypothesis 1: The frequency of distant teaching activities differs between elementary and secondary schools.

Hypothesis 2: The frequency of distant teaching activities differs between the first and second lockdowns for both elementary and secondary schools.

Hypothesis 3: The frequency of distant teaching activities is positively associated with students' motivation, competent and independent learning, and learning progress during the school lockdown.

Hypothesis 4: Distant teaching activities that involve direct forms of interpersonal feedback and communication (e.g., task-related feedback, teaching via videoconference, and student-teacher communication) are particularly strongly related to students' motivation, competent and independent learning, and learning progress during the school lockdown when simultaneously considering other forms of distant teaching activities (e.g., grading, frequency of sending out tasks).

Hypothesis 5: Students' characteristics and social background variables add to the variance explanation of students' motivation, competent and independent learning, and learning progress during the school lockdown above distant teaching activities.

Method

Procedure

The study was conducted online. Parents filled in the online questionnaire between January and March 2021 during the second school lockdown in Germany of the global *Corona crisis* (the COVID-19 pandemic). To reduce the risk of infection, most schools had been closed in Germany from before Christmas 2020 onward for several weeks, for most grades at least until Easter holidays 2021 and beyond. We recruited parents from all over Germany by posting the study link on Facebook.com, Twitter.com, and other social networks (e.g., Bing). Additionally, we contacted 28 parent associations from all federal states in Germany in January 2021 by e-mail. Finally, we disseminated the study link by ourselves via our university homepages and via personal contacts and e-mail distribution lists.

The online questionnaire was nearly identical to the one used by Steinmayr and colleagues (2021). The completion of the online questionnaire took the parents about 20 min. If they had more than one child in the school, parents were asked to indicate for which child they filled in the questionnaire.

Participants

A total of 3,480 adults from all German federal states were included in the study. The mean age of the parents was 43.34 years ($SD = 5.71$). The majority of parents were female ($n = 3,040$; male: $n = 437$; other: $n = 3$), were born in Germany ($n = 3,230$), and had some kind of university entrance certificate [(Fach-)Abitur] ($n = 2,557$). Of all participating subjects, $n = 3,076$ indicated to be the mother of the child for whom they filled in the questionnaire (father: $n = 375$; different responsible relationship to the child: $n = 29$). The sample was representative for the German population with respect to mean age (Federal Statistical Office, 2020b). However, females and parents with a university entrance certificate were overrepresented in the sample (Federal Statistical Office, 2020a, 2020b).

The mean age of the rated children was 10.97 ($SD = 2.96$), of whom $n = 1,696$ were female (male: $n = 1,765$; other: $n = 19$). Children attended the following school types: elementary school: $n = 1,373$; academic track secondary schools (Gymnasium): $n = 1,378$; comprehensive secondary schools (Gesamtschule): $n = 375$; intermediate track secondary schools (Realschule): $n = 264$; lowest track secondary schools (Hauptschule): $n = 29$; schools for special educational needs (Förderschule): $n = 23$; and other school type: $n = 38$. Children were in Grades 1–13.

At the time their parents participated in this study, children had to learn at home because of the school lockdown for 7.59 weeks on average ($SD = 3.97$ weeks). We excluded parents of children who attended a school for special educational needs because these children have systematically different needs than students who are attending regular schools. Furthermore, we excluded parents whose children attended a different school type than the Gymnasium, Gesamtschule, Realschule, and Hauptschule. The final analysis sample of this study thus comprised 3,419 participants, of whom $n = 1,373$ attended an elementary school and $n = 2,046$ attended a secondary school. This distribution of elementary (40%) and secondary school students (60%) was similar to the distribution in the population of German students in 2020/2021 (elementary: 36%; secondary: 64%). A MANOVA with both gender and age variables as well as the indicator of sociodemographic background demonstrated that the present sample slightly differed from the sample in the first lockdown (see Steinmayr et al., 2021). Subsequent ANOVAs showed that the case was statistically significant ($p < .05$) for having an own room ($F = 12.74$), highest school leaving certificate ($F = 18.52$), child's age ($F = 5.42$), and both gender variables (parent: $F = 14.37$; child: $F = 15.67$). However, all effect sizes were $\eta^2 < .003$. Thus, samples assessed in the first and second lockdowns were nearly identical.

Instruments

All scales used in the present paper had been identically assessed and described in detail in Steinmayr and colleagues (2021). Reliabilities for all measures are reported in the Electronic Supplementary Material (ESM 1), Supplement 1, and are high.

Motivation During the School Lockdown. Students' motivation was assessed with the following items: "My child works motivated on the assignments during the school lockdown" and "My child enjoys working on her/his assignments during the school lockdown." Parents were asked to read through the items and indicate whether the following statements apply to their situation at home during the school lockdown. They answered the items on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The two items were combined to a motivation during the school lockdown scale.

Competent and Independent Learning During the School Lockdown. The items were the following: "My child accomplishes her/his assignment during the school lockdown without any difficulties," "My child only accomplishes her/his assignment during the school lockdown with my or my partner's help" (reversely coded), and "My child needs a lot of support for doing her/his school tasks during the school

lockdown" (reversely coded). Parents answered the items on the same scale as the motivation items.

Learning Progress During the School Lockdown. The item "My child learns a lot during the school lockdown" assessed parents' perception of their child's learning progress during the school lockdown. Parents answered the item on the same scale as the motivation items. The item correlated in the expected direction with the other items; for example, correlation with motivation during the school lockdown was high.

Distant Teaching Activities. Eight different distant teaching activities were assessed via eight items assessing the perceived frequency at which different teachers realized these aspects. According to Steinmayr and colleagues (2021), we focused on mathematics, language arts, English, and science (elementary school) and biology teachers (secondary school). Specifically, we asked parents for the frequency at which the respective teacher sent tasks and solutions, requested students' solutions, gave feedback on those, graded students' solutions, taught via videoconference, and had contact with the child and/or parent via chat, e-mail, or phone. Answers were given on a scale with six answer options: 1 (*not yet*), 2 (*every 3 weeks*), 3 (*every 2 weeks*), 4 (*every week*), 5 (*twice per week*), and 6 (*three times per week or more*). Parents were asked to answer these questions for every subject even if the same teacher taught these subjects. Items referring to the same distant teaching activity were summed up indicating how this aspect of distant teaching was realized in general at the school that the rated child attended. Reliabilities were at least satisfactory. We additionally asked parents whether distant teaching was organized via videoconferences according to their child's regular timetable (with the exception of sports). Answering options were *no*, *yes*, and *other*. The item was dummy-coded with *no* and *other* = 0 and *yes* = 1.

Parent Ratings of Student Characteristics. Parents were instructed to compare their child with children of the same age when rating their child's negative emotionality, school engagement, and math and language arts abilities in general. Parents answered all items on a 7-point scale. All items had previously been used in a parent survey (see Steinmayr et al., 2021).

Negative Emotionality. Parents' perception of their child's negative emotionality was assessed with the following four items which were adapted from the *Personality questionnaire for children between the ages of 9 and 14* (Persönlichkeitsfragebogen für Kinder zwischen 9 und 14 Jahren/PFK 9-14; Seitz & Rausche, 2019): "My child is easily annoyed about something," "It is mostly difficult for my child to be patient," and "My child gets angry quickly."

School Engagement. We used the short version of the Behavioral Engagement and Disaffection scales developed by Skinner and colleagues (2008). We assessed behavioral

engagement with the following items: “My child tries hard to do well in school,” “My child listens carefully if someone explains something to her/him,” and “My child always takes an effort to do her/his homework well.”

Math and Language Arts Abilities. Parents’ perception of their child’s abilities in the domain of math was assessed by the following three items (adapted from Lorenz, 2011): “My child is talented in math,” “My child has a good understanding of mathematical relations,” and “My child can solve arithmetic problems well.” Parents’ perception of their child’s ability in the domain of language arts was assessed by the following four items (adapted from Lorenz, 2011): “My child is talented in German,” “My child can understand texts well,” “My child has an extensive vocabulary,” and “My child can read well.”

Social Background. Four items assessed families’ social background. First, we asked for the rater’s highest school leaving certificate. The variable was dummy-coded by recoding no or vocational track leaving certificates as 0 and both academic track school leaving certificates as 1. *Others* were coded as missing. Second, parents indicated if they were born in Germany or in a different country as a measure of migration background. The variable was also dummy-coded with 0 (*born in Germany*) and 1 (*not born in Germany*). Third, we assessed whether the rated child had a bedroom for them and whether the child had a computer or tablet at their disposal for their assignments during the school lockdown (see Wendt et al., 2017). Answer options for the latter two items were 0 (*no*) and 1 (*yes*).

Further Demographics. Additionally, we considered children’s and parents’ age and gender. Gender was dummy-coded with 0 (*male*) and 1 (*female*).

Statistical Analyses

Descriptive statistics and multivariate analyses of variance were calculated with SPSS 28. When conducting MANOVAs to test Hypotheses 1 and 2, we first ran them with demographic variables as covariates as the samples in the first and second lockdowns slightly differ. However, as none of the demographic variables reached statistical significance, the results are presented without covariates. We used Mplus version 7.4 (Muthén & Muthén, 1998–2015) for all other analyses using the same analytical approach as in Steinmayr et al (2021). We accounted for missing data by applying full information maximum likelihood estimation (Enders & Bandalos, 2001). For the structural equation models (SEM), we refer to the comparative fit index (CFI), the root mean square error of approximation (RMSEA) along with its associated CIs, the standardized root mean squared residual (SRMR), and the chi-square test statistic to evaluate

goodness of fit of the tested models (Goodboy & Kline, 2017). The SEMs were set up in the following way: In the first model, parent-rated student’s motivation, competent and independent learning, and learning progress during distant learning were simultaneously regressed on the eight distant teaching activities. Perceived motivation and competent and independent learning were modelled as latent factors and learning progress as a manifest variable. Then, parent-rated student’s motivation, competent and independent learning, and learning progress were additionally regressed on parent-rated child’s general negative emotionality, school engagement, abilities in math and language arts (all modelled as latent factors), dummy-coded parent’s highest school leaving certificate, migration background, possession of a laptop or a tablet during school lockdown, possession of an own bedroom, and child’s and parent’s gender and age (for more details, see ESM 1, Supplement 2). Analyses were run separately for elementary and secondary schools. We checked whether secondary schools differed in the models described below. We found no statistically or practically significant differences. Thus, we decided to perform all analyses for the combined secondary school sample.

Results

Descriptive Statistics and Frequencies

Table 1 displays the results MANOVAs yielded concerning difference in distant teaching activities between measurement points (first and second lockdowns) and elementary and secondary schools. The data used for the first lockdown had already been published in Steinmayr and colleagues (2021). Frequencies of distant teaching activities for the second lockdown are reported in ESM 1, Supplement 3.

The results demonstrated, in line with Hypothesis 1, that the frequency of teaching activities differed between elementary and secondary schools (between different secondary school types, they did not differ statistically significant). Besides *communication with a legal guardian*, all teaching activities were more frequent in secondary schools (see ESM 1, Supplement 3, Table E2). MANOVAs yielded effect sizes ranging between $\eta^2 = .03$ (grading) and $\eta^2 = .35$ (sending tasks). Furthermore, in line with Hypothesis 2, distant teaching activities greatly increased from the first school lockdown to the second school lockdown in both school levels (see also ESM 1, Supplement 4). MANOVAs yielded especially large effect sizes for the frequency by which teacher taught via videoconferences ($\eta^2 = .33$). However, variances for all distant teaching activities were still huge in both school levels.

Table 1. Multivariate analyses of variance with mean frequencies of different distant teaching activities as the dependent variables and type of school (elementary vs. secondary school) and time of measurement (first vs. second lockdown) as independent variables and subsequent univariate analyses of variance

Teaching activities	1. Lockdown				2. Lockdown				ANOVAs					
	M		SD		M		SD		Lockdown		School		Lockdown × school	
	ES	SecS	ES	SecS	ES	SecS	ES	SecS	F	η ²	F	η ²	F	η ²
How often did the following teacher...														
... sent tasks?									281.62	.19	654.93	.35	44.96	.04
Math teacher	3.68	4.00	0.90	0.89	4.15	4.78	0.82	0.92	690.91	.11	398.09	.06	44.99	.01
Language arts teacher	3.68	3.92	0.91	0.90	4.15	4.69	0.80	0.94	666.82	.10	271.54	.04	36.93	.01
English teacher	2.12	3.96	1.35	0.88	3.26	4.67	1.32	0.93	907.92	.14	2,770.04	.34	47.23	.01
Biology/science teacher	2.46	3.29	1.39	1.18	3.58	4.03	1.18	0.88	825.10	.14	385.18	.07	33.77	.01
... sent solutions?									89.57	.07	337.22	.22	3.74	<.01
Math teacher	2.38	3.41	1.59	1.34	2.96	4.05	1.78	1.44	217.01	.04	661.53	.10	0.39	
Language arts teacher	2.31	2.92	1.55	1.53	2.91	3.67	1.78	1.67	235.40	.04	239.24	.04	2.97	
English teacher	1.59	3.12	1.19	1.48	2.38	3.77	1.63	1.58	288.65	.05	1,183.02	.18	2.75	
Biology/science teacher	1.76	2.53	1.32	1.46	2.53	3.29	1.68	1.47	332.34	.06	332.30	.06	0.01	
... requested students' solutions?									313.32	.21	374.93	.24	2.93	<.01
Math teacher	2.40	3.27	1.52	1.45	3.73	4.39	1.44	1.24	1,062.82	.16	408.30	.07	8.20	<.01
Language arts teacher	2.49	3.20	1.50	1.41	3.75	4.35	1.41	1.18	1,077.29	.16	315.59	.05	2.07	
English teacher	1.63	3.22	1.21	1.41	2.91	4.34	1.63	1.18	981.54	.16	1,555.39	.23	4.73	<.01
Biology/science teacher	1.83	2.68	1.29	1.44	3.14	3.76	1.55	1.13	974.29	.16	368.85	.07	8.70	<.01
... gave feedback on students' solutions?									226.81	.16	155.19	.12	7.99	<.01
Math teacher	2.01	2.41	1.40	1.51	3.44	3.39	1.57	1.66	807.19	.13	17.71	<.01	28.11	<.01
Language arts teacher	2.11	2.40	1.43	1.48	3.53	3.34	1.54	1.61	802.25	.13	1.30		34.59	<.01
English teacher	1.42	2.44	1.02	1.49	2.61	3.39	1.65	1.63	613.93	.11	436.13	.08	8.58	<.01
Biology/science teacher	1.57	1.97	1.14	1.35	2.91	2.86	1.62	1.50	750.56	.13	18.40	<.01	28.51	<.01
... graded students' solutions?									57.38	.05	34.97	.03	9.73	<.01
Math teacher	1.15	1.19	0.61	0.71	1.46	1.70	1.12	1.29	220.63	.04	23.92	<.01	12.70	<.01
Language arts teacher	1.16	1.20	0.61	0.72	1.47	1.70	1.12	1.26	214.92	.04	23.64	<.01	11.90	<.01
English teacher	1.08	1.20	0.46	0.73	1.29	1.72	0.89	1.27	175.31	.03	98.64	.02	31.07	<.01
Biology/science teacher	1.09	1.14	0.47	0.59	1.38	1.58	1.00	1.11	220.27	.04	27.23	<.01	10.00	<.01
... taught via videoconference?									572.08	.33	192.01	.14	58.49	.05
Math teacher	1.28	1.80	0.89	1.35	3.05	3.87	2.00	1.70	1963.46	.26	239.18	.04	12.24	<.01
Language arts teacher	1.32	1.67	0.93	1.28	3.19	3.81	2.01	1.71	2,153.55	.28	129.27	.02	9.66	<.01
English teacher	1.12	1.68	0.63	1.26	2.11	3.81	1.72	1.71	1,397.70	.22	735.18	.13	187.49	.04
Biology/science teacher	1.12	1.34	0.61	0.97	2.36	2.92	1.85	1.58	1,321.84	.21	101.74	.02	18.86	<.01
... had contact with the child?									84.60	.07	152.45	.12	4.99	<.01
Math teacher	1.80	2.31	1.29	1.62	2.79	2.93	1.90	1.89	287.10	.05	46.65	<.01	14.87	<.01
Language arts teacher	1.92	2.27	1.30	1.57	2.94	2.95	1.88	1.89	328.90	.06	15.02	<.01	13.34	<.01
English teacher	1.32	2.29	0.92	1.57	2.03	2.88	1.67	1.86	193.70	.04	384.62	.07	1.60	
Biology/science teacher	1.46	1.71	1.06	1.30	2.33	2.35	1.79	1.64	314.34	.06	9.32	<.01	7.42	<.01
... had contact with a parent?									10.39	<.01	239.04	.17	22.57	.02
Math teacher	2.11	1.44	1.35	1.00	2.41	1.26	1.60	0.76	3.64		781.48	.13	55.84	.01
Language arts teacher	2.24	1.44	1.38	0.97	2.50	1.29	1.59	0.80	3.25		951.46	.15	40.67	<.01
English teacher	1.42	1.43	1.00	0.99	1.77	1.23	1.39	0.72	7.03	<.01	84.17	.02	89.64	.02
Biology/science teacher	1.63	1.20	1.20	0.72	2.07	1.11	1.52	0.52	34.52	<.01	575.07	.10	83.85	.02

Note. All F values $p < .05$; exceptions are written in italic letters. *df.* 44,684–15,855. Values written in bold describe the results of the multivariate analyses of variance.

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Indeed, at both elementary and secondary schools, the perceived frequency by parents of all recorded distance learning activities, such as giving feedback, teaching via video conferencing, and the communication with the child, had increased statistically significant from the first lockdown to the second lockdown. However, frequencies were partly still low (see ESM 1, Supplement 3). Only 5.1% of the parents of the elementary school children said that the video conference lessons were given according to the class schedule. This was stated by 24.5% of the parents at secondary schools. Furthermore, many children had not received any distant teaching activity of high quality. For example, at both elementary (19.5%–47.1%) and secondary (24.1%–36.7%) schools, children still did not receive any feedback on their task solutions in the various subjects. In elementary schools, between 41.5% and 68.2% of the parents stated that no lessons had yet taken place via video conference in the assessed subjects (at secondary schools only between 20.1% and 42.1%), although – according to parents – both elementary (75.5%) and secondary (96.8%) schools used Internet platforms for distance learning. Although overall communication with children had also increased from the first lockdown to the second lockdown, many parents indicated that their children had not yet communicated with the teacher in any way (elementary school: 40.9%–69%; secondary schools: 41.1%–58.6%).

All descriptive statistics and bivariate correlations are displayed in ESM 1, Supplement 1 (Table E1). As assumed in Hypothesis 3, most distant teaching activities showed small- to medium-sized positive correlations with students' motivation, competent and independent learning, and learning progress during the school lockdown for elementary and secondary school students. Distant teaching activities just show negligible associations with sociodemographic variables.

Structural Equation Models

First, we tested the measurement model of the distant teaching activities (measurement model depicted in ESM 1, Supplement 2). For the elementary school sample, the model fit was good: $\chi^2(df = 366) = 1852.78, p < .001$; RMSEA = .055 (90% CI: .053; .058); CFI = .950; SRMR = .025. For secondary schools, $\chi^2(df = 366) = 1,135.42, p < .001$;

RMSEA = .032 (90% CI: .030; .035); CFI = .981; SRMR = .014.

Second, we regressed students' motivation, competent and independent learning, and learning progress during the school lockdown on the different teaching activities and students' characteristics (for the results without students' characteristics and demographics, see Supplements 5 and 6 in ESM 1). In the secondary school sample, the item "providing lessons via videoconferences according to the timetable" was additionally included (in Steinmayr et al., 2021, this item was not assessed). However, we did not include it in the elementary school sample as the item barely showed variance. Table 2 displays model fit indices and correlations between residuals for elementary and secondary schools. The model fit was excellent in all models. Table 3 depicts path coefficients from all independent variables to students' motivation, competent and independent learning, and learning progress for the two samples.

In elementary schools, giving feedback, teaching via videoconferences, and communications with a parent were still positively associated with students' motivation and perceived learning progress after controlling for all other variables. Communication with the child displayed an association with these student outcomes and with competent and independent learning. Requesting solutions was negatively associated with elementary students' motivation. However, as this distant teaching activity displayed positive bivariate correlations with students' outcomes (see ESM 1, Supplement 1), this must be due to a suppression effect. Negative emotionality (negatively) and school engagement (positively) predicted all student outcomes after controlling for all other variables with the strongest effects sizes, whereas perceived math and language art competencies were only significant for students' competent and independent learning. Among the demographic and social variables, effects were only found on perceived learning progress: Parents perceived their girls and younger children to learn more. Furthermore, parents with a higher school leaving certificate and/or a migration background, as well as mothers, thought their children to have a higher learning progress during the second school lockdown.

In the secondary school, feedback, videoconferences, and communication with a child predicted all three

Table 2. Model fit indices and intercorrelations between exogenous variables for SEMs regressing distant teaching activities and students' characteristics on students' academic outcomes during the school lockdown for elementary school (ES) and secondary school (Sec)

School type	χ^2 (df)	RMSEA (CI 90%)	SRMR	CFI	$r_{resM \times resC}$	$r_{resM \times resL}$	$r_{resC \times resL}$
ES	3,752.22 (1,290)	.038 (.036–.039)	.024	.956	.520	.492	.256
Sec	3,721.72 (1,322)	.030 (.029–.031)	.022	.965	.462	.584	.206

Note. resM = residual factor motivation, resC = residual factor competent and independent learning, resL = residual learning process.

Table 3. Standardized path weights (β) and standard error (*SE*) of the SEM regressing distant teaching activities on students' academic outcomes during the school lockdown controlling for students' school-related characteristics, socioeconomic background, and parent' and child's age and gender for secondary schools and elementary schools

Model	Elementary school						Secondary school					
	Motivation		CIL		Learning progress		Motivation		CIL		Learning progress	
	β	<i>SE</i>	β	<i>SE</i>	β	<i>SE</i>	β	<i>SE</i>	β	<i>SE</i>	β	<i>SE</i>
Distant teaching activities during the school lockdown												
Tasks	.030	.029	.020	.028	.032	.029	-.046	.056	-.078	.052	-.102	.060
Task solutions	.041	.031	.020	.029	.009	.031	.034	.038	.092*	.036	.092*	.038
Request solutions	-.069*	.034	-.061	.032	-.062	.034	-.046	.046	-.042	.044	.021	.047
Feedback	.091**	.037	.055	.035	.117***	.037	.174***	.043	.134***	.041	.152***	.044
Grading	.013	.028	-.037	.027	.008	.028	.033	.024	-.024	.024	.047	.025
Video	.077**	.031	-.020	.029	.090**	.031	.117**	.038	.153***	.037	.106***	.039
Com. child	.109***	.032	.100***	.031	.095**	.032	.119***	.030	.082**	.029	.082**	.031
Com. parent	.072*	.030	.060*	.028	.086**	.030	.060*	.026	-.024	.025	.112***	.026
Timetable							.080**	.027	.042	.026	.108***	.028
Student characteristics												
Neg. emotionality	-.138***	.032	-.211***	.030	-.092**	.032	-.135***	.029	-.122***	.027	-.019	.030
Engagement	.452***	.038	.135***	.038	.198***	.039	.443***	.032	.097***	.031	.248***	.033
Math competence	-.014	.033	.290***	.031	-.018	.033	.011	.025	.175***	.024	.017	.026
Language competence	-.025	.034	.250***	.032	-.014	.034	.007	.028	.201***	.027	.022	.029
Social background												
HSLC	.040	.027	.039	.026	.085***	.027	.040	.022	.061**	.021	.074**	.022
Migration	-.023	.026	-.038	.025	-.058*	.026	-.001	.022	-.005	.021	-.028	.022
Own room	.028	.027	-.012	.026	.009	.027	.006	.027	-.003	.028	.028	.027
Computer	.031	.026	.030	.026	-.019	.027	.002	.029	.026	.026	.011	.027
Gender and age												
Child's gender	-.004	.028	-.003	.027	.060*	.028	-.012	.023	.031	.023	-.041	.024
Child's age	-.002	.028	.024	.027	-.076**	.027	-.060**	.023	.196***	.023	-.096***	.024
Parent's gender	.006	.027	<.001	.026	.084**	.027	.001	.022	.040	.021	.096***	.022
Parent's age	.048	.029	-.010	.027	.026	.028	-.011	.024	.005	.023	-.048*	.024
<i>R</i> ²	.345 (.027)		.415 (.026)		.156 (.020)		.492 (.022)		.406 (.021)		.296 (.020)	

Note. CIL = competent and independent learning; tasks = sending tasks; tasks solutions = sending task solutions; request solutions = requesting students' solutions; feedback = providing feedback on students' solutions; video = teaching via videoconference; Com. Child = student-teacher communication; Com. Parent = parent-teacher communication; timetable: videoconferences according to the timetable; Neg. emotionality = negative emotionality; engagement = school engagement; math competence = competencies in math; language competence = competencies in language arts; HSLC = highest school leaving certificate; migration = migration background; own room = child has an own bedroom; computer = child has a computer/tablet during the school lockdown. Highest school leaving certificate: 0 = no or vocational track school leaving certificate, 1 = academic track school leaving certificate; migration background: 0 = no, 1 = yes; child has an own bedroom: 0 = no, 1 = yes; child has a computer/tablet: 0 = no, 1 = yes; gender: 0 = male, 1 = female. * $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

student outcomes at strong effect sizes in distant teaching. Furthermore, teaching all subjects (besides sports) according to the timetable incrementally contributed to the prediction of students' motivation and learning progress. Only school engagement was still positively associated with all three student outcomes after controlling for the other variables. Negative emotionality was negatively associated with students' motivation and with competent and independent learning. Students' math and

language arts competencies only incrementally explained variance in students' competent and independent learning. Parents perceived their younger children to work more motivated and learn more during the second school lockdown. However, they also perceived older children to learn more independently and competently. Furthermore, parents with a higher school leaving certificate as well as mothers and younger parents thought their children to have a higher learning progress during the second school

lockdown. Parents with a higher school leaving certificate additionally reported that their children learnt more independently and competently. Thus, in line with Hypothesis 4, those distant teaching activities that directly practice or involve direct forms of interpersonal feedback and communication particularly contributed to students' academic outcomes during the school lockdown. However, in line with Hypothesis 5, children's characteristics additionally contributed to students' academic outcomes during the school lockdown.

Discussion

This study contributes to current literature on learning during times of distance teaching by examining how the realization of distant teaching changed from the first school lockdown to the second school lockdown and how various features of distance teaching were related to different academic outcomes among elementary and secondary school students using parent reports.

Comparison of the First and Second Lockdowns

Our findings show that – as indicated by other studies (Wößmann et al., 2021) – the frequency of distant teaching activities increased from the first school lockdown to the second school lockdown. Thus, in contrast to other countries such as Spain (Alves et al., 2022), the situation improved in Germany. However, compared to other studies, we show a detailed picture of how often different distant teaching activities were realized in different subjects. Contact with a parent increased statistically significant from the first lockdown to the second lockdown but did not reach the effect size of a small effect. The largest effect size was found for teaching via videoconference, which might be a hint that the investments in digital devices such as teacher laptops and in educating teachers paid off in terms of more frequent videoconferences. However, although most teachers should have been able to teach via videoconferences in the second lockdown, quite a lot of teachers at secondary schools and even more at elementary schools did not do so or if just once a week.

Distant Teaching Activities and Student Outcomes

Most correlations between reported distant teaching activities and motivation, competent and independent

teaching, and perceived learning progress were positive. However, different result patterns emerged between elementary and secondary schools. Distant teaching activities explained less variance in elementary student outcomes than in the secondary school. Interestingly, those distant teaching activities related most strongly to parent-reported students' outcomes during the second school lockdown that had the potential to cognitively activate students and to support learning. Thus, in line with prior findings on the first school lockdown (Schneider et al., 2021), our results also indicate that social contact and feedback matter most. Overall, less variance was explained by distant teaching activities in the elementary than in the secondary school sample (see ESM 1, Supplement 6). A possible explanation why distant teaching activities do not seem to make a great difference concerning elementary school learning are that elementary school children strive less for autonomy (Deci & Ryan, 2013) and might still need more direct instructions as their self-regulation is still developing (McClelland et al., 2018), which is less possible by distant teaching activities. Our results also showed that the provision of feedback mattered for both elementary and secondary students' motivation and learning progress. Interestingly, sending solutions only had a (positive) impact on competent and independent learning and perceived learning progress for secondary school learners. An explanation for this finding might be that adolescent learners might already have developed a certain level of self-regulation skills that enables them to compare their own solutions to the solutions that teachers have sent them, whereas younger children might still need to develop these skills of self-regulated learning. Research suggests that childhood is a sensitive period in which self-regulatory skills are shaped by contextual factors, such as schools and teachers (McClelland et al., 2018). Thus, when planning their instruction during times of distant teaching, teachers need to consider academic needs of the children in their learning groups. Our findings suggest that although adolescents can work well with prepared solutions, children need different forms of contact to their teachers such as feedback or direct communication with parents.

Students' Characteristics, Sociodemographic Variables, and Student Outcomes

A comparison of explained variance by teaching activities alone (ESM 1, Supplement 6) and teaching activities plus all covariates (Table 3) demonstrates that students' characteristics explained most variance in all students' outcomes in the elementary school and in competent and independent learning in the secondary school during homeschooling among all relevant variables. Among

students' characteristics, negative emotionality and school engagement explained most variance, whereas math and language art competencies were less relevant. Parents reported sociodemographic background contributed to the prediction of students' motivation, competencies, and learning progress during homeschooling. Parents with an academic school leaving certificate reported more positive student outcomes, which is in line with various studies that demonstrated that children from low SES households suffered the most during school lockdowns (e.g., Ravens-Sieberer et al., 2022). Thus, not only do students academically benefit from their parents' academic education in regular face-to-face schooling but also during homeschooling.

Limitations

A limitation of this study was that we used a cross-sectional design. Thus, the direction of the presented relations between distant teaching activities and student outcomes is unclear. However, as previous studies longitudinally demonstrated an impact of teaching activities on students' motivation and achievement (e.g., Lazarides & Buchholz, 2019), it might well be that teachers' distant teaching activities impacted on students' academic outcomes during the school lockdown. Furthermore, common method bias might have influenced our results because parents reported the teaching methods under investigation and also reported the student outcomes. Thus, the relations that we found in our study might be overestimated due to common method bias. Additionally, we had a slight overrepresentation of academic track schools in our sample (Gymnasium), which might have affected our results when comparing elementary and secondary school students (Hypothesis 1) as mostly high-achieving students attend academic track schools. Moreover, we were not able to assess whether our data had a nested school structure because due to data protection, we were not able to ask parents which school their child was attending. Furthermore, as we carried out an online survey during school closures and did not ask students in classrooms, we also do not have any information about whether students attended the same classrooms.

Another limitation refers to the operationalization of migration background, which would have been more valid if we had referred to the language spoken at home. Finally, children's and parents' gender and age were considered in our analyses but no other variables such as socioeconomic status (besides the school leaving certificate) or parental educational level – both variables that were shown to be of relevance during distant teaching with children from less-educated families with lower economic status made less progress over time than students in higher SES schools

(e.g., Segers et al., 2022). Furthermore, socially disadvantaged children also faced higher risks of worsened mental health (Ng & Ng, 2022).

Practical Implications

As the current study clearly demonstrated the importance of direct forms of contact between teachers and pupils for all age groups, and especially the younger children, the political decision to keep schools and other forms of childcare/day-care open at all costs is timely and appropriate. This will contribute not only to students' academic learning success but also to their emotional well-being and mental health – crucial factors that are strongly impaired due to the pandemic and former lockdowns (Ravens-Sieberer et al., 2022) and that will take time to recover. Regular schooling and contact with peers and friends will support such a recovery.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at <https://doi.org/10.1027/2151-2604/a000528>

ESM 1. Table E1: Descriptive statistics of all variables. **Table E2:** Frequencies of all distant teaching activities. **Table E3:** Model fit indices and intercorrelations between exogenous variables for structure equation models. **Table E4:** Path weights of the structure equation model (SEM) regressing distant teaching activities.

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Publication Ethics

The project is in accordance with established ethical guidelines for psychological research. The study was approved by the local review board at Philipps University Marburg. All participants provided written informed consent in accordance with the Declaration of Helsinki and its later amendments. Participation was voluntary.

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