Are Social and Ethnic Reading Inequalities Increasing During School Closures?—The Mediating Role of Parental Involvement in Distance Learning

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From spring 2020 many countries throughout Europe and beyond temporarily closed schools to tackle the spread of the coronavirus. First studies indicate that these school closures resulted in lower learning gains compared to learning gains in preceding years and widened social and ethnic disparities by affecting disadvantaged students more strongly than their more advantaged peers. Moreover, during school closures, parental involvement in distance learning is regarded as crucial for successful learning, especially for younger children. In the current study, we examine whether social and ethnic disparities in the reading achievement of primary school students widened during COVID-related school closures in spring 2020 and whether increased disparities are mediated by parental involvement in distance learning. We use data from 409 Austrian 2nd graders, whose teachers participated in an ongoing study on the use of learning progress assessment. Adopting a within-subject design, we first compare the effects of social and ethnic family background on reading achievement during a pre-lockdown period with the respective effects during a lockdown period of similar length. Controlling for pre-lockdown reading differences, we found that low socioeconomic status and non-German language use at home negatively predicted post-lockdown reading achievement, indicating that post-lockdown disparities were larger than expected due to disparities at pre-lockdown. In contrast, we found no such effects during the pre-lockdown period. Second, a series of mediation models did not provide any support for the hypothesis that parental involvement accounted for family background effects on reading achievement during the lockdown period.

Keywords: social and ethnic disparities, school closures, COVID-19, parental involvement, reading, primary school

INTRODUCTION

From spring 2020, many countries throughout Europe and beyond temporarily closed schools to tackle the spread of the coronavirus. Concerns quickly emerged that the children's competence development would be impeded by the school closures (Education Endowment Foundation, 2020; Kuhfeld et al., 2020). Drawing on longitudinal achievement data from pre-COVID school years and

research on the effects of being out of school (e.g., summer loss research or absenteeism research), Kuhfeld et al. (2020) projected that after school closures in spring 2020 students would start the school year 2020–2021 with substantially lower achievement levels in reading and mathematics relative to a typical school year. Meanwhile, these projections have been largely confirmed. Using a large sample of primary school students from the Netherlands, Engzell et al. (2021) show that students show lower learning gains in mathematics, reading, and spelling during the first school year with coronavirus in 2019–2020 compared to learning gains in preceding years. Similar results have been reported for a large sample of primary school students from Belgium (Maldonado and De Witte, 2020). Taking a different approach, Tomasik et al. (2020) used data from a computer-based formative assessment tool and compared students' learning gains over a period of 8 weeks before the school closures in Switzerland with an 8-week period during school closures. They found lower learning gains during school closures relative to the period before lockdown for primary school pupils, but not for secondary school students. In line with these results, Pier et al. (2021) report that learning loss is more pronounced in earlier grades, which is presumably associated with difficulties in successfully realizing distance education at these ages, that result from younger children's higher need for adult support and guidance to facilitate learning (Cottingham, 2020). Thus, beside the quality of teachers' distance instruction, parental involvement in the distance learning of their children seems crucial for primary school students' learning success during school closures (Education Endowment Foundation, 2020). However, as research on parental involvement in students' homework has demonstrated, it is not simply the quantity but the quality of involvement that contributes to child learning progress (Dumont et al., 2014; Moroni et al., 2015; Pomerantz and Grolnick, 2017). Drawing on Self-Determination Theory (SDT, Grolnick et al., 1997), several studies show that a more frequent involvement (i.e., quantity of involvement) might even have negative effects on child achievement (Moroni et al., 2015; Barger et al., 2019), whereas homework involvement that supports autonomy, provides structure and is not controlling (i.e., does not interfere with children's need for autonomy) positively predicts achievement (Dumont et al., 2014; Grolnick et al., 2015; Moroni et al., 2015).

Furthermore, various authors (Jæger and Blaabæk, 2020; Dietrich et al., 2021; Engzell et al., 2021; Reimer et al., 2021) hypothesize that students do not experience learning loss due to school closures equally. It is assumed that already disadvantaged student groups [e.g., students with low socioeconomic status (SES), students with migration backgrounds, etc.] are most strongly affected. Thus, well-documented pre-corona differences in academic achievement between students from different socioeconomic and ethnic backgrounds (Bradley and Corwyn, 2002; Sirin, 2005) are expected to grow during school closures. In a rapid evidence assessment, the Education Endowment Foundation (2020) projected–based on summer loss research–that the attainment gap between socioeconomically disadvantaged students and their peers will widen between 15 and 75%.

The current study takes up the issue of projected increasing educational inequalities due to COVID-related school closures and addresses the role of parental involvement in distance learning–conceptually equivalent to parental homework involvement–as a candidate mediator in the association between family background and learning progress during school closures. Specifically, using an Austrian sample of 409 primary school students, we examine whether socioeconomic and ethnic disparities in 2nd graders' reading skills have widened during school closures in spring 2020 and investigate whether widening achievement gaps can be explained by differences in parental involvement in distance learning.

Educational Inequalities Due to COVID-Induced School Closures

To date, several studies have provided evidence on increasing educational inequalities due to the first school closures in spring 2020. However, only a still limited number of studies have directly addressed socioeconomic and/or ethnic differences in learning loss. A recent systematic review on the effects of school closures on student achievement by Hammerstein et al. (2021) included in total eleven relevant studies (published till April 30, 2021), whereas only seven studies also reported results regarding socioeconomic and/or ethnic disparities. A more inclusive review (Helm et al., 2021b), also considering conference presentations and gray literature, identified twelve additional studies on educational inequalities. Notably, eleven of these 19 studies are from the United Kingdom and United States. In contrast to this body of research directly addressing achievement disparities, a considerably larger proportion of studies has indirectly addressed the issue by dealing with socioeconomic and/or ethnic differences in distance learning (time spent in learning, available IT-equipment, etc.), that might in turn, contribute to increasing educational inequalities [Andrew et al., 2020; Grewenig et al., 2020; Reimer et al., 2021; for a review of studies from Germany, Austria and Switzerland see Helm et al. (2021a)].

Using biannually collected achievement data of a sample of about 350,000 Dutch primary students (aged 8–11 years), Engzell et al. (2021) directly addressed increasing inequalities. The first test took place in January and February, thus in 2020 directly before the school closures in March, and the second test took place in June, at the end of the school year. The authors compared the learning gains during this period in 2020 with the learning gains during the same period in previous years and found that in 2020 students' learning progress–estimated using an achievement composite score covering mathematics, reading, and spelling–was about 0.08 SD lower than in previous years. Using various methods to control for confounders (e.g., propensity score weighting), they show that students with less educated parents (i.e., none of the parents has a degree above lower secondary education) experienced a significantly larger learning loss (≈0.1 SD) than their peers with higher educated parents (learning loss ≈0.075 SD). Notably, they did not find any differences in learning loss between age groups, and they did not test whether learning loss differs with the ethnic background of the students. In a

Belgian study, Maldonado and De Witte (2020) compared achievement data from 6th graders assessed at the end of the school year 2020 with respective data from the previous years. By linking aggregated data on the school level over time (i.e., a panel at school level not at individual level) and controlling for various school-level characteristics, they found that achievement differences in 2020, both within schools and between schools, were larger than in previous years. Moreover, they report that learning loss was more pronounced in schools with a higher share of students with low SES (determined by the mothers' educational level and students receiving financial support for schooling). However, they did not find an association between learning loss and the share of students who do not speak the instruction language at home. Note that this study used aggregated school-level data and thus inferring on the individual level is not warranted (ecological fallacy). Providing more support for increasing disparities, Pier et al. (2021) used formative assessment data from 18 Californian districts (about 50,000 students) to compare language and mathematics test score gains within the school year 2019/20 with test score gains within the previous year 2018/19. They found a larger learning loss for socioeconomically disadvantaged students and English language learners.

However, it should be mentioned that there are also some studies that do not find any new educational inequality due to coronavirus (for an overview see Helm et al., 2021b). Interestingly, whereas Helm et al. (2021b) show in their review that studies from English speaking countries (United States, United Kingdom, Australia), the Netherlands and Belgium very clearly confirm increased inequalities, none of the three studies from German speaking countries found support for growing disparities. For example, two German studies (Depping et al., 2021; Schult et al., 2021) compared student (grades 4 and 5) tests scores in reading and mathematics assessed in fall 2020 with test results from pre-corona cohorts and did not find evidence that disparities increased between schools with a disadvantaged student body (low SES, migration background) and schools attended by a lower share of disadvantaged students.

Beside these studies that provide direct support for the hypothesized increase in disparities, there are a growing number of studies that indirectly addressed COVID-induced inequalities by focusing on various aspects of learning during school closures that may account for a widening achievement gap between students with different family backgrounds.

Several surveys addressed the question of whether low SES students became less involved in learning during school closures than socioeconomically more advantaged students. The results of a German study by Dietrich et al. (2021) show that socioeconomically disadvantaged students spent less time on learning during school closures than their better off peers. Similar results are reported in a study from Spain by Bonal and González (2020) who show SES-differences in an opportunity to learn measure, covering the learning time, frequency of online lessons, and teacher contact during school closures. Also considering pre-lockdown differences in learning time, Andrew et al. (2020) and Grewenig et al. (2020) analyzed

whether SES differences in learning time increased during lockdown. For England, Andrew et al. (2020) reported an increasing SES gap in learning time for primary school students, but not for secondary school students. Not differentiating between primary and secondary schools, Grewenig et al. (2020) did not support the increasing SES differences in learning time in a German study.

Using data from a reading app, a Danish study by Reimer et al. (2021) report that the time 4th and 5th graders spent using the reading app changed with the school closures. Notably, differences in reading time increased during the first lockdown phase (i.e., till the Easter holidays) with socioeconomically advantaged peers showing a steeper increase in reading time. However, no differences in the second phase (after the Easter holidays) were found, where students attended school on a limited schedule.

Various studies have also shown that socioeconomically disadvantaged students have limited access to learning resources at home (e.g., own study space, available computer, or tablet) as well as to those provided by schools [see for example the review on surveys in Germany, Austria, and Switzerland by Helm et al. (2021a)].

Moreover, several studies have examined whether there are socioeconomic or ethnic differences in the extent of parental support and involvement in distance learning. Bonal and González (2020) found no SES differences in parental support (whether parents helped children with school tasks during lockdown) among primary school children and upper secondary school children. However, for lower secondary school children, higher SES parents were more likely to report helping their children with school tasks than lower-SES parents. A German study by Sander et al. (2021) focusing on SES-differences in involvement found that higher-SES parents paid more attention to the establishment of structures during distance learning (e.g., regular study times). Interestingly, they found that lower-SES parents and non-German speaking parents reported more process-focused learning support (e.g., help to apply meaningful learning methods). Similarly, a study from Portugal (Ribeiro, et al., 2021) also found that lower-SES parents were more involved in terms of time in their children's learning during school closures.

To sum up, there is growing evidence that socioeconomically disadvantaged and ethnic minority students experienced a larger learning loss during school closures than their better off peers and ethnic majority peers, respectively. Moreover, disadvantaged students had restricted access to learning resources available at home and to those provided by schools and spent less time on learning during school closures. However, it is still unclear whether or not–and to what extent–these aspects of learning during school closures (e.g., time spent on learning) contributed to increased disparities in achievement. Moreover, little is also known about other factors of the learning context at home that may account for an increased learning gap. Here, parental involvement in the distance learning of their children might be of special importance (Education Endowment Foundation, 2020), as missing instruction due to school closures had to be at least partly compensated by parents. This is especially true for

younger children whose self-regulatory skills are still developing and who need more support and guidance for successful learning (Vandevelde et al., 2015; Cottingham, 2020). Several studies that have considered parental involvement in distance learning till date have largely assessed involvement only through few items focusing either on the quantity of involvement (e.g., Grewenig et al., 2020; Nusser, 2021; Ribeiro et al., 2021) or on the general provision of learning support during school closures (e.g., Bonal and González, 2020). Moreover, these studies provide mixed results on socioeconomic and ethnic differences in parental involvement. Therefore, a broader consideration of the concept of parental involvement seems to be purposeful.

Parental Involvement in Schooling

Parental childrearing practices in general (Pinquart, 2016) and especially parental involvement in schooling (Barger et al., 2019) are considered to affect children's academic achievement. Following Grolnick and Slowiaczek (1994), parental involvement in schooling is defined as the dedication of resources (e.g., time, energy, money) to the child's academic lives. It encompasses two broad forms: school-based involvement and home-based involvement (Barger et al., 2019). School-based involvement comprises–amongst others–parents' direct contacts with school. Home-based involvement is multifaceted, covering activities such as talking with children about school, encouraging them in their academic efforts, and helping children with homework (Pomerantz et al., 2007; Pomerantz and Grolnick, 2017). Primary school teachers' distance instruction during school closures was largely characterized by assigning homework-like tasks to students, which they had to complete at home (Grewenig et al., 2020; Weber et al., 2021). Thus, it is reasonable to put a special focus on parental involvement in distance learning, which is conceptually equivalent to homework involvement.

However, whereas research indicates that overall parental involvement in schooling is conducive for children's academic development (Barger et al., 2019), research on the effects of parental homework involvement is ambiguous. A meta-analysis of Patall et al. (2008) showed small positive correlations between homework involvement (helping, monitoring, etc.) and achievement in the primary school and high school years, but a negative correlation for middle school students. In contrast, the results of a recent meta-analysis that considered a larger body of studies indicated that homework involvement is negatively associated with academic outcomes irrespective of the children's developmental stage (Barger et al., 2019).

Distinguishing between quantity and quality of homework involvement appears to resolve some inconsistencies (Dumont et al., 2014; Moroni et al., 2015; Pomerantz and Grolnick, 2017). This body of research largely draws on self-determination theory (SDT; Grolnick et al., 1997; Grolnick, 2003, 2009). In a nutshell, SDT posits that children are born with three psychological needs which are facilitated by three parenting dimensions. By allowing children choices, supporting their initiative, and taking children's perspective (i.e., autonomy support), parents can support the need to feel autonomous. In

contrast, controlling parenting–i.e., the conceptual opposite of autonomy support–is restricting children's choices and thus, frustrates the need for autonomy. Communicating clear rules and expectations–i.e., providing structure–facilitates the need for competence. Finally, the need to feel related to others is satisfied by caring, supportive, and positively involved parenting. Following SDT, the fulfillment of these needs fosters motivational resources necessary for developing competence (Grolnick, 2003, pp. 12–17, 2009, p. 165; Pomerantz and Grolnick, 2017). Applying this theoretical framework to the study of parental homework involvement, frequent assistance and helping with homework (i.e., quantity) is argued to be negatively associated with child achievement, because frequent helping inhibits children's autonomous motivation and feelings of competence and thus interferes with academic development (see also Silinskas et al., 2015; Pomerantz and Grolnick, 2017). In this vein, Silinskas et al. (2015) found that, controlling for achievement in grade 1, frequent helping with homework was related to lower mathematic achievement in grade 4. Similar results have been reported by Moroni et al. (2015). Moreover, several studies show that forms of parental homework involvement (i.e., quality) that are controlling and characterized by negative parental affect have harmful effects on children's academic development (Dumont et al., 2012; Moroni et al., 2015; Silinskas and Kikas, 2019). For example, Moroni et al. (2015) found that controlling involvement (e.g., parents interfere when child is doing her/his homework) predicted lower reading achievement in grade 5, and Dumont et al. (2012) reported that parent-child-conflicts during homework–indicating negatively affective involvement–predicted German and mathematics grades in 8th graders. Both studies have controlled for prior achievement. In contrast, parental homework involvement that is autonomy supportive, responsive to children's needs, provides structure and is characterized by positive affect is conducive to children's academic development (Grolnick et al., 2015; Moroni et al., 2015; Grolnick, 2016; Pomerantz and Grolnick, 2017; Silinskas and Kikas, 2019). For example, Grolnick et al. (2015) report results of a path analysis that show that autonomy supportive involvement (e.g., encouraging children to find solutions on their own) and structuring involvement (e.g., clear and consistent rules and expectations) predict English grades in 7th graders, even when controlling for grades of the previous year.

Parental Involvement as Mediator of the Effects of Family Background on Child Academic Outcomes

There has long been the hypothesis that the effects of socioeconomic status on various aspects of child development are mediated by parenting (Bradley and Corwyn, 2002; Grolnick, 2003; Conger and Donnellan, 2007). Amongst others, it is argued that parents with lower SES are more likely to experience economic stress, which in turn makes them more emotionally distressed and distracts their attention from childrearing (e.g., being less involved). Further, low SES parents invest less resources in their offsprings' development due to a lack of available resources (money, knowledge, etc.) or SES-specific values (Kohn, 1959;

Bradley and Corwyn, 2002; Conger and Donnellan, 2007). Similarly, the ethnic background of parents might be associated with different values that affect parenting and language barriers of immigrant parents can complicate involvement (Antony-Newman, 2019). In this context, Fleischmann and de Haas (2016) found in a Study from the Netherlands that Turkish and Moroccan parents more strongly value obedience in their children than their Dutch counterparts. However, ethnic differences in parental school involvement (Turkish and Moroccan parents reported lower levels of school involvement) were entirely explained by differences in parental education and language proficiency. Ethnic differences in parenting goals were not associated with differences in involvement. In the context of this study, low parental proficiency in the language of instruction could simply pose a challenge for helping students with their homework.

Regarding children's academic development, parental homework involvement is a candidate mediator of family background effects. In testing this hypothesis, Dumont et al. (2012) found no significant indirect effects of family background variables (SES-indicators and migration background) on achievement. Thus, mediation was not supported. However, SES-indicators and immigration status were associated with various aspects of homework involvement. Specifically, immigrant students reported that their parents are less supportive and less competent in helping them with homework, but also less controlling than parents from non-immigrant students. Low-SES students reported less support, less competence, and more homework-related conflicts than their socioeconomically more advantaged peers. Similar results regarding the association between SES and homework involvement are reported in various other studies (Silinskas et al., 2010; Moroni et al., 2014; Sander et al., 2021). For example, Moroni et al. (2014) found that higher SES was associated with more autonomy supportive involvement. Moreover, immigrant students reported less frequent parental involvement (quantity) and less autonomy supportive involvement. In contrast to Dumont et al. (2012), migrant students characterized their parents as more controlling than non-migrant students. Thus, there is evidence that higher-SES parents use more conducive and less detrimental forms of homework involvement. For parents with a migration background, research is somewhat inconclusive.

The Current Study

As outlined above, social and ethnic disparities in school achievement are expected to have grown during school closures. However, although there is growing research confirming the expected learning losses and growth of disparities, the number of studies is still small and largely limited to English-speaking countries (see Helm et al., 2021b; Hammerstein et al., 2021). Thus, our first research question (RQ 1) is:

> Did social and ethnic inequalities in reading comprehension of Austrian 2nd graders increase during the first school lockdown in spring 2020?

In line with the conclusion of recent reviews (Helm et al., 2021b; Hammerstein et al., 2021), we hypothesize that social and ethnic disparities have grown during school closures. Notably, whereas recent studies have analyzed achievement gaps between cohorts (e.g., comparing disparities in 6th graders of school year 2019/2020 with disparities of 6th graders from previous years), this study takes a within-subject perspective and analyzes whether social and ethnic disparities have grown during school closures compared to the pre-lockdown period of the school year 2019/2020.

Moreover, a plethora of studies has focused on the association between social and ethnic family background and variables such as learning time, parental involvement, and access to learning resources, that may account for growing disparities (Andrew et al., 2020; Bonal and González, 2020; Grewenig et al., 2020; Helm et al., 2021a; Dietrich et al., 2021; Reimer et al., 2021; Sander et al., 2021). However, all these studies are not based on achievement data and thus, do not directly address gaps in achievement.

From a mediation analytical perspective (e.g., MacKinnon, 2008, see also **Figure 1**), studies have tested c-paths (i.e., the effects of family background on learning loss without considering mediators) and a-paths (i.e., the effects of family background on mediators). To the best of our knowledge, however, no study has yet tested a mediation model to explore the reasons for grown disparities due to school closures. Using a panel sample of Austrian second graders, the current study focuses on a whole mediation process (see also **Figure 1**) by taking up parental involvement in distance education–conceptually equivalent to homework involvement–as mediators. In detail, we investigate the following research question (RQ2):

> If there are any increased social and ethnic disparities in reading comprehension, are they mediated by parental involvement in distance learning?

Taking an SDT-perspective on parental homework involvement (Grolnick, 2016; Pomerantz and Grolnick, 2017), we hypothesize that family background is associated with homework involvement in such a way that lower-SES parents show less conducive (e.g., autonomy supportive, structuring, positively affective) and more detrimental (e.g., controlling, negatively affective) forms of homework involvement (a-paths). As research on ethnic family background is inconclusive, we do not formulate a directional hypothesis. Socioeconomic and ethnic differences in parental involvement in distance learning might be due to differences in values and stress exposure that already existed before the coronavirus crisis, but which gain in importance due to the shift in learning from the classroom to the home. Put simply, it makes a difference if a parent tends to be controlling due to specific values or stress exposure and thus, gets involved in homework, in a controlling way, some days a week for up to an hour, or if she/he gets involved, in a controlling way, 5 days a week for several hours. Moreover, a recent research review indicates that lockdowns lead to more parental stress and stress outcomes (e.g., depression, burnout), especially in low SES families and in parents of younger

FIGURE 1 | Conceptual mediation model.
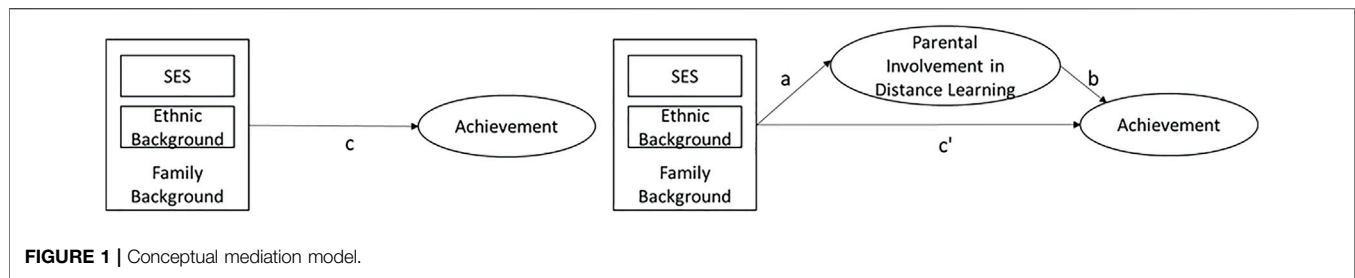
children, which was also accompanied by harsher and less warm parenting (Proulx et al., 2021). Thus, lockdowns might especially increase stress exposure of low SES parents, which in turn affects their involvement in distance learning.

Following research on parental homework involvement (Dumont et al., 2014; Silinskas et al., 2015), we argue that involvement in distance learning is associated with reading achievement (b-paths). Specifically, we hypothesize that autonomy supportive, structuring, and positively affective forms of parental involvement in distance learning are conducive to the development of reading achievement during school closures, whereas controlling and negatively affective involvement is detrimental (Pomerantz and Grolnick, 2017). Notably, whereas research on homework involvement indicates that more involvement is associated with lower achievement (Barger et al., 2019), this might not be the case for parental involvement in distance learning. Due to canceled teacher instruction in classrooms, children would have been left without direct adult support and guidance that largely had to be provided by parents. Thus, we argue that especially young children needed the support, guidance, and involvement of their parents on a largely daily basis (Vandevelde et al., 2015; Cottingham, 2020; Education Endowment Foundation, 2020).

Finally, we hypothesize that family background effects on reading achievement are at least partly mediated by parental involvement in distance learning. Thus, we expect significant indirect effects of background variables on reading, but background effects might still be significant after controlling for parental involvement (i.e., c'-paths). Significant c'-paths might be due to other factors such as the quality of distance teaching and the quality of the study space at home, that might differ between high-SES and low-SES schools (Andrew et al., 2020; Bonal and González, 2020), or SES-differences in child skills (e.g., self-regulation; Bradley and Corwyn, 2002) that affect learning during school closures.

MATERIALS AND METHODS

Sample and Procedures

This research partly draws on data from an ongoing study on the use of learning progress assessment (LPA) in primary school. The W3-study (W3 stands for "Wir Wollen's Wissen!" in English "We want to know how our students' skills are doing!"; Weber et al., 2020) started in school year 2018–2019. In fall 2018, schools were informed about the project *via* the Upper Austrian educational

administrations. A total of 28 schools with 48 classes decided to participate in the study. Parents of 745 students gave their written consent to participate in the study. It was planned that 1st grade students of the 2018/19 school year would participate in the project over the entire span of primary school, which lasts 4 years in Austria. Some teachers, however, decided to leave the project after the first year. Thirty-five classes with 579 2nd graders remained in the project in 2019/20. Initially, it was planned that the students should complete eight short internet-based reading comprehension LPA tests (Souvignier et al., 2021) at fixed intervals of 3 weeks throughout the school year. The LPA tests are completed independently by students during self-study periods or group tests at school, depending on the number of available computers. It has been shown that students can complete the LPA test independently as early as grade 1 (Salaschek and Souvignier, 2013). Moreover, the students of our sample already had 1 year of experience in using the LPA tests. Four LPA tests between March and the end of June were largely not completed due to school closures, which started in Austria on the 16th March and ended on the 18th May. For example, the eighth LPA-test (test period during the first 3 weeks of June) was only used in eleven classes. Notably, although the whole predefined testing period of the eighth and last LPA-test was after school closures, a broader use was hampered by shift-schooling (see later) and three additional days off from school within this period. Moreover, the specific situation after returning to schools must be considered that kept teachers from LPA-testing. Thus, to ensure a broader post-lockdown reading assessment, teachers were asked to administer a standardized reading comprehension test (ELFE II; Lenhard et al., 2017) at the end of the school year (late June/early July). The ELFE II was chosen because it is conceptually equivalent to the LPA-tests (see also *Reading Achievement* section) and has the advantage that it could be simultaneously administered within 30 min to the whole class. Although there is a computer version of the ELFE II, we choose to use the print version of the test, since most classes have only a few computers that could be used for testing. The test was administered by the teachers to their students, using standard instructions. Moreover, we also conducted a parent survey on different aspects of distance learning (including parental involvement). Twenty-five teachers agreed to administer the ELFE-test and we received parent questionnaires from 21 classes. A parent survey covering family background variables (including SES, ethnic background) was already conducted in the school year 2018/19. For the current study, we used data from 25 classes that regularly used the LPA tests before the school closures

FIGURE 2 | Measurement points of the study.
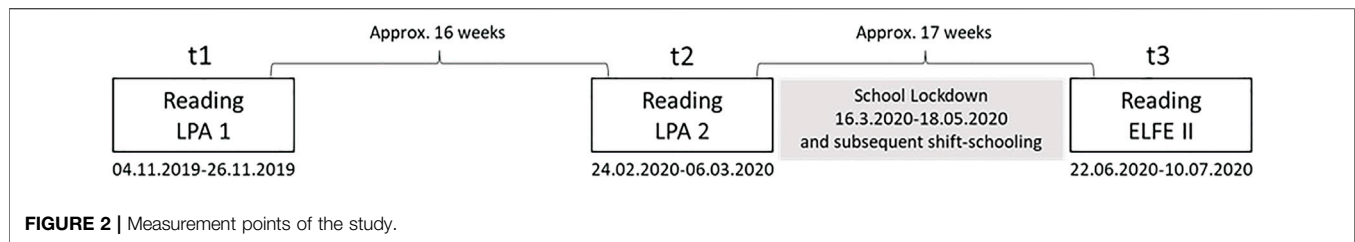
and took the ELFE-test after lockdown ($n = 409$ students; 50.1% females). The mean age of the students at the beginning of the school year was M = 7.7 years (SD = 0.56). 14.8% of the students have a migration background, which is significantly below the rate for the Upper Austrian primary school population [23%; $\chi^2(1) = 10.937$, $p < 0.05$]. In about one-third (29.7%) of the families, at least one parent has a university degree. A further 22.5% have a university entrance qualification. Parental education in the sample is representative of the general parent population of Upper Austrian primary school students [$\chi^2(3) = 5.262$, $p > 0.05$].

For the current study we used three time points (see **Figure 2**). For t1 and t2, LPA reading data are available and for t3, we used data from the ELFE II test. LPA tests at t1 were carried out in November 2019 and LPA tests at t2 between the 24th February and the March 6, 2020. ELFE II tests were administered between the 22nd June and the July 11, 2020. The interval between t1 and t2 covers approximately 16 weeks (including 2 weeks Christmas holidays and 1 week semester break), thus, students regularly attended school for about 65 days (i.e., 13 weeks) in this period. The interval between t2 and t3 covers roughly 17 weeks, whereas schools have been closed in Austria from the 16th March to the 18th May (including one-and-a-half-weeks for the Easter holidays). To reduce class sizes after reopening schools, students attended classes only half the week (shift-schooling). One group of students had to learn at home, while the other group was attending classes. Taken together, students roughly attend classes between t2 and t3 for 25 days, that is, approximately 60 days less than normal.

Measures
Reading Achievement
Reading achievement was assessed using two tests. At t1 and t2, we used the LPA reading tests (www.quop.de), which are a fixed part of the W3-study. The LPA tests assess second grade reading skills in the areas of word comprehension (20 items per test; differentiating words from pseudo-words), sentence comprehension (13 items per test; identifying meaningful sentences), and text comprehension (13 items per test; deciding whether a sentence continues a text in a meaningful way). We estimated reading scores as the number of correct answers divided by the processing time for each subtest. Although the LPA tests have not been developed as outcome measures, they show good psychometric properties. Souvignier et al. (2014), 264pp report both satisfactory reliability (Cronbach's α between 0.76 and 0.89) and validity (correlations with standardized reading tests between 0.47

and 0.66) of the LPA tests (see also Förster and Souvignier, 2014; Förster et al., 2018).

At t3, the ELFE II (Lenhard et al., 2017) test was used to assess reading comprehension. Lenhard et al. (2017) provide comprehensive information on reliability (reliability estimates between 0.87 and 0.98) and convergent, and discriminative validity. Like the LPA, the ELFE II consists of three subtests. Word comprehension with max. 75 items (choose from four words the one that matches a picture), sentence comprehension with max. 36 items (select from five words the one that correctly completes the gap in sentence), and text comprehension with max. 26 items (choose one out of four statements that fits a text). Processing time is limited to 3 min for word and sentence comprehension and to 7 min for text comprehension. For further analyses, we transformed the number of correct answers per subscale into T-scores.

For the current study, we model reading comprehension as a latent variable, at each time point, assessed by three indicators (word, sentence, and text reading). To evaluate internal consistency, we calculated McDonald's ω, which–in contrast to Cronbach's α–does not rely on often violated assumptions such as equal factor loadings (Hayes and Coutts, 2020). Internal consistency was good for LPA$_{t1}$ ($\omega = 0.817$), LPA$_{t2}$ ($\omega = 0.854$), and ELFE II$_{t3}$ ($\omega = 0.898$).

Notably, the tests appear conceptually equivalent (i.e., they refer to the same construct reading comprehension on word, sentence, and text level), what is also supported by a latent correlation of $r = 0.843$ ($p < 0.001$) between ELFE II and the LPA-test at t3, estimated for the subsample of $n = 141$ students who completed both the ELFE II and the LPA-test after the school closures. Thus, ELFE II and LPA share at t3 about 71% (0.843×0.843) of their variance. However, a two-dimensional confirmatory factor analysis (CFA) model provides a better fit to the data than a unidimensional model, where ELFE and LPA subtests load on a single factor reading comprehension[1fn1]. This is presumably due to method differences between the tests (online vs. paper-pencil

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[1]Two-dimensional CFA-model: $\chi^2(8) = 18.754$, $p = 0.016$; root mean square error of approximation (RMSEA) = 0.061, 90%-CI (0.025, 0.097); comparative fit index (CFI) = 0.987; Tucker-Lewis Index (TLI) = 0.975; standardized root-mean-square residual (SRMR) = 0.035. Uni-Dimensional CFA-model: $\chi^2(9) = 62.524$, $p < 0.001$; RMSEA = 0.127, 90%-CI (0.099, 0.158); CFI = 0.934; TLI = 0.890; SRMR = 0.048. MLR-χ^2-Difference(1) = 43.770, $p < 0.001$.

administration, differences in length and item format, no time limit vs. time limit, ...).

Family Background Variables
Family background variables were assessed by a parent questionnaire in the initial stage of the W3-study.

Socioeconomic Status
We employed a SES composite score, computed as the mean of three z-scored SES measures. 1) Occupational status of the parents was assessed using the International Socioeconomic Index (ISEI, Ganzeboom, 2010), whereby we only used the highest ISEI score of the two parents. 2) Parental education was assessed on a 4-point scale (1 = lower secondary compulsory education, 2 = vocational education, 3 = university-preparatory upper secondary education, and 4 = tertiary education). Again, we used the highest education of the two parents. 3) The number of books at home was assessed on a 5-point scale (1 = 0–10 books, 2 = 11–25 books, 3 = 26–100 books, 4 = 101–200 books 5 = more than 200 books).

Ethnic Background
Two dichotomous measures of ethnic student background were considered. 1) Following the definition of the national education reporting in Austria (BIFIE, 2019), we regard a child as having a migration background when either she/he was born in a foreign non-German-speaking country or both parents were born in a non-German-speaking country (0 = no migration background, 1 = migration background). 2) Language use at home (0 = only German, 1 = at least sometimes another language other than German).

Parental Involvement in Distance Learning
Parental involvement in distance learning was assessed by a parent questionnaire administered after the lockdown. We selected and adopted items from previous work on parental homework involvement (e.g., Dumont et al., 2012; Dumont et al., 2014), largely taking an SDT-perspective. An overview of the involvement measures is presented in **Supplementary Table A1** in the supplement.

However, several restrictions regarding the measurement of parental involvement in this study should be noted in advance. First, to raise the response rate during challenging times, we kept the questionnaire as short as possible (see also Huber and Helm, 2020). Second, as previous work largely used student-reports in samples of secondary school students and our sample consists of second graders, some interesting aspects of involvement (e.g., parents interfere in homework) were not considered, because we excepted, that such aspects based on parent-reports would be subject to social desirability bias. Finally, due to unpredictable general conditions during and after the lockdown, there was little time to thoroughly develop items on involvement in distance education.

Structuring Involvement
Structuring involvement was assessed using two scales. 1) Establishing structures for distance learning was assessed by

three items adopted from Dumont et al. (2014). The items [e.g., "I insisted that the tasks for school were done before my child could do other things (e.g., watch TV, etc.)," "I made sure that my child completed his or her tasks for school at fixed times (e.g., always in the morning from 8:00–12:00)"] refer to the parental authority component of structure (Grolnick et al., 2014) and were rated on a 5-point scale ranging from 1 = "does not apply" to 5 = "perfectly applies." Higher scores indicate that parents establish structures for distance learning by taking their leadership role. Internal consistency was adequate ($\omega = 0.743$). 2) Moreover, three items refer to parental oversight activities, that refer to "checking" on the distance learning process (Hoover-Dempsey et al., 2001; e.g., "discussed with my child what she/he had to do for school," "checked whether my child has done his/her homework"). The items were rated on a 5-point scale ranging from 1 = "daily" to 5 = "never or almost never." Thus, the items also capture the quantity component of involvement. We recoded items so that high scores indicate frequent oversight activities. Internal consistency for this scale was rather low ($\omega = 0.635$).

Interpersonal Involvement
Interpersonal involvement was captured by two scales. 3) Three items refer to the allocation of time and resources and to the interest shown in the child's learning ("asked my child what he or she had just learned," "discussed with my child the things he/she has read for school," "practiced reading with my child"), thus assessing positive interpersonal involvement (Grolnick et al., 1997). The parents rated the items on a 5-point frequency scale ranging from 1 = "daily" to 5 = "never or almost never." We recoded the items so that higher scores indicate more frequent positive involvement activities. Notably, the items also capture the quantity component of involvement. Internal consistency was adequate ($\omega = 0.763$). 4) We used three items adopted from Dumont et al. (2012) to assess negative personal involvement. The items refer to parent-child conflicts about homework ("Homework has frequently been a cause of arguments," "When my child has homework, it has often come to arguments between me and my child") and parental negative affect ("I sometimes got angry when my child did not do his/her homework properly"). Items were rated on a 5-point scale (1 = "does not apply" to 5 = "perfectly applies." Thus, higher scores indicate that parental involvement during distance learning was characterized by negative affect. Internal consistency was excellent ($\omega = 0.903$).

Autonomy Supportive vs. Controlling Involvement
Autonomy supportive vs. controlling involvement was assessed using three items. One item explicitly focuses on autonomy supportive involvement ("When my child needed help with tasks, I told him to think well on his own first before I helped him further.") and two items adapted from Dumont et al. (2014) assess controlling involvement ("I often sat next to my child when she/he did her/his homework and immediately corrected any of her/his mistakes," "I have threatened to punish my child (e.g., TV ban) if she/he has not done his/her homework for school properly."). Following an SDT-perspective, autonomy

TABLE 1 | Descriptive statistics and latent correlations.

		M (SD)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
LPA1 (t1)	(1)	19.03 (6.003)	1													
LPA2 (t2)	(2)	27.12 (7.572)	0.739***	1												
ELFE II (t3)	(3)	50.72 (7.811)	0.733***	0.663***	1											
Oversight activities	(4)	4.796 (0.429)	0.013	0.044	0.061	1										
Pos. interpersonal involvement	(5)	4.411 (0.613)	0.088	0.141	0.101	0.587***	1									
Neg. interpersonal involvement	(6)	2.567 (1.179)	0.033	0.011	0.007	0.109	−0.052	1								
Establishing structures	(7)	4.365 (0.636)	0.100	0.068	0.099	0.496***	0.211*	−0.091	1							
Controlling involvement	(8)	2.165 (1.383)	−0.106	−0.089	−0.146*	0.026	0.025	0.525***	−0.176*	1						
Intrusive involvement	(9)	3.164 (1.260)	−0.121	−0.189*	−0.202**	0.281***	0.246***	0.240***	0.019	0.260***	1					
Autonomy supportive involvement	(10)	3.942 (1.041)	0.076	0.007	0.127*	0.135	0.213**	−0.037	0.212**	−0.004	0.007	1				
SES	(11)	−0.052 (0.832)	0.234***	0.189*	0.352***	0.080	−0.029	−0.020	0.255**	−0.145*	−0.224***	−0.007	1			
non-German language use	(12)	21.4%	−0.239***	−0.157*	−0.400***	−0.134	−0.133	−0.101	−0.303***	0.167*	0.165*	−0.134	−0.386***	1		
Migration background	(13)	16.1%	−0.148**	−0.125*	−0.225***	−0.163	−0.016	−0.039	−0.242*	0.194*	0.138	0.061	−0.295***	0.683***	1	
Sex (female)	(14)	50.1%	0.037	0.001	0.038	−0.125*	−0.042	−0.123*	0.002	−0.201***	−0.086	0.072	0.042	0.039	0.029	1
Learning Time	(15)	0.005 (0.778)	−0.103	−0.092	−0.108	0.091	0.169**	0.012	0.079	−0.040	0.092	0.016	−0.107	−0.067	−0.025	0.092

*p < 0.05, **p < 0.01, ***p < 0.001.

supportive and controlling behaviors are conceptualized as the opposite poles of a single dimension (Grolnick et al., 2014). However, the correlations between the autonomy support item and the control items are virtually zero ($r = 0.009$, $p > 0.05$; $r = -0.006$, $p > 0.05$), which is somewhat congruent with research establishing autonomy supportive and controlling parenting as distinct constructs (Silk et al., 2003). Moreover, the two controlling items are also only weakly correlated ($r = 0.258$, $p < 0.001$). Thus, we decided to include the three items as single item-measures. We label the item 5) "I often sat next ..." as intrusive involvement, the item 6) "I have threatened ..." as controlling involvement, and the item 7) "When my child ..." as autonomy supportive involvement.

To confirm the conceptual differentiation of the involvement dimensions, we conducted a confirmatory factor analysis (CFA) considering the four multiple item measures, i.e., established structures, oversight activities, positive interpersonal involvement, and negative interpersonal involvement. The three single-item measures on autonomy supportive vs. controlling involvement were not used in the CFA. The four-factor model showed an adequate to good fit [$\chi^2(48) = 69.729$, $p = 0.022$; root mean square error of approximation (RMSEA) = 0.040, 90%-CI (0.016, 0.060); comparative fit index (CFI) = 0.979; Tucker-Lewis Index (TLI) = 0.971; standardized root-mean-square residual (SRMR) = 0.047], thus, supporting our conceptualization of involvement in distance education. In addition, the latent correlations of the four measures are of medium size (**Table 1**), which further supports the assumption of different but related constructs.

Control Variables

Regarding RQ 2 we include two control variables. First, child sex was included because of sex differences in reading achievement (e.g., Lynn and Mikk, 2009) and parental involvement (e.g., Muller, 1998; Kristjansson and Sigfúsdóttir, 2009). Moreover, we included a composite measure of learning time (mean of z-scores of time spent for reading tasks and time spent for all school assignments; $r = 0.208$, $p < 0.001$) during school closures. Learning time might be associated with family background (Andrew et al., 2020; Dietrich et al., 2021) and reading achievement. Moreover, the quantity of parental involvement and aspects of quality (e.g., negative involvement) might also be associated with the learning time. In detail, parents were asked how much time their children spent on average per day reading (reading tasks, reading exercises, ...) and learning (accomplishments of homework) for school. Overall, there is considerable variation in learning time. Whereas 25% spent on average no more than 2 h a day learning for school, about one third (35%) of the children were learning three or more hours a day. Most children (40%) spent between 2 and 3 h a day for school.

Statistical Analysis

We applied structural equation modeling (SEM) using M*plus* 8 (Muthén and Muthén, 1998–2017). To answer RQ1, we estimated the two models depicted in **Figure 3**: A pre-lockdown model and a lockdown model. Specifically, we regressed reading
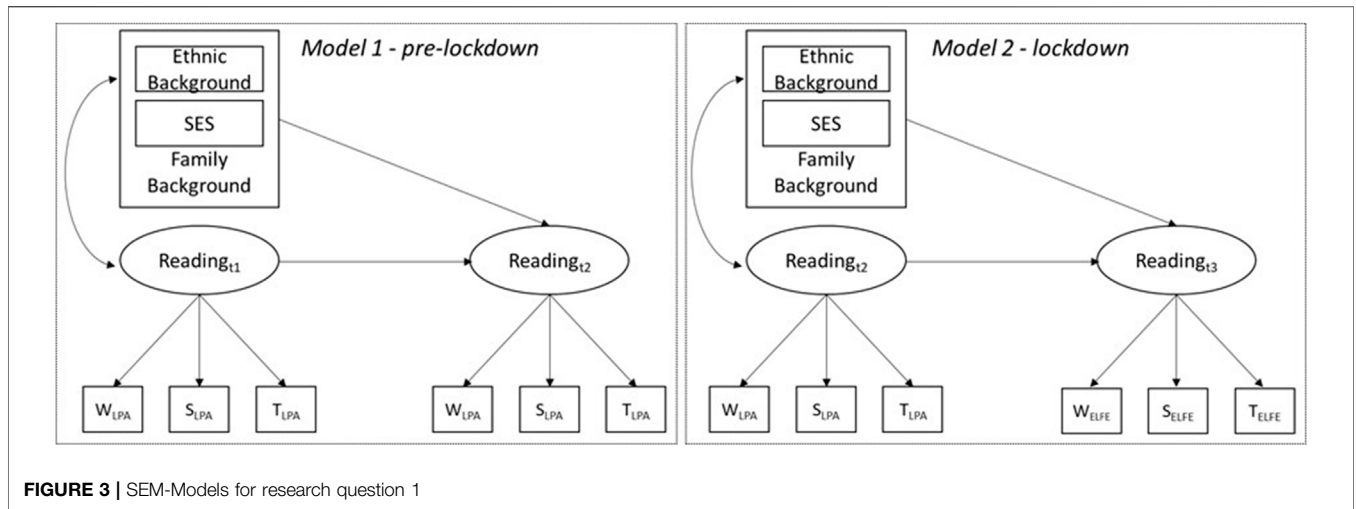
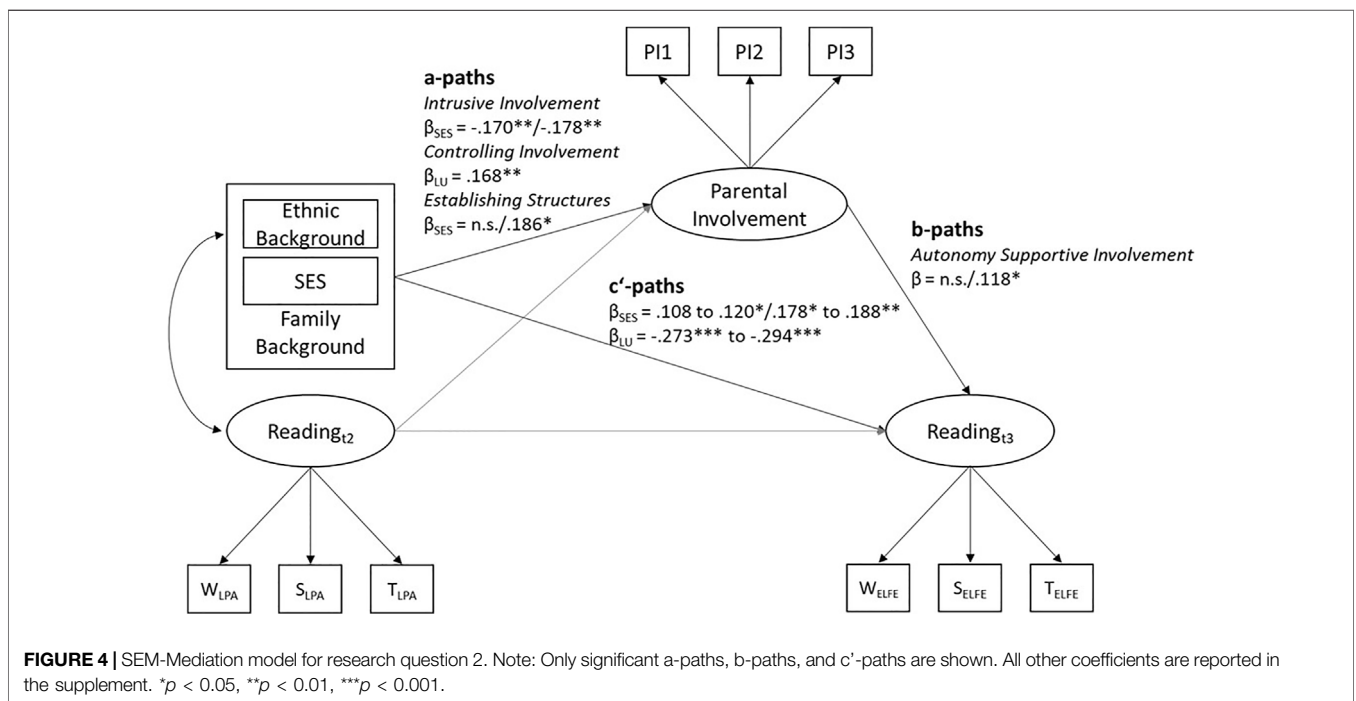**FIGURE 3 |** SEM-Models for research question 1

FIGURE 4 | SEM-Mediation model for research question 2. Note: Only significant a-paths, b-paths, and c'-paths are shown. All other coefficients are reported in the supplement. $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

achievement at t2 and t3, respectively, on socioeconomic and ethnic family background variables and reading achievement assessed at the preceding time point t–1 (i.e., reading t2 was regressed on reading t1 and reading t3 was regressed on reading t2). Reading achievement was modeled as latent variables using the three subtests as indicators. Significant effects of family background variables would indicate that among students who started at t–1 with the same level of reading achievement, family background is associated with their achievement at the end of the respective period (pre-lockdown or lockdown). Looked at another way, family background effects imply that social and ethnic disparities at t2 and t3, respectively, are bigger than expected due to differences at t–1, and thus indicate a relative

growth in the achievement gap. Note that due to different reading tests we cannot conclude whether disparities increase on a common scale.

To answer RQ2, we have extended the lockdown model to the latent mediation model shown in **Figure 4**. The single item measures of parental involvement were included as manifest variables. The mediation hypothesis would be supported if indirect effects are statistically significant (Cheong and MacKinnon, 2012). Due to the high number of parental involvement measures, we estimated separate models for each mediator. In doing so, we end up with seven mediation models. Finally, we included sex of child and learning time as a control variable in the mediation models.

Moreover, as the two ethnic background measures were highly correlated ($r = 0.68$, $p < 0.001$), we estimated separate models (for RQ1 and RQ2) for non-German language use and migration background.

To evaluate the fit of the SEMs, we used the cut-offs proposed by Schermelleh-Engel et al. (2003). A good fit is indicated by $\chi^2/df \leq 2$, CFI ≥ 0.97, RMSEA ≤ 0.05, left boundary of the 90% confidence interval (CI) of the RMSEA equals 0 and SRMR ≤ 0.05. An acceptable fit is indicated by $\chi^2/df \leq 3$, CFI ≥ 0.95, RMSEA ≤ 0.08, 90% CI close to the RMSEA and SRMR ≤ 0.10.

Given the multilevel structure of the data, we used TYPE = COMPLEX in Mplus which applies a sandwich estimator that adjusts for biased standard errors due to clustering (students clustered in classes), provided that the sample size at cluster level is at least 25 (Huang, 2018).

The rate of missing data ranged from 1% (sex) to roughly 10% in the reading tests and about one-third for the parent reports. Whereas missing data on the reading tests were due to students' absence (e.g., illness) during the test period, missing data on parent reports are mainly due to unit nonresponse (i.e., parents did not fill out the questionnaire). As indicated by Little's MCAR-test (Little, 1988), the variable means significantly differed between missing data patterns [$\chi^2(1683) = 2004.28$, $p < 0.001$]. For example, children with missing family background variables (HISEI, parental education, migration background, etc.) scored significantly lower on the ELFE II test. Thus, the results suggest that missing data were the consequence of a missing at random (MAR; see Enders, 2010) mechanism, i.e., the missingness depends on other study variables. To appropriately deal with the missing data, we used a full information maximum likelihood (FIML) estimation, which is an appropriate treatment of missing data under the MAR mechanism (Rioux and Little, 2021).

Finally, as especially LPA-scores were non-normal (skewness ranged from 0.63 to 2.02 and kurtosis from 0.011 to 7.05) and we used ordinal parental involvement indicators, the models were estimated using a robust maximum likelihood estimation (MLR), with standard errors robust to the non-normality of observations and to the use of ordinal variables (Finney and DiStefano, 2006).

RESULTS

Table 1 shows means, standard deviations, and correlations of all variables. For latent variables, latent coefficients are reported. All three reading scores are highly correlated (rs = 0.663 to 0.739, all ps < 0.001). Moreover, the correlations of reading with SES, language use (LU) at home, and migration background (MB) are all small to moderate in size and significant. Notably, they are higher after the lockdown at t3 ($r_{ELFE,SES} = 0.352$, $p < 0.001$; $r_{ELFE,LU} = -0.400$, $p < 0.001$; $r_{ELFE,MB} = -0.225$, $p < 0.001$) than at t1 ($r_{LPA1,SES} = 0.234$, $p < 0.001$; $r_{LPA1,LU} = -0.239$, $p < 0.001$; $r_{LPA1,MB} = -0.148$, $p < 0.01$) and t2 ($r_{LPA2,SES} = 0.189$, $p < 0.01$; $r_{LPA2,LU} = -0.157$, $p < 0.05$; $r_{LPA2,MB} = -0.125$, $p < 0.05$). Reading at t3 is correlated with controlling involvement ($r = -0.146$, $p < 0.05$), intrusive involvement ($r = -0.202$, $p < 0.01$), and autonomy supportive involvement ($r = 0.127$, $p < 0.05$). Intrusive

involvement is also correlated with reading at t2 ($r = -0.189$, $p < 0.01$). Thus, less intrusive, less controlling, and higher levels of autonomy supportive involvement are associated with better reading scores.

Research Question 1

Table 2 shows the results regarding RQ1. Fit indices indicate an acceptable fit. The columns labeled section A provide the results for the pre-lockdown and lockdown period using language use as an indicator of the ethnic background. The columns labeled section B present the results using migration background as predictor. Both models for the pre-lockdown period show that reading at t2 is associated only with reading at t1 (Section A: $\beta = 0.703$, $p < 0.001$; Section B: $\beta = 0.700$, $p < 0.001$). However, in the models for the lockdown period we found significant effects of SES (Section A: $\beta = 0.122$, $p < 0.05$; Section B: $\beta = 0.189$, $p < 0.01$) and non-German language use (Section A: $\beta = -0.274$, $p < 0.001$). The effect of migration background is not significant.

To statistically compare the effects of the pre- and peri-lockdown period, we estimated confidence intervals (CI) for the differences in β-coefficients (i.e., $\beta_{SES,Lockdown} - \beta_{SES,Pre-lockdown}$, etc.) applying the method proposed by Zou (2007) [2] and implemented in the cocor R-package (Diedenhofen and Musch, 2015). Moreover, we report the effect size Cohen's q (Cohen, 1988) to quantify differences in β-coefficients ($q < 0.1$ = no effect, $0.1 \leq q < 0.3$ = small effect; $0.3 \leq q < 0.5$ = moderate effect; $q \geq 0.5$ = large effect). These results are also reported in Table 2. The CIs for the difference in the SES-effects in section B [Pre-Lockdown vs. Lockdown: $q = 0.146$, 95%-CI (0.056, 0.231)] and the difference in the effects of non-German language use in section A [Pre-Lockdown vs. Lockdown: $q = -0.309$, 95%-CI (-0.387, -0.215)] do not contain 0, thus, indicating a significantly stronger effect of SES and non-German language use during the lockdown period than during the pre-lockdown period. However, SES-effects in section A do not differ significantly [Pre-Lockdown vs. Lockdown: $q = 0.072$, 95%-CI (-0.018, 0.160)].

To sum up, reading scores are associated with family background at t1, t2, and t3 (see Table 1). For the pre-lockdown period we found no effects of the family background variables on reading comprehension. Thus, social and ethnic disparities at t2 are not larger than expected due to preexisting disparities at t1. However, the results for the lockdown period indicate that social and ethnic disparities after the lockdown (t3) are larger than expected due to pre-lockdown disparities (t2).

Supplementary Analyses

We performed a series of analyses to better understand the impact of different reading tests that were used as outcome variables. The results are provided in detail as supplement. For the analyses, we take advantage of the fact that a small subsample of $n = 141$ students (Subsample A) has completed the eighth LPA-test during the first 3 weeks of June and later also the ELFE II.

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[2]Note: we applied the method to standardized path coefficients, although it was developed for comparing correlations and R^2s.

TABLE 2 | Results of SEM for research question 1.

	Section A—Ethnic background = Non-German language use				Section B—Ethnic background = migration background			
	Pre-lockdown	Lockdown	Difference		Pre-lockdown	Lockdown	Difference	
	β (SE)	β (SE)	q	95%-CI	β (SE)	β (SE)	q	95%-CI
Reading t-1[a]	0.703*** (0.052)	0.574*** (0.040)			0.700*** (0.049)	0.584*** (0.042)		
Ethnic background	0.028 (0.063)	−0.274*** (0.064)	−0.309	(−0.387, −0.215)	0.007 (0.041)	−0.098 (0.064)	0.105	(−0.193, −0.017)
SES	0.051 (0.072)	0.122* (0.055)	0.072	(−0.018, 0.160)	0.045 (0.077)	0.189** (0.066)	0.146	(0.056, 0.231)
R^2	0.506	0.514			0.505	0.450		
Model Fit								
χ^2(df)	40.667 (15)[b]	47.344 (16)			41.165 (15)[b]	44.842 (16)		
CFI	0.957	0.968			0.956	0.970		
TLI	0.922	0.947			0.921	0.949		
RMSEA	0.065	0.069			0.066	0.067		
90% CI RMSEA	(0.041, 0.090)	(0.047, 0.093)			(0.042, 0.090)	(0.044, 0.090)		
SRMR	0.042	0.039			0.041	0.039		

[a]For the pre-lockdown period we control for reading at t1 and for the lockdown period for reading at t2.
[b]As indicated by the modification index we estimated a covariance between the LPA-word reading subtest errors across time. This seems reasonable as the LPA word reading may require somewhat different skills and strategies than sentence and text reading (Pritchard et al., 2018).
*p < 0.05, **p < 0.01, ***p < 0.001.

Thus, both tests were administered after the lockdown. We investigated whether the results for the lockdown period (**Table 2**) could be confirmed using the LPA test as outcome in subsample A. We found no significant effect of the family background variables. This might be a power issue due to the reduced sample size. However, also the βs are smaller (SES: β = 0.079, $p > 0.05$; Language use: β = −0.071, $p > 0.05$). Thus, at a first glance, these results contradict the conclusion that disparities have grown during the school closures.

Referring to van de Vijver (1998) typology of bias in cross-cultural research that has also been applied to studies linking different tests (e.g., Wagner et al., 2018), there are three explanations for the divergent results.

First, subsample A (i.e., students that completed both tests after the lockdown) might be different from the remaining sample (subsample B; sample bias; van de Vijver, 1998, p. 45). It is possible that, regardless of the reading test, family background effects are smaller or even not present in subsample A. We ran multigroup models to explore whether family background effects on the ELFE II differ between the subsamples A and B. However, we found no significant differences in the family background effects. SES and language use are significantly related to the ELFE II in both subsamples (see **Supplementary Table A2** in the supplement).

Second, the tests might be differentially associated with the family background variables due to instrument bias or administration bias (van de Vijver, 1998, p. 46). That is, although both tests refer to the same construct, stimulus features such as differential stimulus familiarity (instrument bias) and administration aspects such as differential linguistic requirements to understand the test instruction, time restrictions or mode effects (administration bias) might cause different associations with family background. To investigate this explanation, we compared the correlations of the family background variables with the LPA-test and the ELFE II, respectively, in subsample A. Results show that the correlations with SES do not differ significantly [$r_{SES,ELFE}$ =

0.297, $p < 0.01$ vs. $r_{SES,LPA}$ = 0.235, $p < 0.05$; 95%-CI for the correlation difference (−0.038, 0.156), q = 0.067]. However, language use and migration background are significantly stronger correlated with the ELFE ($r_{LU,ELFE}$ = −0.348, $p < 0.001$; $r_{MB,ELFE}$ = −0.330, $p < 0.001$) than with the LPA-test [$r_{LU,LPA}$ = −0.132, $p > 0.05$; $r_{MB,LPA}$ = −0.068, $p > 0.05$; 95%-CI$_{LU}$ (−0.313, −0.120), q_{LU} = −0.230; 95%-CI$_{MB}$ (−0.359, −0.165), q_{MB} = −0.275]. Thus, the effects of language use reported in **Table 2** might by subject to instrument and/or administration bias.

Third, family background might not only be differentially associated with the whole test, but also with the subtests (comparable to item bias, van de Vijver, 1998, p. 46) and thus, biasing the overall results. Most important, it turns out that especially the correlations of the family background variables with the sentence reading subtests differ between the LPA and the ELFE II with significantly stronger correlations for the ELFE II [$r_{SES,ELFE}$ = 0.283, $p < 0.01$ vs. $r_{SES,LPA}$ = 0.115, $p > 0.05$; 95%-CI (0.030, 0.304), q = 0.175; $r_{LU,ELFE}$ = −0.349, $p < 0.01$ vs. $r_{LU,LPA}$ = −0.123, $p > 0.05$; 95%-CI (−0.360, −0.090), q = −0.241; $r_{MB,ELFE}$ = −0.321, $p < 0.001$ vs. $r_{MB,LPA}$ = −0.054, $p > 0.05$; 95%-CI (−0.401, −0.130), q = −0.279]. The correlation differences for the text reading subtests with SES and language use are not significant and negligibly in size [$r_{SES,ELFE}$ = 0.357, $p < 0.001$ vs. $r_{SES,LPA}$ = 0.311, $p < 0.01$; 95%-CI (−0.082, 0.175), q = 0.052; $r_{LU,ELFE}$ = −0.294, $p < 0.01$ vs. $r_{LU,LPA}$ = −0.222, $p < 0.05$; 95%-CI (−0.204, 0.060), q = −0.077]. Similarly, there are no significant differences between word reading and SES and language use, respectively. However, word reading is in general less strongly correlated with the family background (for full results see supplement). Thus, these results indicate that family background is especially differentially associated with the sentence reading subtests, what might bias the overall results reported in **Table 2**. Therefore, we repeated the analyses (results reported in **Table 2**) using the LPA-subtests and the ELFE II-subtests as outcomes at t3 for subsample A (for full results see **Supplementary Table A2** in the supplement). For text reading, the effects of SES ($\beta_{SES,LPA}$ = 0.232, $p < 0.05$; $\beta_{SES,ELFE}$ = 0.301, $p < 0.01$) and language use (LPA: β = −0.259, $p < 0.05$;

ELFE II: $\beta = -0.318$, $p < 0.01$) are confirmed using both, the LPA and the ELFE II as outcome. There are no family background effects on word reading, neither for the LPA nor the ELFE II as outcome. In line with differential correlations reported above, there are significant effects of SES and language use on ELFE II sentence reading ($\beta_{SES} = 0.175$, $p < 0.05$; $\beta_{SES} = -0.294$, $p < 0.001$), but not on LPA sentence reading ($\beta_{SES} = 0.004$, $p > 0.05$; $\beta_{SES} = -0.057$, $p > 0.05$).

Overall, these results indicate that the use of different reading tests has somewhat affected the effects of the family background variables. However, the additional analyses at least confirm family background effects on the text reading subtest.

Research Question 2

Results regarding RQ2 are shown in **Figure 4**. Note that only significant coefficients for a, b and c'-paths are displayed. Detailed results are reported in **Supplementary Tables A3, A4** in the supplement. Note that in the case of two reported values separated by a slash, the first value refers to the results using language use as indicator of the ethnic background (Section A in **Supplementary Table A4**) and the second value refers to results for migration background (Section B in **Supplementary Table A4**). Fit indices indicate an acceptable to good fit (χ^2/df = 1.78–2.37, RMSEA = 0.044–0.058, CFI = 0.966–0.975; TLI = 0.942–0.964, SRMR = 0.032–0.047).

First, there is only scant support for the hypothesis that family background is associated with parental involvement in distance learning (a-paths). Specifically, high-SES parents more frequently reported that they established structures for distance learning (β = 0.186, $p < 0.05$) and high-SES parents also reported less intrusive involvement ($\beta = -0.170/-0.178$, ps < 0.01). Moreover, parents with a migration background reported higher levels of controlling involvement (β = 0.168, $p < 0.01$). Second, we hardly found any support for the hypothesis that parental involvement is associated with reading achievement at t3 (b-paths). Only one out of 14 analyses resulted in a significant effect of parental involvement on reading. Higher levels of autonomy supportive involvement were associated with better reading at t3 (β = 0.118, $p < 0.05$). After controlling for multiple testing (Bonferroni-Holm), even this association becomes insignificant. Third, because the lack of significant a-paths and b-paths direct effects of family background (c'-paths) remain largely statistically significant and hardly change in size (SES: βs = 0.108–0.120/0.178–0.188, ps < 0.05–0.10/.01–0.05; LU: βs = −0.273 to −0.294, ps < 0.001) and thus, we did not find any significant indirect effects of family background on reading achievement.

Finally, sex of child was associated with controlling involvement and intrusive involvement. Parents were more involved in a controlling ($\beta = -0.208/-0.204$, $p < 0.001$) and intrusive ($\beta = -0.093/-0.089$, $p < 0.05$) way in distance learning of boys than that of girls. Moreover, learning time was positively associated with establishing structures (β = 0.084/0.097, $p < 0.10/0.05$) and positive interpersonal involvement (β = 0.121/0.127, ps < 0.05) and reading at t2 was negatively related to intrusive involvement ($\beta = -0.111/-0.115$, ps < 0.05).

DISCUSSION

The current study had two objectives. On the one hand, we wanted to examine whether social and ethnic disparities in reading widened during COVID-related school closures in spring 2020 (RQ1). On the other hand, if there were any increased social and ethnic disparities in reading achievement, we wanted to discover whether the increased disparities could be explained by ethnic- and socioeconomic differences in parental involvement in distance learning (RQ2). Notably, whereas various studies have directly focused on increased disparities (i.e., c-paths in a mediation framework; Engzell et al., 2021; Pier et al., 2021) and others have focused on the associations of family background variables with variables that might account for a growing achievement gap (i.e., a-paths; Andrew et al., 2020; Reimer et al., 2021), the current study is–to the best of our knowledge–the first that explicitly tests a full mediation model. To answer our research questions, we used data from an ongoing longitudinal study (started in 2018) on the use of learning progress assessment in primary schools (25 classes and 409 2nd graders).

First, comparing a pre-lockdown and a lockdown period of similar length, our results revealed effects of family background (SES and non-German language use at home) on post-lockdown reading achievement, even after controlling for pre-lockdown achievement. Social and ethnic reading disparities after the lockdown (June 2020) were larger than expected due to the social and ethnic differences that already existed before the lockdown (reading and family background were moderately correlated before the lockdown). In contrast, we found no family background effects on reading achievement during the pre-lockdown period. Thus, social and ethnic disparities have grown during the lockdown period, whereas disparities remained stable during the pre-lockdown period. Our results are in line with the growing research that highlights that COVID-19-related school closures have affected educationally disadvantaged students more strongly than their more advantaged peers, resulting in a widening achievement gap (Maldonado and De Witte, 2020; Engzell et al., 2021; Pier et al., 2021). Whereas these other studies took a between-subject perspective–i.e., comparing the same grade students of different years–we took a within-subject perspective, i.e., we compared family background effects during a pre-lockdown period with family background effects of a lockdown period within the same sample of 2nd graders. Thus, our conclusion about increased disparities assumes that family background effects are equally at work throughout the school year. Possibly, this assumption might not hold. However, some research suggests constant reading-SES-associations throughout a school year (e.g., Kieffer, 2012). Importantly, it must be noted that we used a different reading outcome measure before and after the lockdown. This is far from ideal but is due to the special circumstances surrounding the school closures. The use of different tests might bias results if family background generally accounts for a different amount of variance in LPA-tests and the ELFE-test. Although additional analyses based on a subsample of students who completed the ELFE and the LPA-test after the lockdown showed that LPA and ELFE score are highly correlated

(r = 0.843), we also found that family background is significantly stronger correlated with the sentence reading subtests of the ELFE than with respective subtest of the LPA-test. As this might bias the overall results, we performed separate analyses for subtests. For the text reading subtests family background effects (SES and language use) during the lockdown period are confirmed and appear robust against the use of different tests. In contrast, the different tests affect the results on the family background effects on sentence reading, i.e., background effects are upwardly biased when using the ELFE as outcome. These discrepancies must be investigated in the future. Moreover, using different tests has generally been argued to bias results of studies on summer loss by artificially increasing achievement gaps (von Hippel et al., 2018). However, whereas these studies focus on quantifying the achievement gap over time in a common metric, we used a lagged-score approach (i.e., regressing achievement on family background and achievement at t–1) that asks a somewhat different question, namely, are social and ethnic disparities at time t larger than expected due to existing disparities at t–1 (see also Dumont and Ready, 2020). Finally, as students in our sample are nested within classes and schools, we adjusted the standard errors for clustering and did not use a multilevel approach because we focused on an overall effect of family background (see also Dumont et al., 2012). However, it is well known that such an overall effect is an uninterpretable blend of within cluster and between cluster effects (Raudenbush and Bryk, 2002), thus, our results might conflate compositional and individual level effects. A recent study by Dumont and Ready (2020) found effects of mean school SES during summer holidays, but not during the school year. In this regard, it might be that schools with a higher share of disadvantaged students provided less qualitative distance instruction during school closures, thus, increasing between-school differences.

Second, we found no support for the hypothesis that increased disparities during school closures were associated with social and ethnic differences in parental involvement in distance learning. This agrees with the findings of Dumont et al. (2012), who also did not find support for the hypothesis that family background effects on achievement are mediated by parental homework involvement. However, we found some evidence that high SES-parents show more conducive (structuring involvement) and less detrimental (intrusive involvement) forms of involvement in distance learning. Similar results have been reported in various other studies on parental homework involvement (Dumont et al., 2012; Moroni et al., 2014) and recently also in a study on parental involvement during COVID-19-related distance learning (Sander et al., 2021). Moreover, we found that parents with migrant background reported higher levels of controlling involvement during school closures. This finding is in line with results of Moroni et al. (2014) but contradicts the results of Dumont et al. (2012) who found that students with migration background characterized their parents as less controlling. The inconsistent findings regarding the effects of migration background might be associated with different cultural backgrounds that have (inappropriately) been collapsed into a binary variable (migration background no/yes). Parenting goals and behaviors might differ between ethnic groups (see e.g., Bornstein, 2012) and even might differentially affect achievement (Pinquart and Kauser, 2018). The culture of origin as well as the culture of the receiving country may also interact in affecting parental involvement (Nauck et al., 2017). Thus, ethnic background effects on involvement may differ depending on the ethnic groups that make up the migrant population. However, in our study we did not assess the country of origin (amongst other to ensure anonymity). Therefore, our analysis options on ethnic background effects are limited. Nonetheless, this issue should be subject to future research.

In this context, as the parent questionnaire focusing on distance learning during school closures was kept very short to maximize response rates during challenging times, this research cannot address a variety of contextual factors (e.g., remote working of parents, parents working in food stores and thus, outside the home) that would also be relevant to involvement, and may be candidate mediators for the relationship between family background and parental involvement (e.g., perceived stress). For example, the hypothesized SES effect on involvement is–amongst others–based on a family stress perspective (Conger and Donnellan, 2007). It is argued that low SES parents experience more stress what in turn negatively affects the quality and quantity of their involvement. However, an Italian study by Spinelli et al. (2021) showed that low SES parents even experienced lockdown and home confinement as less stressful than socioeconomically more advantaged parents. Spinelli et al. (2021) argue that this may be because daily routines have been more disrupted in families with higher SES. In these families more supportive resources may have been available before the lockdown, making it harder to cope with the loss of these resources. Higher SES parents may also more often work in jobs allowing remote working during the lockdown, thus, increasing strain due to difficulties to reconcile work and childcare, what in turn affected parental involvement. In a similar vein, remote working may have limited parental time and energy to get involved in the distance learning of the children. To sum up, our study does not provide information on relevant context factors that have changed and evolved due to lockdown, school closures, and home confinement, and in turn affected parental involvement and child (academic) development. A more comprehensive (especially also qualitative) assessment of the complex ecological system (Bronfenbrenner, 1979) during school closures would have been desirable, but could not be implemented in this study.

Further, we did not find evidence that parental involvement in distance learning is associated with students' achievement. This result contradicts research indicating that structuring, autonomy supportive, and positively affective involvement is conducive, whereas controlling and negatively affective homework involvement is detrimental to children's academic achievement (Dumont et al., 2012; Dumont et al., 2014; Moroni et al., 2015; Silinskas and Kikas, 2019). Moreover, given the high importance attached to parental involvement for successful distance learning (Cottingham, 2020; Education Endowment Foundation, 2020)—especially for younger children as in our study–the non-significant effects are somewhat surprising. There are several

explanations for this finding. Amongst others, three constructs (controlling, intrusive, and autonomy supportive involvement) were measured using single items, thus results are likely biased by measurement error. Related to this, the measures–and especially the single item measures–do not sufficiently capture the conceptual width of the constructs. For example, controlling involvement may take various other manipulative forms such as love withdrawal and guilt induction (Pomerantz and Grolnick, 2017), that might affect achievement. Similarly, Grolnick et al. (2014) describe various aspects of structuring involvement (e.g., provision of rationales for rules) that have not been considered in our study. Moreover, we assessed parental involvement *via* parent reports. However, for various aspects of involvement, such as controlling or structuring involvement, it might be much more important how children perceive and interpret their parents' behavior, and not simply what parents do (Kakihara and Tilton-Weaver, 2009). Thus, most research showing effects of parental homework involvement on achievement use child reports on involvement (Dumont et al., 2012; Moroni et al., 2015; Silinskas and Kikas, 2019).

Finally, we studied parental involvement from an SDT-perspective (Grolnick et al., 1997) and thus, might have missed relevant aspects of involvement derived from other theoretical perspectives. For example, the quality and quantity of instruction provided by parents during school closures and process-focused (e.g., praising the effort for and not the result of learning) involvement (Pomerantz and Grolnick, 2017) might be more relevant for reading achievement. Parental instruction might directly affect reading achievement, whereas SDT-based involvement is argued to indirectly affect reading achievement *via* motivation. Thus, given the relatively short period of school closures, these mediation processes may not have had enough time to produce their effects. To test this assumption, future studies may include student motivation in our mediation model. To conclude, a broader assessment of parental involvement using well-developed and validated scales would have been beneficial. However, this was not possible because the parent questionnaire had to be kept short to maximize response rate in challenging times and most importantly, available homework involvement scales could not directly be applied to involvement during school closures, as involvement in distance learning comprises more than "classical" homework involvement. Similar to a broader assessment of contextual factors, a detailed qualitative assessment of what constitutes parent involvement in distance learning would have been valuable.

CONCLUSION

This study adds to the growing research showing that social and ethnic inequalities were growing during COVID-19-related school closures. Thus, education systems and its actors are faced with the challenge of how to counteract these increased disparities. Effective interventions for promoting the target groups are available and should be considered (Dietrichson et al., 2017). Finally, future research must identify relevant mediators that accounted for growing disparities. This is necessary to prevent the future growth of disparities as the pandemic is still not over, and further school closures cannot be ruled out.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because data is part of an ongoing study. Requests by qualified researchers to access the minimal set of variables used in the study should be directed to the corresponding author. Requests to access the datasets should be directed to CW, christoph.weber@ph-ooe.at.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

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SUPPLEMENTARY MATERIAL

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