

# **School-level variation in distance learning practices during the COVID-19 pandemic in Finland**

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# DISTANCE LEARNING PRACTICES IN FINNISH SCHOOLS DURING COVID-19 PANDEMIC

## **Abstract**

The COVID-19 pandemic forced most countries to close schools and rapidly transfer to distance learning without preparation. Our study tests the hypothesis that educational equity has been threatened during the pandemic because of high school-level variation in distance learning practices. Our study is conducted in Finland, a country known for its low school segregation. The theory of transactional distance suggests that in distance learning situations the expected level of autonomy of the target group (pupils) should be considered in the design of structure and dialogue between teachers and learners. Therefore, in lower secondary and especially primary education, distance learning should be highly structured and dialogic. In order to evaluate the extent of school-level variation in distance learning practices, we applied multilevel structural equation modelling to nationally representative survey data from pupils in grades 4 to 10 ( $N = 61974$ ) and parents of children in grades 1 to 10 ( $N = 39186$ ) in basic education schools. The results show that the two dimensions (structure, dialogue) contributing to transactional distance were separate, yet strongly associated. Distance learning was on average less structured in primary grades even though younger children would require stronger support to be autonomous learners. Differences between schools were larger in lower secondary education. They were partly explained by parents' educational level; thus, educational equity was compromised. Based on the results and theory, we provide recommendations for schools on how to prepare for future exceptional circumstances.

*Keywords:* distance learning, COVID-19, Finland, primary education, lower secondary education, theory of transactional distance

**7972 WORDS**

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## 1. Introduction

The COVID-19 pandemic forced countries to close schools and implement distance learning practices almost overnight. Due to variation in school-level experience with distance learning and pupils' unequal access to digital devices and online platforms, the quick transition challenged even well-functioning education systems. Because of the decentralised education system, schools and municipalities in Finland could implement different strategies in this unexpected situation. This study investigates the effects of school closures in 2020 in Finland, a country known for its high educational equity and small between-school variation in learning outcomes. This is the first large-scale attempt to produce nationally representative results on the school-level variation of distance learning practices in Finnish basic education schools. By using Moore's theory of transactional distance (2013), the study provides internationally valuable information about the implementation of distance learning for possible future school closures.

### 1.1 School closures during the COVID-19 outbreak

The COVID-19 pandemic closed schools nationally in 106 countries and affected more than one billion pupils. Most other countries implemented at least localised or partial closures (UNESCO, 2020). Finland began its two-month closure in March based on the government's decision. Schools were reopened for the last two weeks of the school year in May.

The school closures were a dramatic action, which have been criticised e.g. by experts of children's and adolescents' mental health. When writing this article, the most cited scientific source was the rapid systematic review by Viner and colleagues (2020), which included recent modelling studies about the current situation and the actual outcomes of the earlier SARS outbreak. The evidence was partially controversial regarding the COVID-19 modelling studies, but the overall effect of school closures on the spreading of coronaviruses

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was marginal. The adverse effects of social isolation, parents' staying at home with children, and the lack of support for disadvantaged children were considered to be larger than the benefits (Viner et al., 2020).

Another rapid review (Loades et al., 2020) focused on the adverse effects of social isolation and loneliness on the mental health of children and adolescents. Based on 63 studies (one pandemic-specific), the authors found clear effects of social isolation and loneliness on later mental health problems. Additionally, the pandemic-specific study about the effects of quarantine and social isolation revealed post-traumatic stress symptoms. The length of loneliness and isolation predicted the severity of mental health symptoms, which is why the authors recommended other social distancing methods in schools. Nevertheless, preventative clinical support and the utilisation of virtual social contacts when organising distance learning were recommended to diminish the negative effects on mental health (Loades et al., 2020).

### **1.2 Distance learning during the school closure**

Distance learning processes and practices have often been analysed using Moore's theory of transactional distance (Moore, 2013) developed in the early 1970s, decades before the emerge of current distance learning practices. Yet, it has successfully been implemented and further developed in numerous studies (see review in Moore, 2013). Even though the theory has received some critique for low empirical support and potential unidimensionality (Gorsky & Gaspi, 2005), it remains one of the dominant frameworks for understanding and designing distance learning. Therefore, we used the elaborated version of it as the theoretical framework of our study.

Moore (2013) defines the *transaction* in distance education as “*the interplay of teachers and learners in environments that have the special characteristic of their being spatially separate from one another*”. According to *transactional distance*, the degree of structure,

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dialogue and autonomy of the learning situation is a continuum in which the actual distance is determined as a relative outcome of structure and dialogue. A tighter structure and more regular dialogue between teachers and learners reduce transactional distance even with greater physical distance. The greater the transactional distance, the more learner autonomy is required. Learner autonomy refers to a pupil's capacity for self-directed learning, which increases with age (cf, van de Pol, Volman, & Beishuizen, 2010). Distance learning situations should therefore be designed considering the balance of structure and dialogue suitable for the target learner population and the content of learning (Moore, 2013).

Internationally, some non-theory-driven research has already been published about distance learning practices during the COVID-19 pandemic. Huber and Helm (2020) administered a barometer survey in Austria, Germany and German-speaking Switzerland. Similar to Finland, education was quickly transferred online in these three countries in mid-March and in Germany and Switzerland, there was relatively little national steering of practices due to the strong autonomy of states (Germany) or cantons (Switzerland). Another relevant comparison point for Finland is the study about distance learning practices in Norway (Federici and Vika 2020), which showed differences between primary and lower secondary educational levels in how distance learning was organised and pupils and parents received communication. It also revealed school-level differences in how vulnerable children were identified and supported during the distance learning period.

In the study of Huber and Helm (2020), pupils' self-reported effort in schoolwork (measured by learning time) was predicted by regular daily routines, a lack of challenges in planning their own day, time spent on sports, teachers' monitoring of pupils' tasks and pupils' feeling that they learned more now compared to usual. This means that pupils' effort was explained by structure and dialogue-related variables. Overall, the authors found low levels of

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commitment to learning at home; less than a third of pupils spent more than 5 hours a day on schoolwork, indicating that lower secondary pupils were not highly autonomous learners. Tran and colleagues (2020) observed similar results in Vietnam about students' learning habits during school closures. Compared to older pupils, younger pupils reported more frequent online learning and receiving of some kind of instruction (Tran et al., 2020), which fits well with the assumption that younger learners need more structure and support (Moore, 2013; van de Pol et al., 2010; Tennant et al., 2015). Huber and Helm (2020) suggested that the great variation in pupils' learning time may partly be explained by teachers' varying capacity to teach online and use digital devices (i.e., resulting in a lack of both structure and dialogue). This finding was supported by a small-scale qualitative study of German geography teachers who returned to traditional textbooks instead of using diverse educational media to create equal learning opportunities for students with varying access to digital devices (Bagoly-Simó, Hartmann, & Reinke, 2020).

Some evidence from the COVID-19 school closures shows that distance learning methods in terms of structure and dialogue and the demand of learner autonomy are related to pupils' learning outcomes. In a quasi-experimental Chinese study, Cai, Wang, Xu, & Zhou (2020) compared pupil-centred, highly structured self-regulated online learning based on pupils' collaboration and continuous teacher-pupil interaction to teacher-centred delivery of online lessons and assigning tasks to pupils. Compared to "usual" online teaching and task assignment, the pupil-centred approach yielded better learning outcomes as measured by standardised tests in all assessed domains (Chinese, Math, English). However, in Math and English, none of the groups reached the predefined target performance level, leading the researchers to discuss the varying suitability of the method to different school subjects (Cai et al., 2020). In Finland, highly teacher-centred teaching methods are no longer favoured under

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normal circumstances, but we hypothesise that during the school closures, like in Germany (Bagoly-Simó et al., 2020), some teachers and schools may have returned to more traditional teaching approaches and delivery of learning tasks and instruction. Furthermore, we assume that we will find differences in the extent pupils have experienced responsive online instruction and timely monitoring of their learning process instead of mechanical delivery of tasks to be completed independently. Overall, the few already published studies about distance learning practices demonstrate a great variety of approaches internationally and they reveal that the worries expressed in public discussions about the quality of education and the adverse effects of school closures on educational equality and children's well-being (e.g., Armitage & Nellums, 2020; Clemens et al., 2020) must be taken seriously.

### **1.3 Educational equity and equality in Finland**

The Nordic countries have had relatively similar basic education systems based on educational equity and equality (Antikainen 2006; Telhaug, Medås & Aasen 2006). Here *equity* refers to access to services and resources regardless of the student's background, including support for compensating for initial differences and disadvantages (Willms, Tramonte, Duarte, & Bos, 2012). *Equality*, instead, can be measured by the learning outcomes of subpopulations, e.g. girls and boys or students from different socioeconomic backgrounds (Willms et al., 2012). A central mechanism producing inequity and inequality is school segregation, which Willms (2010) divides into two categories: *horizontal segregation* (the distribution of pupils from different socioeconomic backgrounds) and *vertical segregation* (the distribution of pupils at different performance levels in different schools). The best-performing education systems, based on PISA studies, have low horizontal segregation (i.e., schools are heterogeneous when it comes to pupils' family background (Willms, 2010)). In this kind of education system, relatively similar educational practices and support services

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should be available for all pupils, just as the Nordic educational ideology requires. However, among the countries included in Willms' comparison, Finland was exceptional because school-level performance differences (vertical segregation) were even smaller than background-related differences.

The uniform outcomes of Finnish basic education schools have, however, not resulted from tight national steering. The education system is decentralised and, with the municipalities as organisers, schools and teachers have the freedom to adjust the national curriculum to meet local needs. Normally this has proven to be a good strategy, but did this work during the exceptional, unexpected school closures? If the Finnish education system is as equal as it claims to be, we should not find systematic school-level differences in distance learning practices.

### 1.4 Research questions and hypotheses

This study aims to evaluate the extent of school-level variation in distance learning practices as reported by Finnish pupils and parents. We studied the following questions:

RQ1. During the COVID-19 school closures, was there systematic school-level variation in the distance learning experiences of primary and lower secondary grade pupils and their parents in terms of structure, dialogue and demand for pupil autonomy? *Hypothesis:* Compared to normal circumstances, there has been considerably more variation between schools than expected in organising learning during the school closures. Thus, educational equity has not been met to the desired extent in terms of equal access to services.

RQ2. Are the observed school-level differences in distance learning practices explained by pupils' socioeconomic background? *Hypothesis:* The school-level variation in distance learning practices is related to pupils' background in the school, posing a more serious threat to educational equity.



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## 2. Methods

The study started in April 2020 through discussion with local and national education authorities. First, a collaboration agreement was made with 16 mid-sized municipalities in Southern Finland, after which the Ministry of Education and Culture supported the extension to the whole country. Research permits were obtained for the 16 original municipalities and from the ministry for the rest of the country. School leaders (i.e. principals) were contacted for school-level research permits. Schools from large cities were somewhat more reluctant to participate due to stricter municipal-level policies concerning research participation, resulting in some data loss.

The data were collected online using Qualtrics survey system during the last two weeks of the school year in May when the pupils had returned to school. The electronic questionnaires were available in both national languages (Finnish, Swedish). Links were delivered to the different respondent groups (pupils, parents, teachers, pupil welfare personnel and other supporting staff, and principals) through principals using the usual communication channels of the school. Participation was voluntary and parents could prevent their child from participating. Most pupils answered the questionnaire during school hours using their personal mobile phone, but it was possible to answer the questionnaire at home. The data were collected anonymously, but all respondent groups were informed that school and municipality identification codes were included in the response. Afterwards, the data from different respondent groups were linked at school level.

The design of our study was similar to Huber and Helm's (2020) school barometer. They defined a barometer survey as having four characteristics: first, it assesses conditions and practices related to a current social phenomenon instead of evaluating institutions.

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Second, it provides action-relevant information to different stakeholders and target groups.

Third, the data are collected quickly while the phenomenon is acute to allow for data-informed actions. Finally, multi-perspectivity is used by including several respondent groups to describe the phenomenon. In this article, we use data from pupils and parents.

### 2.1 Participants

#### 2.1.1 Pupils.

The pupil questionnaire was distributed to pupils in grades 4 to 9 as well as to pupils taking an additional 10<sup>th</sup> school year within basic education. Altogether 61974 pupils corresponding to approximately 10% of the entire pupil population answered the survey. The pupils were from 886 different schools (232 codes missing) representing 41% of the 2187 basic education schools. Thus, the missingness occurred largely at school level due to principals not distributing the survey further. The participating schools were in 226 out of 310 municipalities (73%; 36 codes missing), which means that the sample can nevertheless be interpreted as nationally representative. Most pupils (89%) answered in Finnish and 11% in Swedish (twice as much as the proportion of Swedish-speaking population in Finland). About 3% of pupils did not have either Finnish or Swedish as a native language. The sample is presented by grade level and gender in Table 1.

*Table 1.*  
*Participating pupils by grade level and gender.*

Grade	N	Gender	N
4	7 884		
5	8 804		
6	9 501		
7	12 410		
8	12 021	Girl	33 617
9	11 091	Boy	27 104
10	132	Other	1 194
Missing	131	Missing	59

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Total	61 974	Total	61 974
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### 2.1.2 Parents.

The parent questionnaire was distributed to all parents regardless of the child's grade level. Parents were instructed to answer the questions thinking about the child that goes to the school that distributed the link. In case of several children in the same school, parents were instructed to think about their first child according to alphabetical order unless they wanted to answer the questionnaire multiple times. The 39186 parent responses were linked to 922 schools (7 codes missing; 42% of all schools in Finland) and 227 municipalities (73% of all municipalities; 6 codes missing). Table 2 shows that the distribution of respondents' children in different grade levels was quite equal, but most answers were given by mothers.

*Table 2.*  
*Participating parents by child's grade level and parent's role.*

Grade	N	Role	N
1	4 290		
2	4 081		
3	4 173		
4	4 417		
5	4 283		
6	4 076		
7	4 857		
8	4 570	Mother	31 806
9	4 269	Father	4 662
10*	32	Other caregiver	420
Missing	138	Missing	2 298
Total	39 186	Total	39 186

\*voluntary basic education

## 2.2 Measures

All pupils answered a set of statements regarding their experiences of distance learning practices. They were asked to evaluate to what extent the instruction was organised according to the schedule (entirely, partially, not at all) and to what extent they actually participated in

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instruction (Likert 1 = All the time to 5 = Not at all). They rated the amount and difficulty of learning tasks during the school closures on a Likert scale 1 = clearly fewer/easier tasks to 5 = clearly more/more difficult tasks. A similar one-item scale was used for self-reported learning outcome (Compared to usual, I learned 1 = clearly less to 5 = clearly more). The same scale was used for evaluating the amount of support they received from teachers during the school closures. Learning time was measured by the question, “How much time did you typically spend on schoolwork in one day?” (less than half an hour, about one hour, about 2-3 hours, 4-5 hours, 6-7 hours, 8 hours or more). One-item scales were used to keep the questionnaire short for primary school children in spite of limitations for analyses. In grades 7 to 10, we presented an additional set of statements about the frequency of online instruction and written assignments, as well as teachers’ availability on agreed times as single Likert scale items (1 = every lesson to 5 = not at all) separately for Finnish/Swedish language, mathematics and first foreign language (usually English). The subject-based ratings were used in forming factors for the three measured dimensions. Pupils also rated their own activity in submitting tasks back to teachers and the rate of completing tasks (1 = All tasks to 5 = I didn’t submit/complete any task). There were only used in descriptive analyses.

The parent questionnaire included nine items for evaluating the school’s distance learning practices from the perspective of homes. All items were answered on a Likert scale 1 = Not at all to 7 = Every lesson. The items were developed for this study and they measured structure (schedule, requirement of participation in online teaching, lesson-based tasks and task submission control) and dialogue (teacher’s availability and activity in communicating with the child about his/her progress; cf., Moore, 2013) as well as more passive assignment-based teaching method (tasks given as larger sets, task submission control not tied to schedule). Parents were also asked to evaluate their child’s learning progress during the

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school closure (1 = Clearly worse than usual to 5 = Clearly better than usual). As an indicator of the family's socioeconomic background, respondents reported their and the possible other parent's highest educational level. Based on both items, an index for parents' average educational level was calculated. The values varied from 1 (both parents had lower secondary level education) to 5 (both parents had PhD level education). The index was normally distributed ( $M = 2.77$ ,  $SD = .84$ ).

### 2.3 Statistical methods

First, descriptive statistics were calculated for the variables and t-tests (and a Mann-Whitney U test for one categorical variable) performed in SPSS 26 to initially evaluate the differences between primary and lower secondary levels regarding all pupil and parent indicators. The actual results were analysed by two-level models in Mplus. We used Maximum Likelihood Robust (MLR) estimation to handle the slightly non-normal distribution of some variables (Lai, 2018). Intraclass correlations were estimated to evaluate the amount of school-level variance for each variable for pupils and parents separately. The lower secondary pupil data about subject-related practices and the parent data were analysed with two-level confirmatory factor analyses (CFA) to identify the dimensions of online instruction, written assignments and teacher's availability (pupil data), and of structure, dialogue and written assignments (parent data), and to study school-level correlations between the factors. Factor loadings were constrained equal to have comparable factors across levels. The second research question was answered by adding the index for parents' education as a predictor of the parent factors at both levels.

$CFI$  and  $TLI > .95$  and  $RMSEA < .06$  were used as criteria for an acceptable model. The parent models were tested for all respondents and for primary (grades 1 to 6) and lower secondary (grades 7 to 10) levels in multiple group analysis. Measurement invariance was

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tested by first constraining factor loadings and then intercepts equally across groups and studying the changes in fit indices.

### 3. Results

The first hypothesis assumed that there would be considerable school-level variation in how distance learning was organised. Table 3 with descriptive statistics of pupil and parent variables shows that the overall responses were more positive than negative, but the standard deviation particularly of parent responses was large. In pupils' responses, the frequency of online instruction had the largest standard deviation and most negative values (larger values mean less). Due to large sample sizes, all differences between primary and secondary grades were statistically significant ( $p < .001$ ).

*Table 3.*  
*Descriptive statistics for analysis by pupil's grade level (primary vs. secondary)*

<b>Pupil</b>	<b>Primary school</b>			<b>Lower secondary school</b>		
	<b>N</b>	<b>M</b>	<b>SD</b>	<b>N</b>	<b>M</b>	<b>SD</b>
Self-reported learning outcomes	25124	2.81	.91	32935	2.58	1.02
Following the schedule	25199	1.82	.60	32975	1.65	.61
Participation in instruction	25227	1.37	.75	33016	1.46	.76
Number of tasks	25137	2.94	1.19	32973	3.58	1.24
Difficulty of tasks	25133	2.91	.88	32967	3.31	.89
Received support	25104	2.93	.85	32870	2.68	.88
Frequency of online instruction	Finnish/Swedish:			32070	2.92	1.36
Written assignments given				32008	1.92	1.17
Teacher available at agreed-upon times				31923	1.87	1.11
Submitting assignments to teachers				31953	1.45	.80
Completion of given assignments				31950	1.48	.79
Frequency of online instruction	Mathematics:			31628	2.39	1.36
Written assignments given				31581	1.77	1.21
Teacher available at agreed-upon times				31540	1.68	1.00
Submitting assignments to teachers				31568	1.48	.85
Completion of given assignments				31570	1.60	.86

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	First foreign language:					
Frequency of online instruction				31077	2.71	1.39
Written assignments given				31008	1.74	1.11
Teacher available at agreed-upon times				30962	2.01	1.17
Submitting assignments to teachers				30982	1.45	.82
Completion of given assignments				30988	1.48	.841
		<b>Primary school</b>		<b>Lower secondary school</b>		
<b>Parent data</b>	<b>N</b>	<b>M</b>	<b>SD</b>	<b>N</b>	<b>M</b>	<b>SD</b>
Parent-reported learning progress	25142	3.01	.89	13662	3.08	1.03
Parents' educational level						
Following the schedule	22137	5.19	1.74	11986	5.72	1.47
Required participation in online instruction	23183	4.60	2.01	12573	5.23	1.65
Assignments given separately for each lesson	22696	4.83	2.13	11663	5.42	1.50
Assignment submission required during each lesson	22120	3.48	2.10	11327	4.31	1.75
Teacher available at agreed-upon times	23121	5.43	1.68	11881	5.56	1.45
Teacher communicates frequently with the child about progress	23495	5.18	1.65	11937	4.83	1.74
Assignments given as larger packages, not lesson-based	23005	5.37	1.99	10683	3.64	1.95
Assignment submission required, but not lesson-based	21981	5.10	1.75	11250	4.94	1.49

Distribution of learning time is displayed in Figure 1. Primary school pupils typically spent 2-3 hours a day on learning, whereas in lower secondary grades 4-5 hours was equally common. The difference between the grades was statistically significantly ( $\chi^2 = 5437.20$ ,  $df = 5$ ,  $p < .001$ ).

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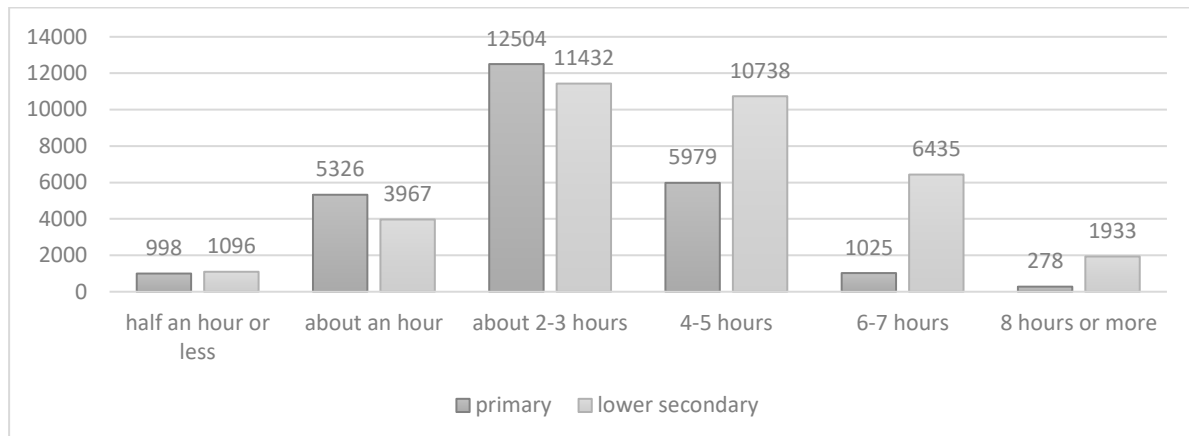


Figure 1. Daily learning time during the school closures

Table 4 presents the school-level variation by pupil variables as measured by intraclass correlation in two-level models without predictors. Pupils' self-reported learning outcome did not have considerable school-level variation and neither did the pupils' evaluation of the amount of support they received from teachers. The number of tasks varied only slightly at school level when primary and secondary grades were analysed separately, but across all pupils, the intraclass correlation was larger. This is likely caused by the existence of joint primary and secondary schools in the data, which strengthened the school effect. A similar phenomenon was observed for learning time, which to some extent depended on the school, particularly in the analysis across all grade levels. In subject-based items presented only to lower secondary-level pupils, intraclass correlations were not very high for the rate of completing tasks and submitting them to teachers.



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*Table 4.*

*Intraclass correlations of the pupil-level variables describing distance learning practices and pupil outcomes*

<b>Pupil outcomes</b>	<b>Primary education</b>	<b>Lower secondary education</b>	<b>All</b>
Daily learning time	.09	.07	.11
Self-reported learning outcome	.01	.01	.02
<b>Distance learning practices, all grades</b>	<b>Primary education</b>	<b>Lower secondary education</b>	<b>All</b>
Following the schedule	.09	.21	.14
Participation in instruction	.11	.08	.08
Number of tasks	.05	.04	.09
Difficulty of tasks	.02	.02	.06
Received support	.01	.01	.03
<b>Distance learning practices by school subject, lower secondary grades only</b>	<b>Finnish</b>	<b>Math</b>	<b>English</b>
Frequency of online instruction	.41	.32	.37
Written assignments given	.11	.09	.08
Teacher available at agreed-upon times	.14	.13	.14
Submitting assignments to teachers	.04	.07	.08
Completion of given assignments	.04	.04	.04

In primary school grades, the strongest school-level effects were found for daily learning time, the extent of following the schedule and the rate of participation in instruction. However, ICCs around .10 cannot be considered very high even though they support our hypothesis about systematic school-level practices even at primary school level.

In lower secondary grades, there was considerably more school-level variation in the extent the schedule was followed. Teachers' availability during agreed time in different school subjects seemed to depend on school to some extent as well as the frequency of getting written assignments. For frequency of online instruction, intraclass correlations were large for all measured school subjects. This together with other results indicates that there were

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considerable differences in how distance learning was organised in Finnish schools particularly in lower secondary grades.

We continued the analysis of subject-specific lower secondary school data with CFA beyond single-item indicators to identify more generalisable patterns of school-level differences. As submission of tasks to teachers and the rate of completing tasks had lower school-level variation and initial analyses also showed the incompatibility of the items for factoring, we focused on the frequency of online instruction and teachers' availability, measuring the dialogue dimension of transactional distance, and the frequency of receiving written assignments. First, we specified a two-level measurement model with individual and school-level factors for the three properties of distance learning across different school subjects, but the model did not fit the data at the individual level. This was due to moderate subject-specific residual correlations. By allowing the teacher's availability to correlate with online instruction and written assignments within each subject at individual level, the model fit the data acceptably (baseline model  $CFI = .971$ ,  $TLI = .951$ ,  $RMSEA = .020$ , factor loadings equal across levels  $CFI = .971$ ,  $TLI = .956$ ,  $RMSEA = .019$ ). The variances of all factors were statistically significant at both levels. Frequency of online instruction across subjects had more variance at school level (.38 vs. .17), whereas for teacher availability and written assignments the situation was the opposite (.10 vs .41 and .07 vs .45). At the school level, frequency of online teaching and teachers' availability had a strong positive correlation ( $r = .91$ ,  $p < .001$ ) and the frequency of receiving written assignments was negatively associated with online instruction ( $- .43$ ,  $p < .001$ ) and teacher's availability ( $- .16$ ,  $p = .11$ ; not statistically significant). Thus, schools had clearly different approaches to dialogic distance learning. This finding was confirmed across school subjects. When the school-level variation was taken into account, individual-level correlations were all positive ( $r = .22 - .42$ ,  $p < .001$ ),

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indicating that there were individual differences in pupil experiences. The pupil data strongly supported our first hypothesis.

Next, we ran empty two-level models on parent data. Overall, intraclass correlations were larger compared to pupil data, but learning progress had no school-level variation in parents' reports. The greatest school-level variation was observed in the extent to which schools had required their children to participate in online instruction. The ICC was particularly high for lower secondary grades. Schedule-based teaching, assignment control, and teachers' availability also varied by school, especially in secondary grades. In primary grades, there was more school-level variation in the practice of delivering tasks to pupils as larger non-lesson-based sets.

*Table 5.*  
*Intraclass correlations of the parent-level variables describing distance learning practices*

	<b>Primary education</b>	<b>Lower secondary education</b>	<b>All</b>
<b>Pupil outcomes and background</b>			
Parent-reported learning progress	.01	.02	.01
Parents' average educational level	.14	.14	.13
	<b>Primary education</b>	<b>Lower secondary education</b>	<b>All</b>
<b>Distance learning practices</b>			
Following the schedule	.08	.18	.10
Participation in online instruction required	.17	.30	.20
Assignments given separately for each lesson	.04	.15	.06
Assignment submission required during each lesson	.07	.16	.10
Teacher available at agreed-upon times	.09	.14	.10
Teacher communicates frequently with the child about progress	.07	.11	.08
Assignments given as larger packages, not lesson-based	.13	.09	.18
Assignment submission required, but not lesson-based	.04	.05	.04

We extended the analysis beyond reporting single indicators by specifying a two-level measurement model using the two dimensions of transactional distance theory, structure and

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dialogue. The two items for non-lesson-based delivery of tasks were excluded from the model due to theoretical and model fit issues. We had to allow a cross-loading on the requirement of participation in instruction for both factors, and a residual correlation of it with the schedule item at both levels to reach a satisfactory model fit. Table 6 shows that the model was sufficiently measurement invariant across levels and across primary and secondary grades.

*Table 6.*  
*Measurement invariance of parent factors across levels and child's grade level*

<b>Level</b>	<b>Factor</b>	<b>CFI</b>	<b>TLI</b>	<b>RMSEA</b>
<b>All</b>	Baseline model	.989	.973	.028
	Factor loadings constrained equal across levels	.988	.979	.025
<b>Grouping</b>	Baseline model with factor loadings crossed equal across levels but not groups	.987	.977	.027
<b>primary vs. lower secondary</b>	Factor loadings constrained equal across levels and groups	.984	.975	.028
	Intercepts constrained equal	.977	.968	.032

In multiple-group testing, variances were statistically significant at school and individual level in both educational levels for structure (primary: .175 vs. 1.419; lower secondary: .392 vs. .865) and dialogue (primary: .150 vs. 1.226; lower secondary: .247 vs. .935). The relative proportion of school-level variance was much higher in lower secondary grades. The latent mean of the lower secondary group was statistically significantly higher ( $M = .597$ ,  $p < .001$ ) for structure, but not for dialogue ( $M = -.018$ , ns.). The two factors correlated strongly at both levels in both groups (primary:  $r = .80$  and  $r = .71$ ; lower secondary  $r = .93$  and  $r = .80$  for school and individual level, respectively,  $p < .001$ ), but two factors nevertheless existed as a unidimensional measurement model did not fit the data. The results indicate that while distance education was more structured at the lower secondary level than in primary education, its school-level variation was also much larger.

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Our second research question deepened the perspective of educational equity by looking at possible background-related effects on the observed differences, as there was some horizontal segregation of schools in terms of socioeconomic background (measured by both parents' education (see Table 5). It was added as a predictor in the multiple-group model at individual level and as a school-level aggregate at school level. The model fit the data well ( $CFI = .972$ ,  $TLI = .960$ ,  $RMSEA = .031$ ). The parents' educational level did not predict school-level variation of structure and dialogue in primary education ( $\beta = .04$  and  $\beta = -.04$ , ns.), but in secondary education parents with a higher average educational level reported the teaching to be slightly more structured and dialogic ( $\beta = .15$  and  $\beta = .17$ ,  $p < .05$ ). At individual level parents' higher education predicted lower values both at the primary ( $\beta = -.19$  and  $\beta = -.17$ ,  $p < .001$ ) and secondary level ( $\beta = -.17$  and  $\beta = -.18$ ,  $p < .001$ , for structure and dialogue, respectively), indicating that within schools, children with a more disadvantaged background have received more attention from their teachers. The results gave some support to our hypothesis that the variation in distance learning practices is related to pupils' socioeconomic background even at school level.

### 4. Discussion

The aim of this study was to evaluate whether school closures compromised the equality of the Finnish education system and to analyse the implemented distance learning practices in order to provide recommendations for schools to consider in corresponding future situations. We analysed nationally representative survey responses of 61794 grade 4 – 10 pupils and 39186 parents of children in grades 1 to 10 using the theory of transactional distance (Moore, 2013).

The hypothesis was that systematic school-level differences in distance learning practices in Finnish schools would be larger than the small school-level variance observed in

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various pupil outcomes in national and international assessment studies (OECD, 2019; Vainikainen, 2014; Willms, 2010). Typically, school-level effects have accounted for about 5% – 8% of variance in performance measures and in studies measuring attitudes, beliefs and experiences, school-level variance has often been under 2%. In the present study we had no standardised performance measures, but according to pupils' and parents' self-reports, learning outcomes did not vary much by school. In this respect, the results give some indication that vertical segregation between Finnish schools was not higher during the school closures than it was before (Willms, 2010). However, school-level variation was considerably larger in most indicators measuring pupils' and parents' experiences of distance learning practices: educational equity measured by equal access to services (Willms et al., 2012) was not met at the expected level.

We measured pupils' and parents' experiences of distance learning within the framework of transactional distance theory (Moore, 2013). Next, we reflect our findings through the theory to understand what contributed to the quality of distance learning in the exceptional situation. According to the theory, a high-quality distance learning situation is designed by regulating the level of structure and dialogue, but we found it necessary to complement this in our measurements by adding a third dimension - task delivery and control - that was not applied according to tight structure or schedule.

Our first single-item scales were administered to pupils in both primary and lower secondary grades and their nature was more descriptive. Their results supported the interpretation of the more sophisticated scales for lower secondary pupils and all parents by making even the younger pupils' perspective visible. The results showed that there was higher school-level variation at the lower secondary than primary level concerning how the schedule was followed. Parents' data revealed very similar results. The common items for all pupils

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also revealed that pupils' daily learning time varied to some extent by school at both educational levels, and as expected, lower secondary pupils reported more study time per day than primary pupils. The results regarding learning time were relatively similar with studies published from other countries. Huber and Helm (2020) were worried about German-speaking students, as only under a third spent more than 5 hours a day on schoolwork, but in our study the proportion was even lower, resembling the results of Tran and colleagues (2020) from Vietnam. This may reflect differences in study times between countries in normal circumstances (see OECD, 2019). From the Finnish perspective, our findings were neither surprising nor worrying except for about a fifth of pupils who only spent an hour or less daily. As the daily learning time varied mainly at individual level, we did not focus on it more in our school-level analyses.

Our main interpretations regarding the first hypothesis derive from the two-level CFA models on pupil data from lower secondary schools and parent data covering all grades. We observed high (.32 - .41) intraclass correlations for the frequency of online instruction in different subjects: Finnish/Swedish, mathematics and first foreign language. Teachers' availability and the frequency of receiving written assignments varied by school too, but to a much lesser extent. Frequency of online teaching across different subjects (as a measure of structure) and teachers' availability (as a measure of dialogue) had a very high school-level correlation, but these could not be reduced to a single factor like Gorsky and Gaspi (2005) have earlier suggested. As we had expected based on anecdotal evidence, there was also a moderate negative school-level correlation between the frequency of online teaching and written assignments, strengthening our interpretation that some schools had implemented distance learning largely as delivery of written assignments to be completed. Even though the theory of transactional distance does not separate the task dimension from the structure

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dimension, we think the task dimension should be considered as well when evaluating the quality of distance education. Based on our results, we claim that poorly designed task delivery and even teacher-centred online teaching (Cai et al., 2020) contribute to an increased transactional distance and set unrealistic demands for young children to learn without social support or advice from teachers or peers (van de Pol et al., 2010; Tennant et al., 2015). This is a central point schools should focus on when updating their emergency plans in terms of preparing for exceptional circumstances.

The parents' answers strengthened our interpretation that the two dimensions contributing to transactional distance were separate, yet strongly correlated (c.f., Gorsky & Gaspi, 2005). In the parent questionnaire, instead of using subject-specific repeated single-item scales, we could measure structure and dialogue by multiple indicators. The structure factor included the schedule, requirement of participation in online instruction and lesson-based task assignment and control, whereas dialogue consisted of teachers' availability, communication about progress and a cross-loading on the requirement of participation. Even though we reported intraclass correlations for the non-lesson-based task delivery and control items and observed systematic school-level differences, they did not fit the CFA models. Thus, the parents' data gave stronger support to the original theory compared to the structure of pupils' data.

The highest intraclass correlations in individual variables were observed for the requirement of participating in online instruction, which varied considerably both at the primary (.17) and particularly lower secondary level (.30). This means that while many schools required their pupils to attend classes, some did not and thereby pupils did not have equal access to teaching activities. At the lower secondary level, all other items for structure and dialogue also had relatively large intraclass correlations (.14 - .18). In CFA, this was



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reflected especially in the school-level variance of the latent factor for structure at the lower secondary level, but all the factor variances were statistically significant at both educational levels.

The most surprising – and theoretically contradictory – finding was that parents of lower secondary level pupils reported significantly higher level of structure than parents of primary level pupils. In the Vietnamese study of Tran and colleagues (2020), the authors had expected to see results similar to ours and were surprised by the opposite findings.

Theoretically, a close teacher-student interaction is first needed for younger children to develop independency, (van de Pol et al., 2010). There were also differences between primary and lower secondary levels in the extent of variation between schools: despite a lower overall level of structure, primary schools were more similar with each other. The differences observed between lower secondary schools were to a small extent related to the average educational level of pupils' parents.

Overall, we observed some horizontal segregation (Willms, 2010) in terms of having pupils from different socioeconomical backgrounds distributed in different schools. Even though the segregation was not strong in international comparisons, school segregation is indeed increasing in Finland as well (c.f., Bernelius & Vilkama, 2019). There is currently little empirical evidence from Finland on how this increasing horizontal segregation is reflected in educational equity as measured by access to services, but the distance learning experiences of parents showed that some schools were dealing with the exceptional situation more effectively than others and this was not a completely random phenomenon. However, it seems that the potential disadvantages were to some extent compensated for within schools as at individual level, parents with lower education experienced higher structures.

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### **4.1 Limitations of the study**

The main limitations are related to the used measures. Due to the lack of existing measures for evaluating the structure and dialogue in basic education schools' distance learning practices, we had to develop all measures for this study within a few weeks' timeframe after the COVID-19 outbreak. Even though we based the measures on theoretical grounds both regarding distance learning and pupils' learning and development generally, a pilot study would have improved the measures. In the pupil data, because of young children's inability to answer long questionnaires, we compromised and considered single-item scales as satisfactory even though they limited the analysis options. Therefore, this first article of the data concentrates mainly on lower secondary pupil data and parent data that had longer scales suitable for confirmatory factor analyses.

In this article, we did not link different respondent groups' data at school level. As the data were collected anonymously despite using school codes, we cannot link children and parents at individual level, but linking the data at school level in further analyses will most likely give us a more fine-tuned picture of the phenomena.

The third limitation is the lack of standardised performance measures in pupil data. An important question is whether the observed school-level variation is reflected in learning outcomes (c.f., Cai et al., 2020), but we only had to rely on self-reports instead of measuring performance with more objective measures. This, however, is not possible in the Finnish context as standardised tests do not belong to our educational assessment system. At later stages of the project we will try to obtain school-based performance measures to overcome this obstacle at least to some extent.

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## 5. Conclusions

This study revealed that educational equity was compromised during the COVID-19 - related school closures in Finland, a country otherwise known for its well-functioning education system. The results showed that the level of structure and dialogue met by the pupils varied by school particularly at the lower secondary level where, however, the schools seem to have managed the unexpected situation better than at the primary level. The results indicate that ensuring every child's equal access to education under exceptional circumstances requires stronger than usual national guidance even if the education system normally relies on the autonomy of local education organisers. The observed differences may be explained by teachers' varying digital competences and the availability of devices and resources - an important topic for future research. Our study gave some indication that schools with a higher concentration of socioeconomically disadvantaged pupils may have had greater difficulties in maintaining the quality of education during these unusual times. Therefore, opportunities and support for teacher professional learning should be targeted to schools in disadvantaged areas and – if future studies demonstrate socioeconomic differences in the availability of devices and resources – need-based means should be used for ensuring sufficient digital infrastructure for the most vulnerable target groups. The present pandemic is most likely not a unique experience and schools' emergency plans should cover unexpected closures. Based on our results, published studies and theoretical understanding, these emergency plans should set criteria for teachers related to the level of interaction and dialogue as well as for responsible personnel related to both monitoring implementation and providing digi-pedagogical assistance in the transition phase. This, however, requires teacher competencies and support structures for teachers, which demand both resources, training and collaboration.

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