
Impact of the COVID-19 Pandemic on the Academic Achievement of Primary School Students in Luxembourg: First Longitudinal Results from the National School Monitoring Programme “Épreuves Standardisées” (ÉpStan) (Integral version)

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Auswirkungen der COVID-19-Pandemie auf die schulischen Kompetenzen von Grundschüler*innen in Luxemburg: Erste längsschnittliche Befunde aus den „Épreuves Standardisées“ (ÉpStan)

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1. Introduction

The outbreak of COVID-19 in 2020 led to a pandemic-related state of emergency, during which governments worldwide implemented extensive measures to protect the population and curb the spread of the virus, which largely brought public life to a standstill (e.g., border closures, closures of restaurants, retail and service businesses, restrictions on social contacts outside of one's own household). This entailed school closures, the duration of which varied depending on the country and progression of the pandemic (see *Figure 1.2* in OECD, 2021, p. 9), and represented a profound disruption to the education of 1.5 billion students across 188 countries. While the 2019/20 school year was affected by such school closures, the 2020/21 school year was characterised by the resumption of regular schooling under certain protective and hygiene measures (e.g., maintaining physical distance, wearing masks during classes, regular testing, and placing classes or students in quarantine), which could also have influenced students' education (e.g., hybrid learning or complete absence from classes in the case of quarantine; Betthäuser et al., 2023).

While studies on school closures during holiday periods (Cooper et al., 1996; Johnston et al., 2015) or in cases of temporary extreme situations (e.g., natural disasters like storms or earthquakes; Connolly, 2013; Gibbs et al., 2019), as well as modeling studies on the potential impact of COVID-19-related school closures (Bao et al., 2020; Kuhfeld et al., 2020), have already indicated that the suspension of in-person classes during the COVID-19 pandemic could have negatively affected students' learning progress, the current body of research appears to confirm this assumption.

First data from international studies show that the pandemic-related school closures and protective measures had a negative impact on the academic achievement of primary and secondary school students, and that certain groups of students (e.g., those from socioeconomically disadvantaged households, younger students) were more severely affected than others, for example, due to a limited access to technology or less support at home (for a systematic overview and meta-analyses of individual study results, see Betthäuser et al., 2023; Di Pietro, 2023; Hammerstein et al., 2021). Additionally, the studies concluded that observed declines in performance were more pronounced in mathematics than in other subjects (e.g., languages).

With the results of the national school monitoring programme *Épreuves Standardisées* (ÉpStan, for more information, see section 2.2) from the autumn of 2020, 2021, and 2022, Luxembourg has comprehensive and fully representative datasets available that provides initial answers to the questions of how the school closures during the first phase of the COVID-19 pandemic (spring 2020), as well as the protective and hygiene measures implemented in the subsequent 2021/2022 school year, affected students' academic achievement in Luxembourg (see *Info Box – Previous findings in Luxembourg* for an overview).

As the **cross-sectional data** displayed in *Figure 1* shows, the ÉpStan competency scores in primary schools remained largely stable. Thus, the pandemic-related school closures and protective measures in the 2020 to 2022 school years did not seem to lead to a systematic decline in achievement, but rather to specific decreases in certain areas of competence. In autumn 2020, regardless of their language background or

socio-economic status (SES), the noteworthy decrease observed in German listening comprehension in Cycle 3.1 affected all students. While *Figure 1* may initially suggest that the students who attended Cycle 3.1 in autumn 2022¹ achieved a mean score in German listening comprehension comparable to the pre-pandemic cohorts (5 ÉpStan points lower than in autumn 2019), *Figure 2* highlights that the impact varied depending on students' language background. In this context, students who speak Luxembourgish and/or German with at least one of their parents showed a considerably higher mean achievement score in German listening comprehension in autumn 2022 (21 ÉpStan points) compared to the pre-COVID cohort in autumn 2019. For students who do not speak either of these two languages, a different picture emerges. Both French- and Portuguese-speaking students scored below the mean of the 2019 cohort in the school years following the outbreak of the COVID-19 pandemic (by 26 and 22 ÉpStan points, respectively). These findings indicate that the observed mitigation of the achievement decrease in German listening comprehension in Cycle 3 (*Figure 1*) can be explained by the performance of students who speak Luxembourgish and/or German at home, while students speaking French or Portuguese have continued to display lower mean achievement scores since 2020. A similar pattern can also be observed for the domain of German reading comprehension in Cycle 3. While students who speak Luxembourgish and/or German at home had largely stable achievement scores in German reading comprehension since the outbreak of the pandemic, their peers with a French or Portuguese language background stayed behind the 2019 cohort's mean by 30 and 18 ÉpStan points, respectively.

In addition to this considerable decrease in German listening comprehension, which had already become visible in Cycle 3.1 students' mean achievement score in the 2020 school year, achievement decreases in mathematics (C3.1) and in French reading comprehension (C4.1) can be observed in the 2022 school year. These declines exceed the regular fluctuations of ± 10 ÉpStan points compared to the previous school year and could potentially be understood as delayed effects of the school closures and protective measures. Whereas the decrease in mathematics (C3.1) can be observed across all language groups (see *Figure 3*), the pandemic-related school closures and protective measures appear to have affected French reading comprehension competences differently, depending on the students' language background. This finding seems to be in line with the pattern observed for German listening comprehension in C3.1. While Luxembourgish and/or German-speaking students were the ones who improved their achievement scores in German listening comprehension compared to the pre-COVID cohort (autumn 2019), it was the French-speaking students who achieved higher mean scores in French reading comprehension compared to the autumn 2019 cohort (by 13 ÉpStan points). With a difference of 27 ÉpStan points, students who speak Luxembourgish and/or German at home showed the greatest decrease in French reading comprehension.

Figure 4 illustrates the development of the ÉpStan competency scores in secondary school from 2014 to 2022 by the example of the 5^e classes². In the *Enseignement Secondaire Classique* (ESC), the highest track

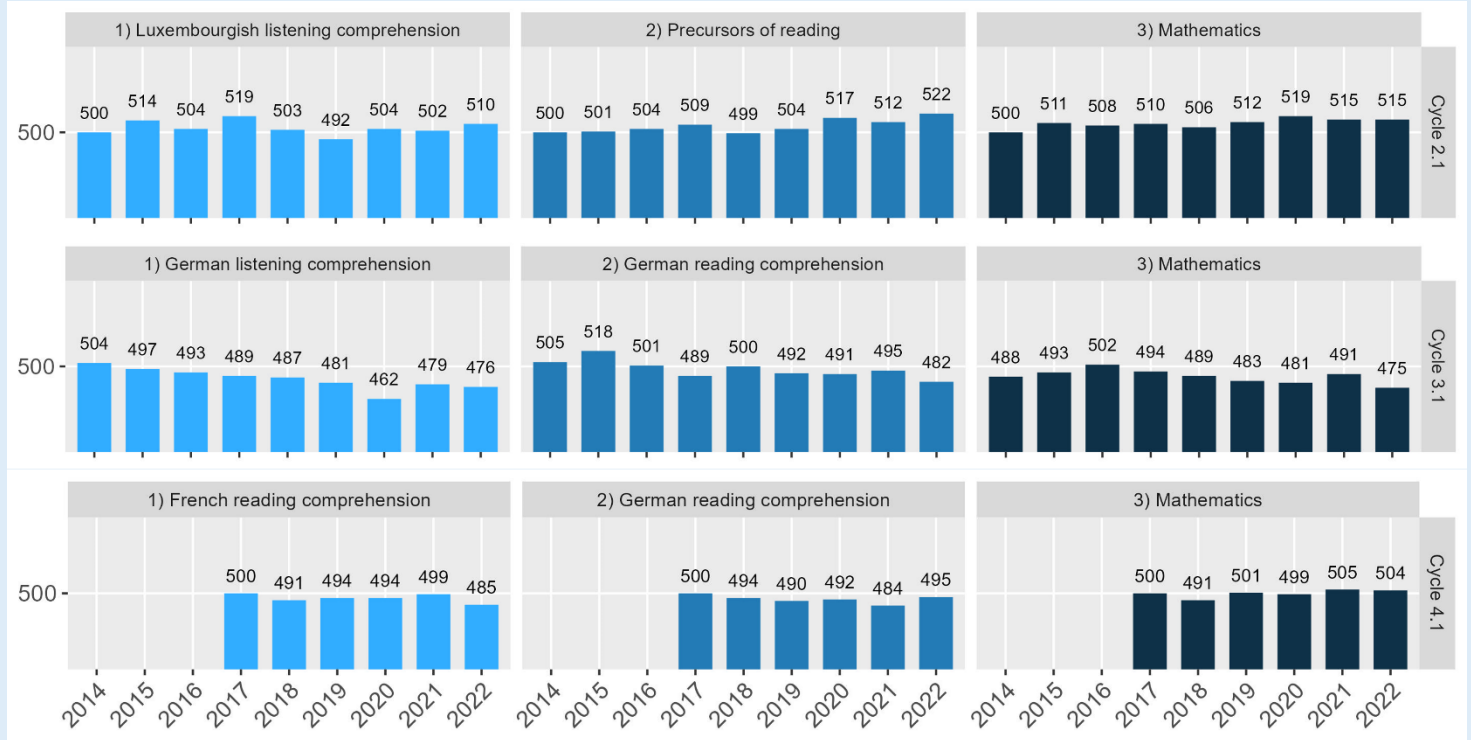
¹ As cross-sectional data are presented here, it is important to note that these do not track the same students over time but rather represent different cohorts who attended a specific learning cycle at a given point in time (e.g., autumn 2020).

² In Luxembourg, the 5^e marks the third year of secondary education.

of secondary education (for details on the different secondary school tracks, see Lenz & Heinz, 2018), the achievement scores remained largely stable since the outbreak of the pandemic, except for a 15 ÉpStan point decrease in mathematics observed in autumn 2022, which should be monitored in the coming years. In both the *Voie d'orientation* (ESG, intermediary track) and the *Voie de préparation* (ESG-VP, lowest track) of the *Enseignement Secondaire Général*, a decrease of about 40 ÉpStan points in the domain of German reading comprehension has been observed since the outbreak of the COVID-19 pandemic, affecting secondary school students irrespective of their SES and language background. In the ESG-VP, a comparable decrease in French reading comprehension becomes apparent. However, in line with the findings for Cycle 4.1, it is primarily students speaking Luxembourgish and/or German at home who show the strongest decrease in French reading comprehension compared to the 2019 cohort (62 ÉpStan points).

Info box – Previous findings in Luxembourg

Figure 1: Mean scores of the ÉpStan achievement tests in primary school from 2014 to 2022



Based on cross-sectional data, *Figure 1* shows the mean scores of the ÉpStan achievement tests in different key domains for the cohorts of primary school students who attended learning cycles C2.1, C3.1 and C4.1 between 2014 and 2022. The ÉpStan metric is standardised so that the mean score of all students in Luxembourg in a reference school year (typically the first year in which the competency was assessed in the respective learning cycle) is set at 500 points, with a standard deviation of 100 (Fischbach et al., 2014). While fluctuations of ± 10 ÉpStan points can be considered normal variations between cohorts, the school years since the outbreak of the COVID-19 pandemic (2020-2022) have shown decreases in German listening comprehension (by 19 ÉpStan points in autumn 2020), German reading comprehension (by 13 ÉpStan points in autumn 2022) and mathematics (by 16 ÉpStan points in autumn 2022) in cycle 3.1, as well as in French reading comprehension (by 14 ÉpStan points in autumn 2022) in cycle 4.1.

Figure 2: Mean scores in German listening and reading comprehension by language background and SES in C3.1 from 2018 to 2022

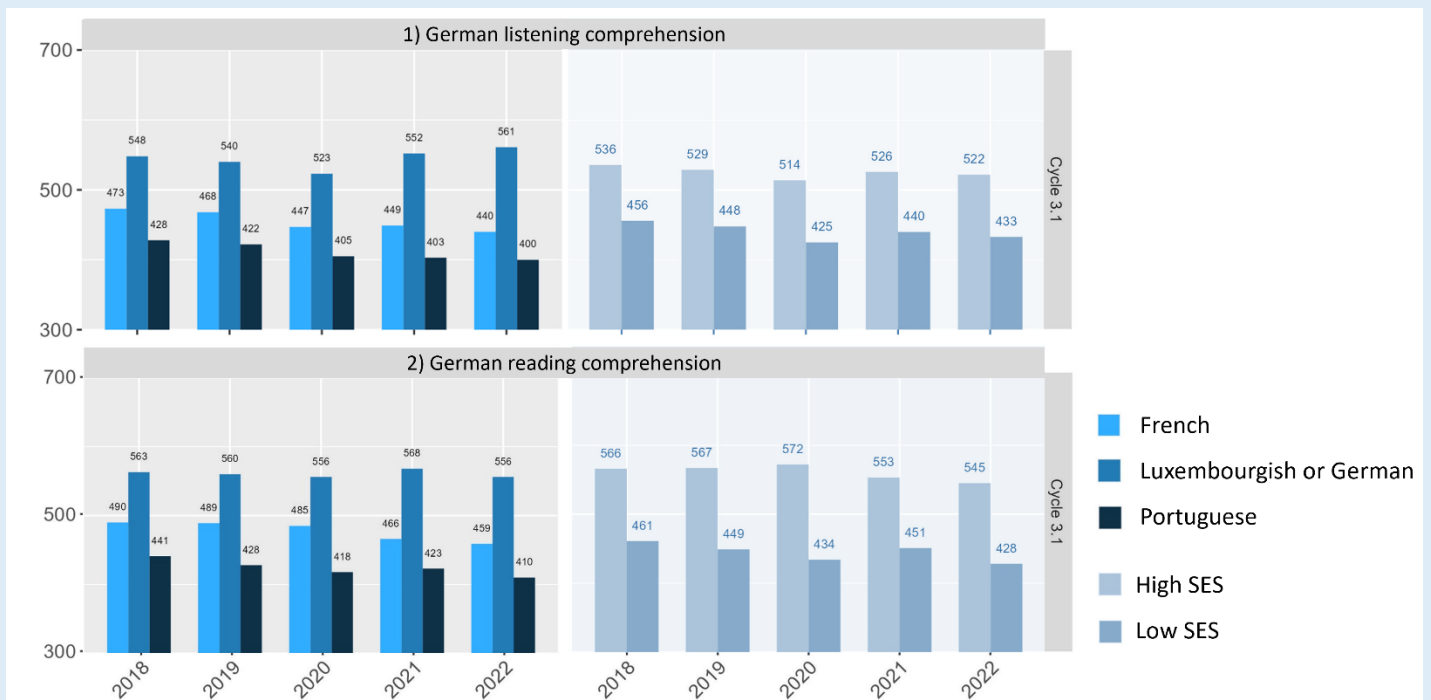
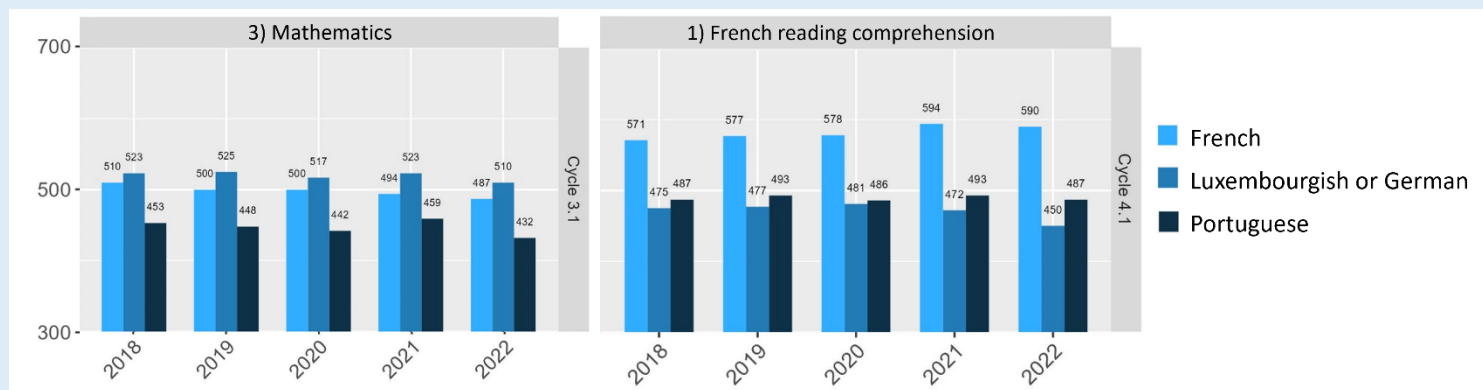


Figure 2 shows the mean scores in German listening comprehension and German reading comprehension – two domains where an achievement decrease has been observed in learning cycle C3.1 since the outbreak of the COVID-19 pandemic – split by students' language background and socioeconomic status (SES; for details on these background variables see section 2.3). While both socioeconomically advantaged and disadvantaged students have achieved lower mean scores in the two competency domains – particularly in German reading comprehension (see the lower right half of Figure 2) – in the school years since the outbreak of the pandemic compared to previous cohorts, a more differentiated picture emerges for the different language groups (see section 1 for a more detailed explanation).

Figure 3: Mean scores in mathematics (C3.1) and French reading comprehension (C4.1) split by language



As described below Figure 1, achievement declines in mathematics (C3.1) and in French reading comprehension (C4.1) were observed in autumn 2022. Figure 3 shows the mean scores in these two competency domains split by language background. In French reading comprehension, in particular, a differentiated picture emerges for the various language groups (see section 1 for a more detailed explanation). In contrast, SES does not appear to have a differential effect on academic achievement. Both socioeconomically advantaged and disadvantaged students showed lower mean scores in both achievement domains in the 2022 school year compared to previous cohorts.

Figure 4: Mean scores of the ÉpStan achievement tests in 5^e of secondary school from 2014 to 2022 split by school track

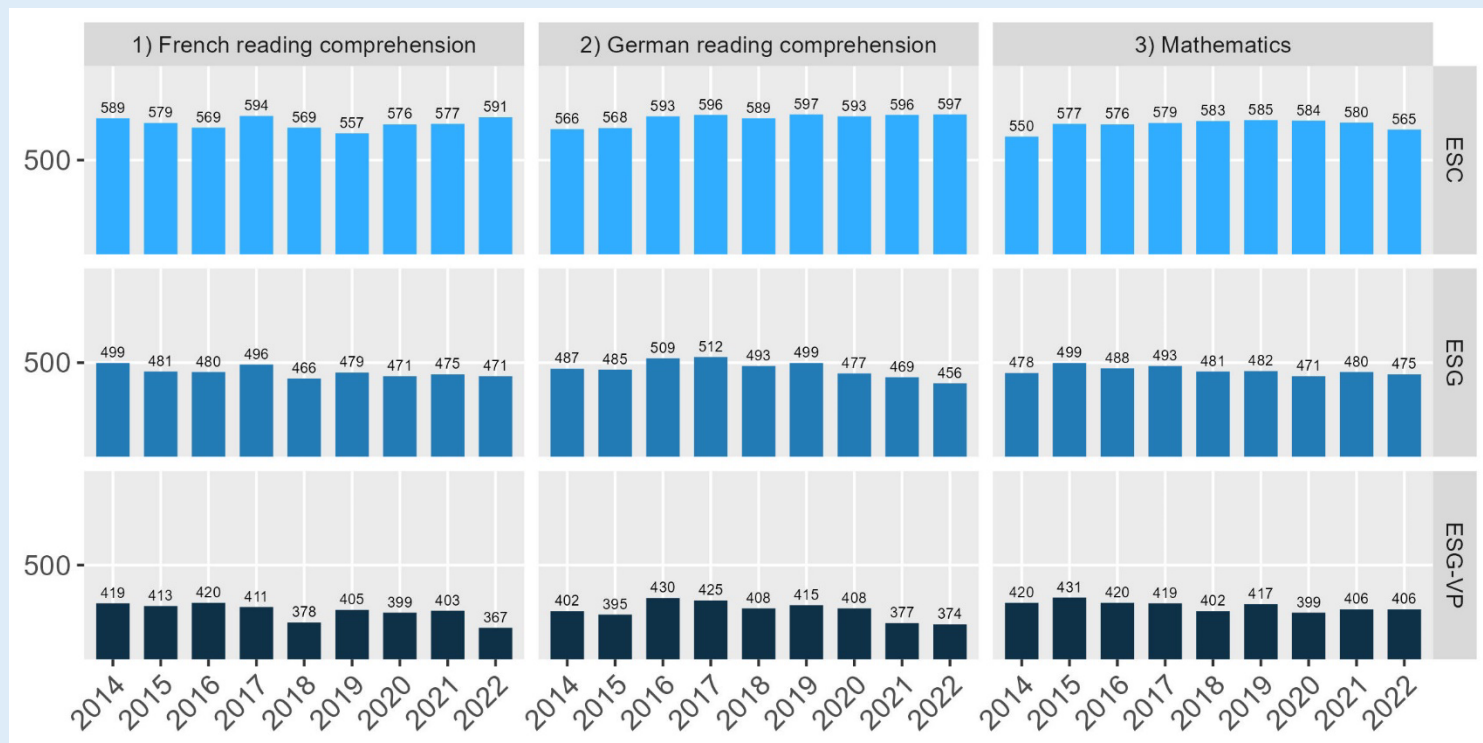


Figure 4 shows the mean scores of the ÉpStan achievement tests across different domains for the secondary school cohorts that attended a 5^e class between 2014 and 2022 split by school track. While fluctuations of ± 10 ÉpStan points in secondary school can be considered normal variations between cohorts, achievement decreases in German reading comprehension (by 43 ÉpStan points in the ESG and by 41 ÉpStan points in the ESG-VP) as well as in French reading comprehension in the ESG-VP (by 38 ÉpStan points) have been observed since the outbreak of the COVID-19 pandemic (between autumn 2020 and 2022).

In summary, it can be concluded that the pandemic-related school closures and protective measures during the school years 2020 to 2022 did not result in a systematic achievement decline among primary and secondary school students in Luxembourg. Possible reasons for these findings include the relatively short duration of complete school closures compared to other countries (OECD, 2022), the good technical equipment in schools and households that facilitated an encompassing transition to homeschooling, and the introduction of a free *Summer School* during the summer holidays to help primary and secondary school students address potential learning deficits (MENJE, 2020).

Nevertheless, achievement decreases in specific competency domains have been observed during the school years since the outbreak of the COVID-19 pandemic (2020–2022). The observed declines in language subjects seem to affect students' academic achievement to varying degrees, depending on their language background. While both French- and Portuguese-speaking students showed a decrease in achievement in German listening and reading comprehension (C3.1), students speaking Luxembourgish and/or German at home were able to achieve a similar or even higher mean score compared to the pre-COVID cohort of 2019. In French reading comprehension (C4.1 and 5^e in ESG-VP), however, students with a Luxembourgish and/or German language background achieved lower mean scores than the pre-COVID cohort of 2019, suggesting that the achievement decline is stronger in the language that is (more) distant from the language spoken at home. International studies explain the observed declines in mathematics by the fact that parents might find it more difficult to support their child with remote learning in mathematics due to a lower confidence in their own mathematical abilities (Panaoura, 2020). In Luxembourg, the linguistic heterogeneity of the population might, however, result in parents not having sufficient knowledge of the school languages, and they might therefore have faced difficulties to adequately support their child during remote learning in language subjects. In contrast to most international findings (see *section 1*, Betthäuser et al., 2023; Di Pietro, 2023; Hammerstein et al., 2021), it appears that the most important background characteristic in Luxembourg is the students' language background rather than SES, a variable for which no clear pattern emerged across the different achievement domains. In addition, the cross-section ÉpStan data suggest a stronger decline in language subjects than in mathematics, whereas international studies (e.g., Betthäuser et al., 2023; Di Pietro, 2023) indicate that the achievement declines in mathematics were more pronounced than in other subjects.

2. Research Objective and Methodology

2.1. Research Objective of the Present Chapter

By assessing school competences in the same key domains across multiple grade levels in primary school, the data collected in 2020 and 2022 allows for a longitudinal analysis of students' academic achievement, which provides a better understanding of the impact of the COVID-19 pandemic on students' educational trajectories in Luxembourg. As the ÉpStan have been administered in C2.1 and C3.1 since 2014, as well as

in C4.1 since 2017, they furthermore allow for a comparison of the longitudinal achievement development of the COVID cohort (2020-2022) with a pre-COVID cohort (2017-2019).

In addition to the achievement tests, the ÉpStan also collect data on student background characteristics (e.g., gender, SES, language, and migration background). This provides the opportunity to investigate whether certain student groups were more significantly affected by the school closures than others, which seems to be indicated by international (e.g., students from socioeconomically disadvantaged households) and early cross-sectional findings from Luxembourg (e.g., students with language background other than Luxembourgish and/or German).

In summary, the present chapter addresses the following research questions:

- 1) How has the academic achievement of primary school students in the COVID cohort (2020-2022) developed in mathematics and German listening comprehension compared to a pre-COVID cohort (2017-2019)?
- 2) Were primary school students with certain background characteristics more affected by pandemic-related school closures than others?

2.2. Information on the *Épreuves Standardisées* (ÉpStan)

The ÉpStan are standardised achievement tests that are administered every autumn in learning cycles 2.1, 3.1, and 4.1 of primary school, as well as in 7^e und 5^e of secondary school (Martin et al., 2015)³. The tests measure key competences (e.g., in German, French, and mathematics) and evaluate to what extent the educational standards defined by the Ministry of Education have been achieved. Considering that all tests contain a fixed number of *anchor items* (i.e., tasks that were part of the data collection in previous years), it is possible to reliably compare the academic achievement of different cohorts (Fischbach et al., 2014). The ÉpStan metric is thereby standardised for each achievement domain so that the mean score of all students in Luxembourg in a reference school year is set at 500 points, with a standard deviation of 100 (Fischbach et al., 2014). Regular fluctuations of ± 10 ÉpStan points from one year to the next are observed at both the primary and secondary school levels. These relatively small variations should generally not be interpreted as significant differences⁴.

The ÉpStan also collect data on student background characteristics via parent and student questionnaires. Regarding gender, the information from the student database of the Ministry of Education, Children and Youth (SCOLARIA) allows for a distinction between male and female students. The *International Socio-Economic Index of Occupational Status* (ISEI; Ganzeboom, 2010) was used to determine the SES of the

³ Although the 7^e, which marks the first year of secondary education in Luxembourg, has been integrated into the ÉpStan since the 2018/2019 school year, only about half of the students in this grade currently participate, meaning the data are (still) not representative. For this reason, the 7^e is not considered in this chapter.

⁴ However, if the ÉpStan results trend in one direction by ± 10 points over several years, it indicates a systematic deterioration or improvement in academic achievement.

students, based on the occupational status of their parents, with values ranging from 10 to 90. In the ÉpStan, the highest available ISEI value (HISEI) of the father or mother (or the respective guardian) is used to classify students into high (upper 25%) or a low (lower 25% of the distribution) SES groups. With regard to migration background, students are considered native if they themselves and at least one parent were born in Luxembourg. To compare students based on their language background, the ÉpStan distinguishes between students with a Luxembourgish/German, French, or Portuguese language background, as these are the most prevalent language groups within the student population in Luxembourg (SCRIPT & MENJE, 2021). In the present chapter, students are assigned to a specific language background if they speak the respective language at home with at least one of their parents. This means that a student can be assigned to multiple language groups. In this context, a child who speaks Luxembourgish with their mother and Portuguese with their father would be considered as having both a Luxembourgish and a Portuguese language background.

2.3. Demographic Information on the Different Cohorts

The data analysis of the present chapter is based on four cohorts, whose demographic characteristics are presented in *Table 1*. Each of these cohorts includes all students who had a regular educational pathway, without grade repetition, between the years 2020 and 2022 (for the COVID cohorts) and between 2017 and 2019 (for the pre-COVID cohorts).

Table 1: Overview of the Four Different Cohorts

		N	HISEI (M)	% female	% native	Language background		
						% Lux/German ⁵	% French	% Portuguese
C2.1 – C3.1	COVID cohort	4933	51	48 %	45 %	53 %	25 %	22 %
	Pre-COVID cohort	4006	49	49 %	47 %	56 %	23 %	28 %
C3.1 – C4.1	COVID cohort	4633	49	50 %	45 %	51 %	24 %	24 %
	Pre-COVID cohort	4199	48	50 %	45 %	52 %	22 %	27 %

Note. N = Number of students. HISEI = Highest available value of the *International Socio-Economic Index of Occupational Status*. M = Mean. More detailed information on the operationalisation of all student background characteristics can be found in *section 2.2*.

⁵ The proportion of students who speak Luxembourgish and/or German at home is higher in all cohorts than reported in other studies (e.g., Fischbach et al., 2021). One possible explanation for this observation could be that all cohorts in the present chapter consist solely of students who have not repeated a grade, and this proportion is higher among students with a Luxembourgish/German language background compared to the other language groups.

3. Results

The following section presents the results on how the academic achievement in mathematics and German reading comprehension of primary school students in Luxembourg has developed since the outbreak of the pandemic (*general effects*), and whether students with certain background characteristics (e.g., low SES students or students who do not speak Luxembourgish and/or German at home) were more affected by the pandemic-related school closures and protective measures than their peers (*differential effects*). The following information box provides important guidance on how a lower ÉpStan score in cycle C3.1, compared to cycle C2.1, should be interpreted, thus allowing for a better understanding of the results presented in the following.

Info box

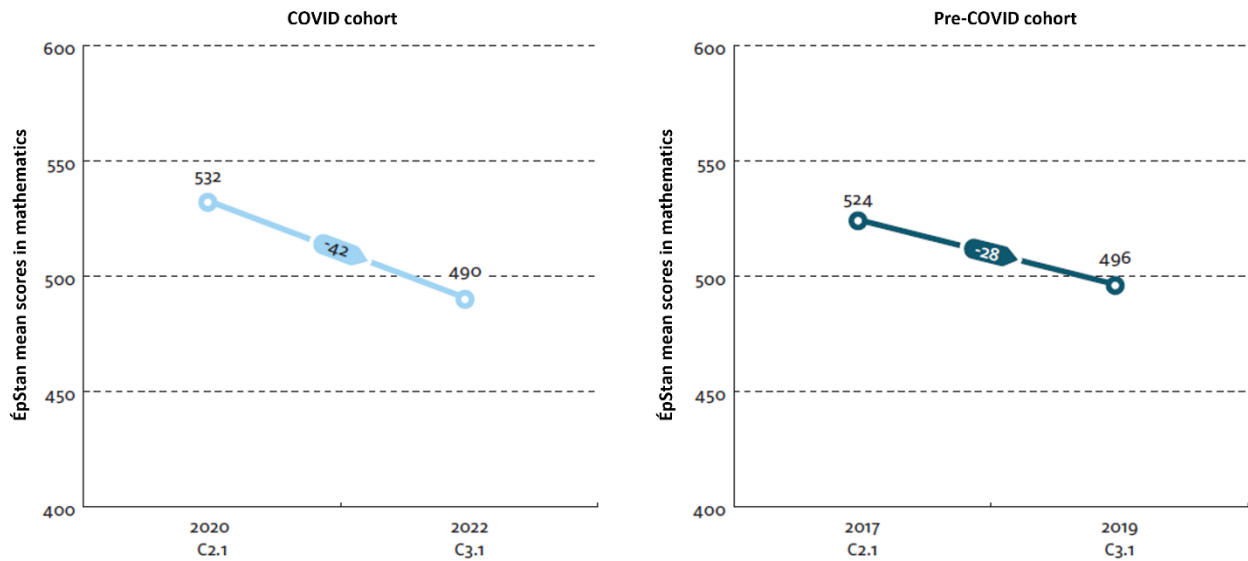
The aim of the ÉpStan is to assess whether students have achieved the educational standards (*Socles*) defined by the Ministry of Education at the beginning of a learning cycle, based on the standards of the previous cycle. While a student in C2.1 is, for example, expected to count and compare collections of up to 10 elements, in cycle C3.1, students are expected to be able to order and compare numbers up to 100 to meet the *Niveau Socle*. The educational standards to be achieved are thus becoming more challenging as the grade level progresses. The described lower achievement scores in C3.1 do **not** indicate that students have lost competences acquired in C2.1, but rather reflect the fact that fewer students have reached the *Niveau Socle* in C3.1 compared to C2.1.

3.1. Mathematics

In the first step, the **development of academic achievement in mathematics between C2.1 and C3.1** was examined for both the COVID and the pre-COVID cohort. *Figure 5* shows the longitudinal development in mathematics, highlighting that an achievement decline can be observed in both cohorts. With a decrease of 42 ÉpStan points, this decline is, however, more pronounced in the COVID cohort compared to the pre-COVID cohort, where a decrease of 28 ÉpStan points was recorded. These lower achievement scores in C3.1 do **not** mean that students have lost competences acquired in C2.1, but rather reflect the fact that fewer students in C3.1 reached the *Niveau Socle* compared to cycle C2.1. These results suggest that the more pronounced achievement decrease in the COVID cohort (by 14 ÉpStan points) is most likely due to the pandemic-related school closures in spring 2020 and the school operations of the following months, which were characterised by extensive protective and hygiene measures. Since the achievement

decrease can be observed in the entire cohort, it can be considered as a *general effect* on academic development in mathematics between C2.1 and C3.1.

Figure 5: Achievement Development in Mathematics between C2.1 and C3.1



In the following, it will be examined whether certain students are more affected by the pandemic-related school closures than their peers due to their background characteristics (*differential effects*). Figure 6 depicts the longitudinal development of academic achievement in mathematics between C2.1 and C3.1, split by **gender**. In the COVID cohort, male and female students appear to be equally affected by the decline in academic achievement. When comparing the two cohorts regarding the extent of the observed decline, it becomes apparent, that the decline is significantly more pronounced in the COVID-cohort for male students. Whereas the male students in the COVID-cohort experience a loss of 41 ÉpStan points, the decline observed for male students in the pre-COVID cohort amounts to only 22 ÉpStan points (*differential effect*). For female students, however, the difference between the cohorts is less pronounced with a difference of only 10 ÉpStan points.

Figure 6: Achievement Development in Mathematics between C2.1 and C3.1 split by Gender

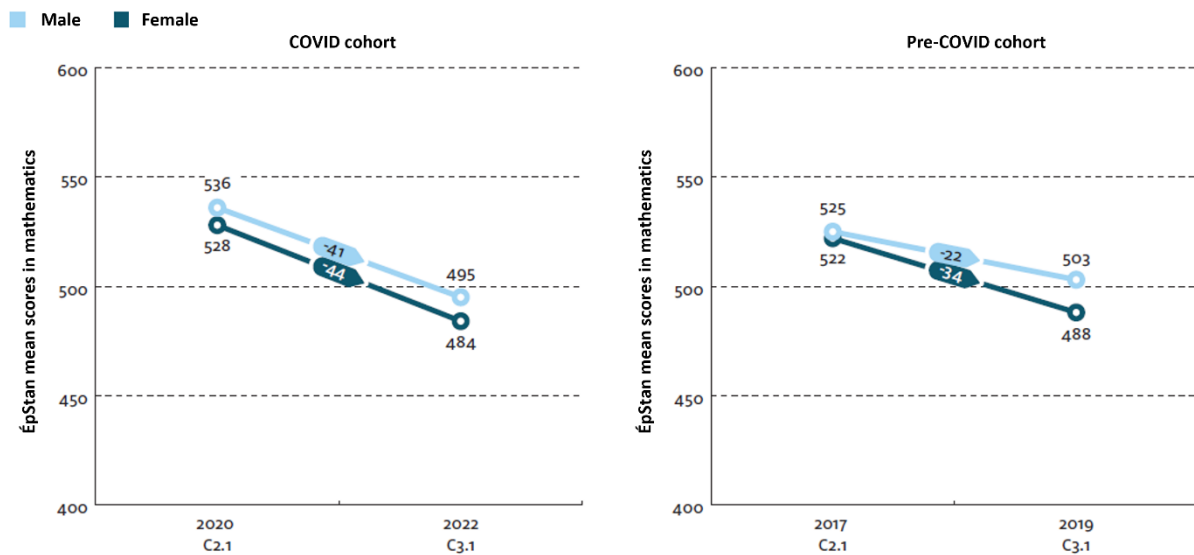
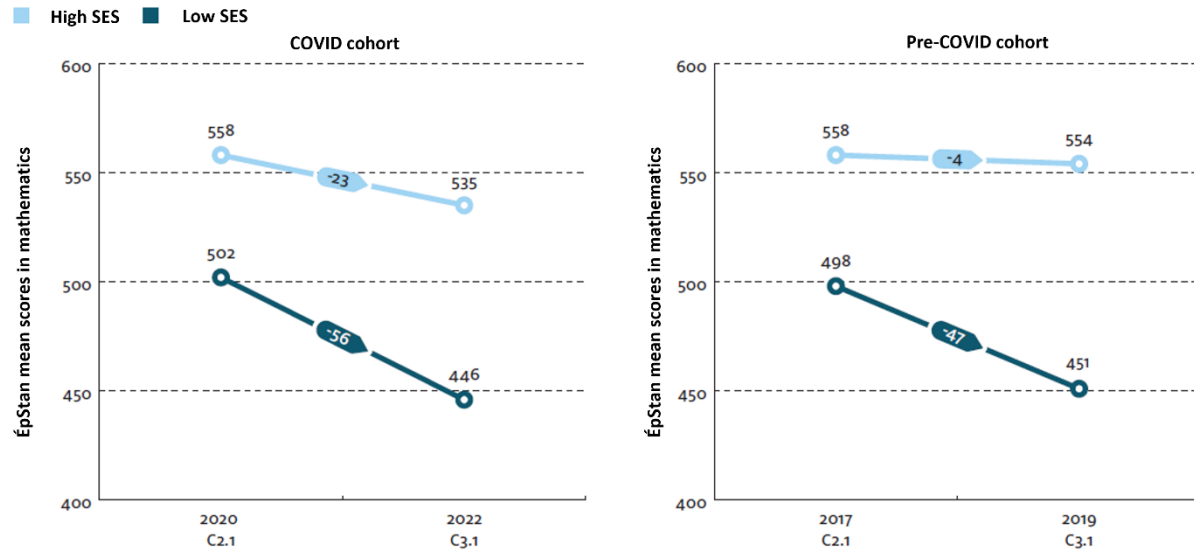


Figure 7 illustrates the longitudinal development of academic achievement in mathematics between C2.1 and C3.1, split by **SES**. In the COVID cohort, students with a low SES appear to be more affected by school closures and protective measures (loss of 56 ÉpStan points) compared to students with a high SES (loss of 23 ÉpStan points). However, when taking the development of mathematics achievement in the pre-COVID cohort into consideration, a more differentiated picture emerges. While the mathematics achievement of students with a high SES remained stable in the pre-COVID cohort (loss of 4 ÉpStan points), students with a high SES in the COVID cohort experienced a significantly more pronounced performance decline (loss of 23 ÉpStan points). For students with a low SES, however, the achievement decrease is less pronounced compared to the pre-COVID cohort, although this group of students still shows a greater overall decline in mathematics achievement compared to students with a high SES in both cohorts. The comparison of the two cohorts thus indicates a differential effect to the disadvantage of students with a high SES in the COVID cohort (with a decline that is more pronounced by 19 ÉpStan points), whereas the cohort difference for students with low SES is less pronounced (cohort difference of 9 ÉpStan points).

Figure 7: Achievement Development in Mathematics between C2.1 and C3.1 split by SES



A similar pattern emerges from *Figure 8*, which illustrates the longitudinal development of mathematics achievement between C2.1 and C3.1, split by **migration background**. In the COVID and pre-COVID cohort, a decrease in mathematics achievement can be observed, both for native students and for students with a migration background. In the COVID and pre-COVID cohort, however, this decline is more pronounced for both students with a migration background (loss of 45 ÉpStan points) and without a migration background (loss of 39 ÉpStan points) compared to the pre-COVID cohort, where a decline of 32 ÉpStan points was observed for students with a migration background and of 23 ÉpStan points for those without a migration background. In contrast to the background characteristics of gender and SES, the cohort difference seems thus similarly pronounced for students without a migration background (with a decline that is more pronounced by 19 ÉpStan points) and for students with a migration background (with a decline that is more pronounced by 13 ÉpStan points), indicating no differential effect.

Figure 8: Achievement Development in Mathematics between C2.1 and C3.1 split by Migration Background

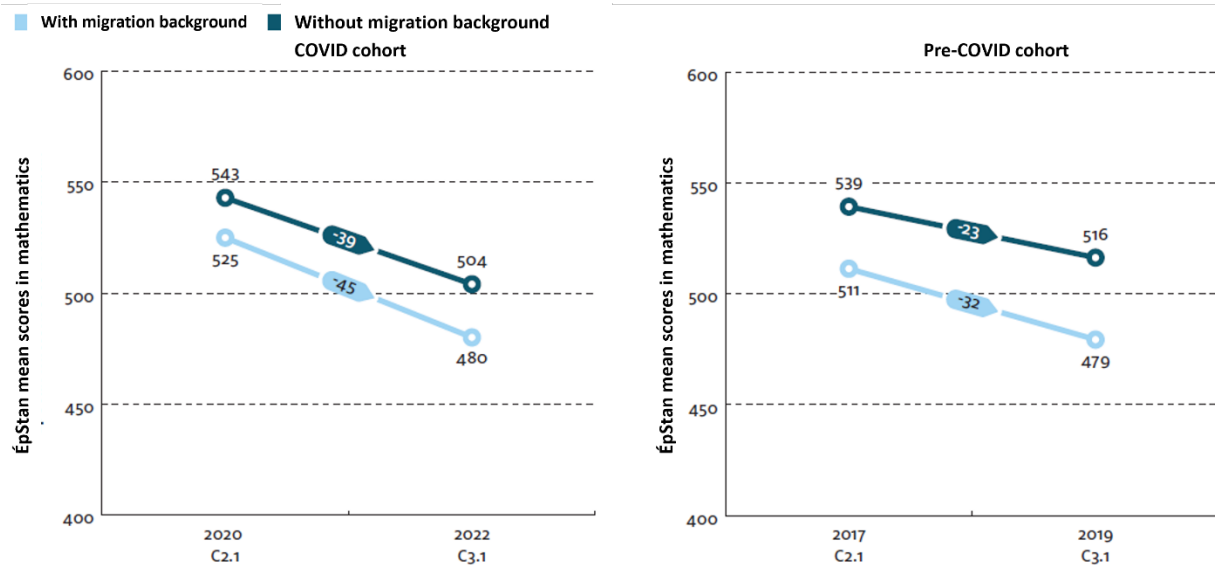
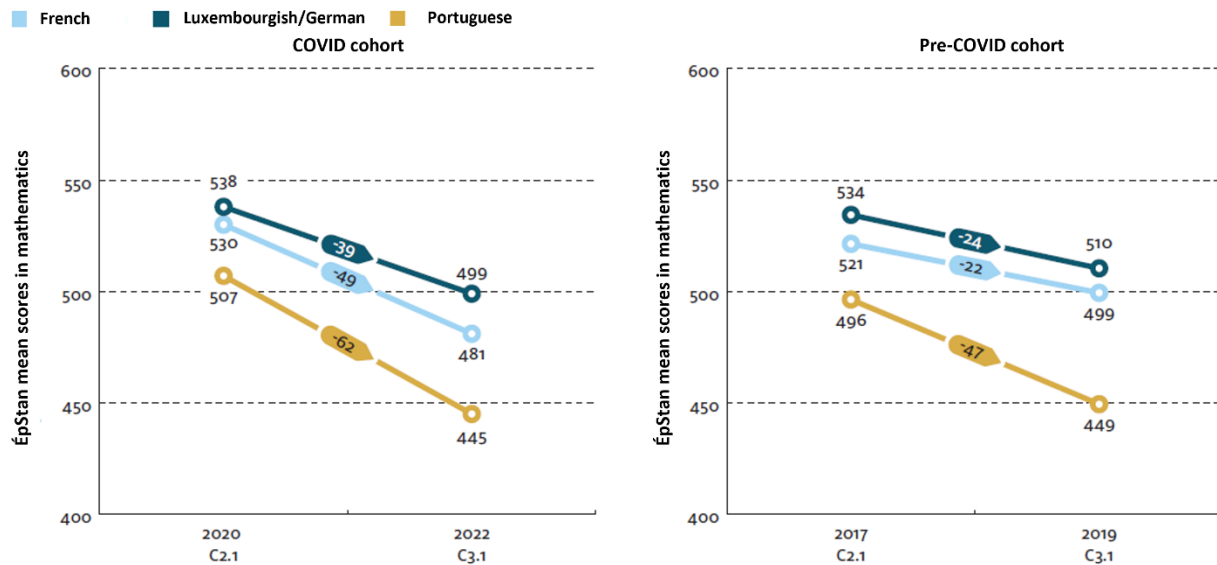


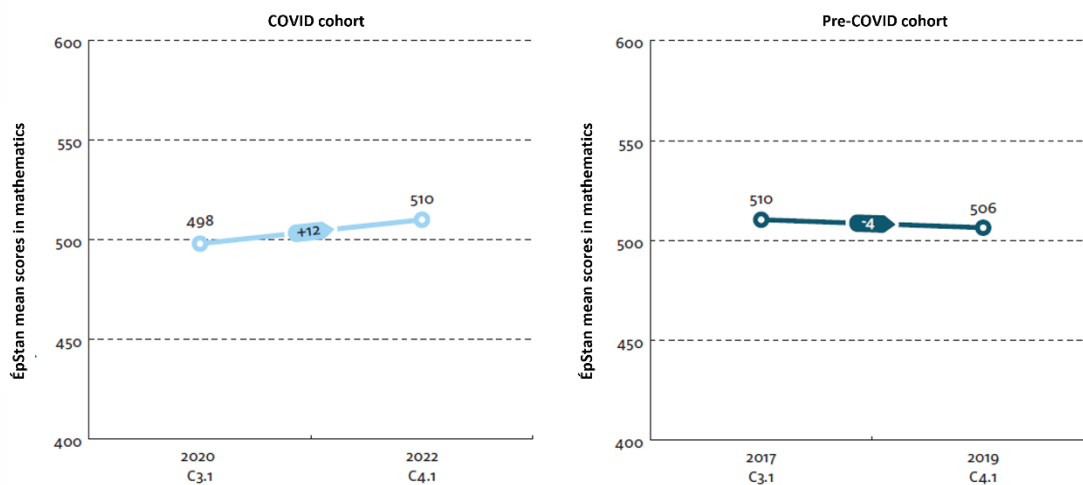
Figure 9 illustrates the longitudinal development of mathematics achievement between C2.1 and C3.1, split by the students' **language background**. In line with the findings for the other student background characteristics, a decrease in mathematics achievement can be observed in the COVID cohort regardless of the students' language background. This decline is more pronounced for students with a French (loss of 49 ÉpStan points), or Portuguese language background (loss of 62 ÉpStan points) compared to students speaking Luxembourgish and/or German at home (loss of 39 ÉpStan points). When comparing the COVID cohort with the pre-COVID cohort, the observed achievement decline in mathematics is 15 ÉpStan points more pronounced in the COVID cohort for both students with a Luxembourgish and/or German language background, as well as for students with a Portuguese language background. With a cohort difference of 27 ÉpStan points, the achievement decrease is most pronounced among students with a French language background in the COVID cohort when compared to their peers with a French language background in the pre-COVID cohort. Although students from all three language groups show a significant achievement decline in mathematics, these results suggest a pandemic-related differential effect to the disadvantage of students with a French language background in the COVID cohort.

Figure 9: Achievement Development in Mathematics between C2.1 and C3.1 split by Language Background



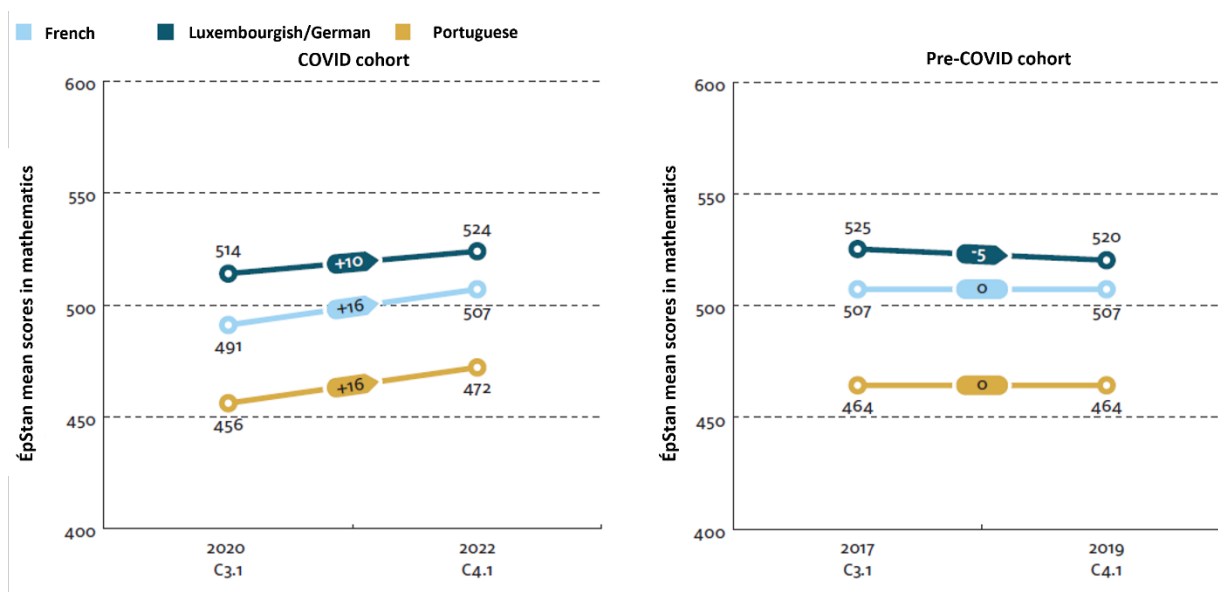
In the second step, the **development of academic achievement in mathematics between C3.1 and C4.1** was examined. While a significant achievement decrease was observed in both cohorts between C2.1 and C3.1 (see Figure 5), Figure 10 indicated that academic achievement in mathematics remains largely stable between C3.1 and C4.1, with a slight improvement in the COVID cohort (gain of 12 ÉpStan points). These findings suggest that unlike for younger students (between C2.1 and C3.1), the pandemic-related school closures in spring 2020 and the school operations characterised by protective measures in the following months did not result in a general negative effect when looking at the development of achievement in mathematics between C3.1 and C4.1.

Figure 10: Achievement Development in Mathematics between C3.1 and C4.1



The pattern of achievement stability observed for the overall sample in the pre-COVID cohort and a slight improvement in mathematics achievement in the COVID cohort can also be seen when the results are split by gender, SES, language, and migration background. *Figure 11* illustrates this pattern with the example of students' **language background**. While mathematics achievement in the pre-COVID cohort remained largely stable (i.e., changes not exceeding the regularly observed fluctuations of ± 10 ÉpStan points), a slight improvement emerged in the COVID cohort (gain of 16 ÉpStan points). This improvement seems to particularly benefit academically disadvantaged students speaking French or Portuguese at home. Similar patterns can also be observed for students with a low SES or with a migration background⁶. These findings split by background characteristics indicate thus that the school closures and protective measures did not have a more negative impact on certain student groups than on others.

Figure 11: Achievement Development in Mathematics between C3.1 and C4.1 split by Language Background



3.2. German Reading Comprehension

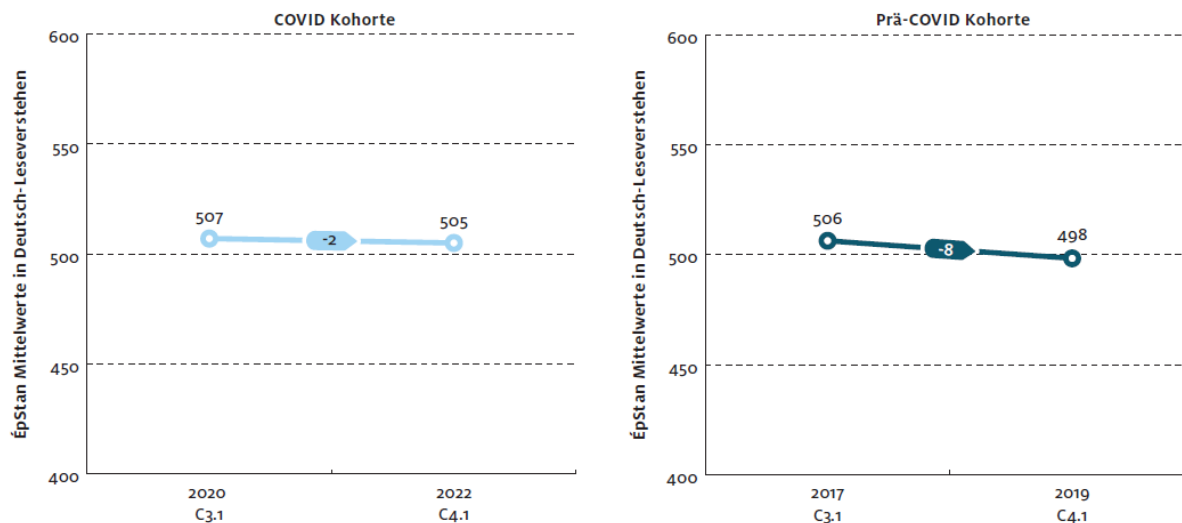
In addition to the longitudinal development of academic achievement in mathematics, the **development of German reading comprehension** was also examined. In contrast to mathematics, German reading comprehension is, however, only assessed starting from the learning cycle C3.1. Therefore, an analysis of the longitudinal development of German reading comprehension is only possible between C3.1 and C4.1.

Figure 12 shows the longitudinal development in German reading comprehension between C3.1 and C4.1. As for the development in mathematics between C3.1 and C4.1 (see *Figure 10*), academic achievement in German reading comprehension also appears to remain largely stable in both cohorts, as no achievement decrease exceeding the regularly observed fluctuations of ± 10 ÉpStan points can be seen. These findings

⁶ The corresponding figures can be found in the online supplement of this chapter at www.bildungsbericht.lu.

suggest that the school closures and protective measures did not result in a general negative effect on the development of German reading comprehension between C3.1 and C4.1.

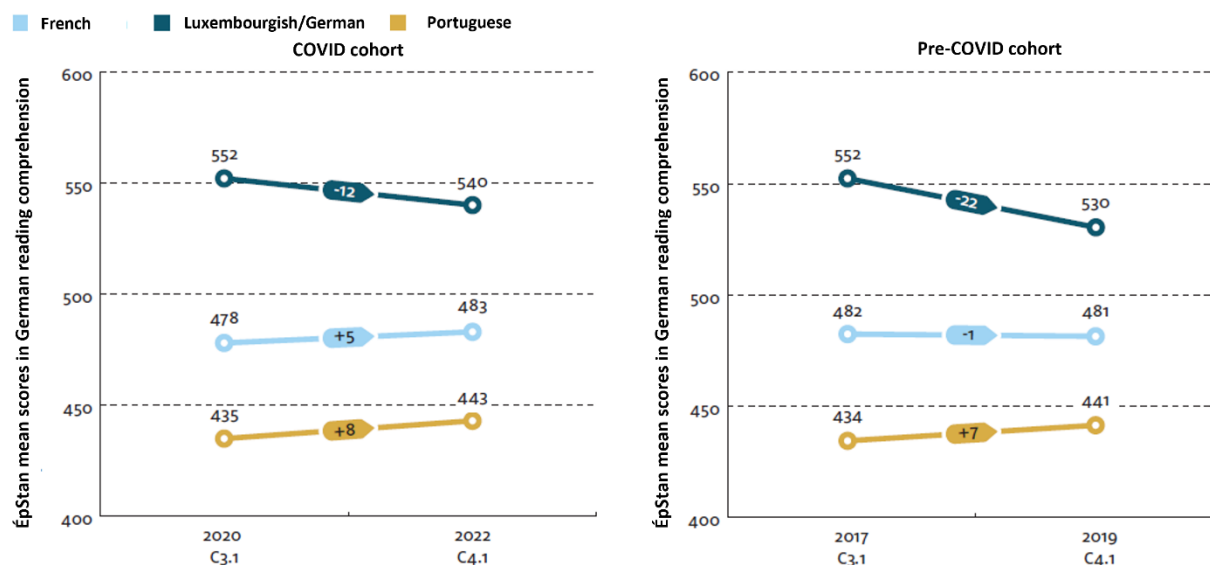
Figure 12: Achievement Development in German Reading Comprehension between C3.1 and C4.1



In line with the analyses for mathematics, the development of academic achievement in German reading comprehension was also studied separately by gender, SES, language, and migration background⁷. While the pattern of a largely stable achievement development observed in the overall sample was also found when splitting the results by gender, a more differentiated picture emerged for the other background characteristics. *Figure 13* illustrates this with the example of students' **language background**. Whereas the development of academic achievement in German reading comprehension remained largely stable for students with a French or Portuguese language background, students who speak Luxembourgish and/or German at home showed a slight decline (loss of 12 ÉpStan points), although this decline only slightly exceeds the regularly observed fluctuations of ± 10 ÉpStan points and is furthermore, by 10 ÉpStan points less pronounced than the achievement decline in the pre-COVID cohort (loss of 22 ÉpStan points). Similar decreases can also be found for students with a high SES and those without a migration background, while a slight improvement emerges for students who are academically often disadvantaged (with a low SES or a migration background) that does, however, typically not exceed regularly observed fluctuations. Overall, similar to the longitudinal development of academic achievement in mathematics between C3.1 and C4.1, it can be concluded that the results split by background characteristics do not indicate that the pandemic had a substantially more negative impact on the development of academic achievement in German reading comprehension on certain student groups than on others.

⁷ The corresponding figures can be found in the online supplement of this chapter at www.bildungsbericht.lu.

Figure 13: Achievement Development in German Reading Comprehension between C3.1 and C4.1 split by language background



4. Discussion and Outlook

First international studies on the impact of the pandemic found that school closures had a negative effect on students' academic competencies (Betthäuser et al., 2023; Di Pietro, 2023; Hammerstein et al., 2021). Additionally, certain student groups (e.g., younger students, students with a low SES) appear to be more affected than their peers. The *Épreuves Standardisées* (ÉpStan) provide a representative data set that has made it possible to examine how school closures have affected the academic achievement of primary and secondary school students in Luxembourg, both in general and split by background characteristics. In the following, the main findings are briefly summarised before being discussed in the context of international studies.

4.1. Summary and Discussion of the Results

The **cross-sectional data** from the ÉpStan 2020, 2021, and 2022 reveal that school closures and protective measures did not result in a systematic negative trend across all subjects and cycles, but rather to specific decreases of achievement in certain domains (e.g., German listening comprehension and mathematics in C3.1, French reading comprehension in C4.1 and in 5^e ESG-VP). Regarding the question of whether certain student groups showed a greater decrease in academic achievement than others, the observed pattern varies depending on the assessed competency domain. Whereas the decrease in mathematics (C3.1) can be observed across all the language groups (see *Figure 3*), the decreases observed in language subjects appear to depend on the students' language background, with the decreases appearing more pronounced among students whose language background is (more) distant from the language subject

in question. Looking at German listening and reading comprehension in C3.1, the decrease is stronger among French- and Portuguese-speaking students than among their peers who speak Luxembourgish and/or German at home. In French reading comprehension (C4.1 and 5^e ESG-VP), however, students with a Luxembourgish and/or German language background show a more pronounced decline. In summary, these cross-sectional data suggest that the academic achievement of both primary and secondary school students has remained largely stable with the observed declines in specific domains occurring in language subjects rather than in mathematics. In Luxembourg – unlike in international studies – it thus appears that the language background of the students is the most significant background characteristics, compared to the students' SES.

While the cross-sectional data provide first insights into how the pandemic-related school closures and protective measures have impacted the academic achievement of primary and secondary school students, the **longitudinal data** allow to investigate how academic achievement in the selected areas – mathematics and German reading comprehension – have developed across grade levels in primary school (from C2.1 to C3.1 and from C3.1 to C4.1). In line with the cross-sectional data, the results of the longitudinal analyses also do not indicate a systematic negative trend across subjects and cycles, but rather specific decreases of achievement in certain domains and age groups. The achievement development of the COVID cohort in German reading comprehension between C3.1 and C4.1 (see *Figure 12*) appears thus largely stable, and in mathematics, the data even indicated a slight improvement (see *Figure 10*). This slight improvement in the COVID cohort could be related to the fact that, during the years of the pandemic, teachers (and peers) provided additional support if needed, especially to those student groups who were disadvantaged at the academic level (e.g., students with a low SES or with a Portuguese language background; Fischbach et al., 2021). However, when looking at the achievement development in mathematics between C2.1 and C3.1, a different picture emerges for the COVID cohort (see *Figure 5*). The observed decrease suggests that the pandemic negatively impacted the development of achievement in mathematics. Since the decrease was observed across the entire cohort and does not only affect specific student groups, it represents a general effect on achievement development between C2.1 and C3.1.

In line with international research, these findings suggest that, in Luxembourg, younger students appear to be more affected by the pandemic-related school closures than older students. A possible explanation for this result may lie in the cognitive and emotional development of younger students (Hammerstein et al., 2021). For example, it can be assumed that executive functions – cognitive processes that "enable the achievement of a higher goal through the control, regulation, and coordination of various subprocesses" (translated from Seiferth et al., 2007, p. 266) – and the associated ability for self-control are not yet fully developed in younger students. However, these functions would have been particularly important for self-regulated learning during the pandemic-related school closures (Tomasik et al., 2021). Additionally, it can be assumed that digital learning during homeschooling in the spring of 2020 was more difficult for younger students to manage than for older ones, as they were not yet able to operate digital devices independently and, therefore, had to rely on the help of others to complete digital tasks (Di Pietro, 2023). Due to these

difficulties, teachers may have reduced the use of digital media (e.g., holding digital lessons with the entire class via Teams) and instead focused on providing teaching materials that their students could use in homeschooling with the support of their parents/guardians or older siblings. While this approach allowed students to engage with the academic content, they may have missed the contextualised learning that comes from interaction with their teacher and peers. In this context, cognitive scaffolding, defined as the guidance and structure a teacher provides to help students solve tasks they otherwise could not solve within an interactive process (Van de Pol et al., 2010), appears to be particularly crucial for learning in younger students.

Furthermore, it should be considered that the COVID cohort included in the analysis of achievement development between C2.1 and C3.1 was in their final preschool year (C1.2 of *Enseignement Préscolaire*) during the 2019/2020 school year, which was affected by the widespread school closures. It may have been assumed that the school closures would have less of an impact on students at the end of the *Enseignement Préscolaire* than on students in C2.1, whose first year of primary school (*Enseignement Fondamental*) was affected by the pandemic-related school closures and, as a result, fell into the crucial phase of literacy acquisition. However, the present results seem to indicate that students in *Enseignement Préscolaire* are acquiring an important foundation (e.g., phonological awareness, recognition of numbers, shapes, and quantities) that enables them to achieve the learning objectives of Cycle 2. As such, it must be considered a "key adjustable parameter to improve learning development" (Hornung et al., 2023, p. 6) in the scope of early childhood education. Since this foundation may have been lacking for the students in the COVID cohort when they entered C2.1 of the *Enseignement Fondamental*, it can be assumed that teachers had to focus on developing basic skills before they could concentrate on the learning objectives of Cycle 2. This could, at least in part, explain the observed performance decrease in younger students.

Moreover, the achievement development in mathematics for the COVID cohort shows that students, who are advantaged academically (e.g., students with a high SES, students with a Luxembourgish/German or French language background), exhibit a more pronounced achievement decrease compared to the pre-COVID cohort, in contrast to their more disadvantaged peers (e.g., students with a low SES, students with a Portuguese language background). This finding could be interpreted as an indication that the measures taken by the Ministry of Education (e.g., free summer school during the summer break to help students catch up on potential learning gaps; MENJE, 2020), as well as the additional support provided to the more disadvantaged student groups by teachers and peers (Fischbach et al., 2021), helped to largely prevent a further deterioration of academic achievement among these student groups. However, it cannot be ruled out that other differences in the learning setting between the two cohorts (e.g., teaching materials) may have contributed to the more pronounced achievement declines in certain student groups. Thus, further studies are needed to gain a more comprehensive understanding of the impact of the pandemic on the academic achievement of primary and secondary school students in Luxembourg.

4.2. Potential Action Areas for Research and Policy

Based on the results presented in this chapter, the following action areas can be derived:

- Regarding the finding that the COVID cohort, which started the *Enseignement Fondamental* (C2.1) in the 2020/2021 school year, and whose final year of the *Enseignement Préscolaire* (C1.2) was affected by the widespread school closures in the spring of 2020, it is important to monitor their achievement development through further longitudinal studies. Investigating the development of their achievement between C3.1 and C4.1 would, for example, allow for determining whether the achievement declines observed between C2.1 and C3.1 have been mitigated. From an educational policy perspective, it can be recommended to specifically support this particularly affected cohort both within (e.g., raising teacher's awareness) and outside of formal instruction (e.g., through a targeted programme as part of the summer school) to address the pandemic-related learning gaps. Otherwise, these students might risk remaining disadvantaged throughout their entire school years due to these early learning gaps, which could in turn increase the likelihood of grade repetitions, which are scientifically considered to be largely ineffective (Hornung et al., 2021), as well as early school dropouts.
- Furthermore, the cross-sectional results of the present chapter suggest that achievement declines in language subjects appear to be dependent on the students' language background, with the observed decline being more pronounced among students whose language background is (more) distant from the language being assessed. Considering that, unlike in international studies, the language background of students appears to be the most significant background characteristic in Luxembourg, the achievement development in language subjects should therefore be explored in greater depth in further studies. Teachers should also place an increased emphasis on supporting students whose language background is (more) distant from the language of instruction.
- Given that the actors in the education field in Luxembourg seem to have successfully prevented a systematic achievement decline across all subjects and cycles, and that a comparison with the achievement development of the pre-COVID cohort furthermore shows that a systematic decline among academically disadvantaged students was avoided, it appears advisable to maintain the measures taken by the Ministry of Education (MENJE, 2020), as well as the additional support provided to more disadvantaged student groups by teachers and peers (Fischbach et al., 2021).

5. Conclusion

The COVID-19 pandemic led to widespread school closures, which resulted in a profound disruption to students' education worldwide. In contrast to findings from international studies, no systematic decrease in the academic achievement of primary and secondary school students occurred in Luxembourg. Possible reasons for these findings include the relatively short duration of complete school closures compared to other countries (OECD, 2022), the good technical infrastructure in schools and households that enabled widespread homeschooling, as well as the introduction of a summer school during the summer break aimed at addressing learning gaps early (MENJE, 2020).

While there was no systematic achievement decline, specific decreases of achievement in certain domains have been observed (e.g., mathematics between C2.1 and C3.1, German listening comprehension in C3.1, and French reading comprehension in C4.1 and in 5^e ESG-VP). Overall, the school closures and the protective measures appear to have had a greater impact on younger students (between C2.1 and C3.1) than on older students (between C3.1 and C4.1). Additionally, in language subjects, students having a language background that is (more) distant from the assessed language exhibited a more pronounced achievement decline compared to their peers.

Targeted support for these student groups through educational policy measures (e.g., continuation of the summer school, raising teachers' awareness) is therefore recommended. Whether such measures might contribute to addressing existing achievement gaps should be further investigated in the coming years using longitudinal ÉpStan data (e.g., examining how the cohort that was in its final year of *Enseignement Précoce* in spring 2020 developed between C3.1 and C4.1).

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