EARLY CHILDHOOD EDUCATION AND CARE IN LUXEMBOURG

ATTENDANCE AND ASSOCIATIONS WITH EARLY LEARNING PERFORMANCE

Luxembourg Centre for Educational Testing (LUCET)

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BiSS	Bildung durch Sprache und Schrift
CSA	Chèque Service Accueil
ECEC	Early Childhood Education and Care
ÉpStan	Épreuves Standardisées
EU	European Union
FörMig	Förderung von Kindern und Jugendlichen mit Migrationshintergrund
Isei	International socio-economic index of occupational status
L1	First language
L2	Second language or here: majority instruction language
LUCET	Luxembourg Center of Educational Testing
MENFP	Ministry of Education and Civil Service
MENJE	Ministry of Education, Children and Youth
OECD	Organization for Economic Co-operation and Development
ONQS / OEJQS	National Observatory for Children, Youth and School Quality
PISA	Programme for International Student Assessment
SCRIPT	Service de Coordination de la Recherche et de l'Innovation Pédagogiques et Technologiques
SNJ	Service National de la Jeunesse
STATEC	National Institute of Statistics and Economic Studies of the Grand Duchy of Luxembourg
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization

EXECUTIVE SUMMARY (EN)

- Luxembourg's student population is highly diverse in terms of language and family background and shows disparities in learning performances as early as first grade (Cycle 2.1). Achievement gaps might be increased by the high language demands in the traditional Luxembourgish school system. **Early Childhood Education and Care (ECEC)** including for instance *crèche*, *précoce* and Cycle 1, is one of the possible mechanisms to reduce these gaps that is currently discussed by researchers, policy makers, and the broad public.
- A lot of international literature points towards a positive association of ECEC and child development. However, findings vary widely with characteristics of ECEC, as well as characteristics of children and their families.
- For this report, we used data from the Luxembourg School Monitoring Programme "ÉpStan" from 2015 to 2021 including students' learning performances in three domains in Cycle 2.1 – Luxembourgish listening comprehension, early literacy, mathematics – as well as student and parent questionnaire data. Additionally, data from ÉpStan 2022 on German and Luxembourgish listening comprehension and students' language exposure at home are presented.
- **Who attends which type of ECEC in Luxembourg?** We find that the attendance in ECEC is generally high. On average, *crèches* were attended at a moderate level of intensity and duration. Family background (socioeconomic status, migration background and home language group) interacts in a complex way with attendance in ECEC. For example, children from families with a high socioeconomic status speaking Portuguese or French at home, attended *crèche* for more hours a week than children from families with a high socioeconomic status speaking Luxembourgish at home. In regard to language exposure in ECEC, Luxembourgish appears to play a dominant role for most children.
- **How are ECEC attendance and family background associated with learning performance in Cycle 2.1?** Most importantly, non-formal (*crèche*) and formal types of ECEC (*précoce*, Cycle 1) have positive but small to moderate associations with learning performance in the three learning domains. Looking at *crèche* attendance in more detail, effects of *crèche* intensities are different for Portuguese speaking and Luxembourgish speaking children – i.e., only Portuguese speaking children benefit from higher intensity attendance in *crèche*. As can be expected, all children benefit most in their Luxembourgish listening comprehension if they attended a *crèche* in which Luxembourgish was spoken. Well-known performance disparities in the three learning domains between children of different backgrounds have been confirmed – with advantages for native, Luxembourgish speaking children from higher socioeconomic backgrounds.
- **Is the pattern of differences between children of different home language groups the same in Luxembourgish and German listening comprehension?** Children's performances in German

listening comprehension show even larger disparities between home language groups than those in Luxembourgish listening comprehension. This argues against the assumption of a transfer from Luxembourgish to German language skills for all children.

- Conclusively, this report points towards ECEC as a **key adjustable parameter** to improve learning development and concludes with the call to collect data on ECEC quality. Structural (e.g., child-caregiver-ratio) and procedural (e.g., characteristics of interaction) aspects of quality should be regulated and systematically evaluated to ensure positive child development and equal opportunities for every child. With more monitoring data on diverse quality aspects and language practices in ECEC, important insights on the effects of new reforms in the educational system could be gained. Additionally, the present results reveal a significant negative relationship between children's learning performance and a previous *allongement de cycle* in Cycle 1, calling for a thorough revision of this frequently used procedure.
- Finally, the **continuity** between languages in ECEC and the successive schooling is important. This alignment is currently not ensured due to more flexible language policies in ECEC and more rigid language practices in formal schooling. For example, the plurilingual education in ECEC promoting Luxembourgish and French, could build a solid basis for a French literacy acquisition, yet explicit promotion of the current instruction language of reading and writing acquisition, German, in Cycle 2 is still missing. A crucial demand therefore arises to revise the language demands in the curricula and policies – to continuously support ECEC's plurilingual education in formal schooling (e.g., European and international schools or French literacy acquisition) and to explicitly promote German in ECEC to build a solid basis for literacy acquisition in German.

EXECUTIVE SUMMARY (DE)

- Die luxemburgische Schülerschaft ist in Bezug auf Sprache und familiären Hintergrund sehr divers und weist bereits in der ersten Klasse (Zyklus 2.1) Unterschiede in ihren schulischen Lernleistungen auf. Die Leistungsunterschiede könnten durch die hohen sprachlichen Anforderungen im traditionellen luxemburgischen Schulsystem noch verstärkt werden. **Frühkindliche Bildung und Betreuung (FBBE),** z.B. in Form von *crèche*, *précoce* und Zyklus 1, ist einer der möglichen Ansätze, um diese Unterschiede zu verringern und wird derzeit von Forschern, politischen Akteuren und der breiten Öffentlichkeit diskutiert.
- Ein Großteil der internationalen Literatur deutet auf einen positiven Zusammenhang zwischen FBBE und kindlicher Entwicklung hin. Die Ergebnisse variieren jedoch stark mit den Merkmalen der FBBE sowie den Merkmalen der Kinder und ihrer Familien.
- Für diese Untersuchung haben wir Daten aus dem luxemburgischen Schulmonitoring-Programm aus den Jahren 2015 bis 2021 verwendet, einschließlich der Lernleistungen der Schülerinnen und Schüler im Zyklus 2.1 in den drei Lernbereichen – Luxemburgisch Hörverstehen, frühe Lesekompetenz und Mathematik – sowie Daten aus Schüler- und Elternfragebögen. Zusätzlich werden Daten aus ÉpStan 2022 zum deutschen und luxemburgischen Hörverstehen und zur Sprachexposition der Schülerinnen und Schüler zu Hause präsentiert.
- **Wer besucht welche FBBE-Einrichtung in Luxemburg?** Wir stellen fest, dass die Teilnahme an FBBE im Allgemeinen hoch ist. Im Durchschnitt wurden *crèches* mit einer mittleren Intensität und Dauer besucht. Der familiäre Hintergrund (sozio-ökonomischer Status, Migrationshintergrund und Sprachgruppe) steht in einer komplexen Interaktion mit dem Besuch von FBBE. So besuchten beispielsweise Kinder aus sozio-ökonomisch begünstigten Familien, die zu Hause Portugiesisch oder Französisch sprechen, *crèches* für mehr Stunden pro Woche als Kinder aus sozio-ökonomisch begünstigten Familien, die zu Hause Luxemburgisch sprechen. In Hinblick auf den Kontakt mit Sprachen in FBBE scheint Luxemburgisch für die meisten Kinder eine dominante Rolle zu spielen.
- **Wie hängen der Besuch von FBBE und der familiäre Hintergrund mit den schulischen Lernleistungen in Zyklus 2.1 zusammen?** Herauszustellen ist, dass nicht-formale (*crèche*) und formale Formen der FBBE (*précoce* und Zyklus 1) in einem positiven, aber geringen bis mäßigen Zusammenhang mit den Lernleistungen in den drei Lernbereichen stehen. Betrachtet man den *crèche* Besuch im Detail, unterscheiden sich die Auswirkungen der Betreuungsintensität für Portugiesisch sprechende und Luxemburgisch sprechende Kinder, d.h. nur Portugiesisch sprechende Kinder profitieren von einer höheren Betreuungsintensität in der *crèche*. Allgemein profitierten Kinder am meisten in Bezug auf ihr Luxemburgisch-Hörverstehen, wenn sie eine *crèche* besucht hatten, in der Luxemburgisch gesprochen wurde. Die bekannten Leistungsunterschiede in den drei Lernbereichen zwischen Kindern unterschiedlicher familiärer

Herkunft wurden bestätigt – mit Vorteil für einheimische, zuhause Luxemburgisch sprechende Kinder aus sozio-ökonomisch begünstigten Familien.

- **Ist das Muster der Leistungsunterschiede zwischen Kindern verschiedener Herkunftssprachengruppen beim luxemburgischen und deutschen Hörverstehen dasselbe?** Die Leistungen im Deutsch-Hörverstehen weisen noch größere Unterschiede zwischen den Sprachgruppen auf als beim Luxemburgisch-Hörverstehen. Dies spricht gegen die Annahme eines Transfers von luxemburgischen zu deutschen Sprachkenntnissen für alle Kinder.
- Zusammenfassend verweist dieser Bericht auf die FBBE als eine **wichtige Stellschraube** für die Förderung der Lernentwicklung und schließt mit der Aufforderung, Daten zur Qualität der FBBE zu erheben. Strukturelle (z. B. das Kind-Betreuer-Ratio, *Betreuungsschlüssel*) und prozedurale (z. B. Merkmale der Kind-Betreuer Interaktionen) Qualitätsaspekte sollten geregelt und systematisch evaluiert werden, um eine positive Entwicklung des Kindes und Chancengleichheit für alle Kinder zu gewährleisten. Mit mehr Monitoring-Daten zu verschiedenen Qualitätsaspekten und Sprachpraktiken in der FBBE könnten wichtige Erkenntnisse über die Auswirkungen neuer Reformen im Bildungsbereich gewonnen werden. Darüber hinaus zeigen die vorliegenden Ergebnisse einen signifikanten negativen Zusammenhang zwischen den Lernleistungen der Kinder und einem früheren *allongement de cycle* in Zyklus 1, was eine gründliche Revision dieses häufig angewandten Verfahrens erforderlich macht.
- Schließlich ist die **Kontinuität** der Sprachen in FBBE und der weiteren Schule wichtig. Diese Angleichung ist derzeit aufgrund der flexibleren Sprachpolitik in der FBBE und der rigideren Sprachpraxis in der formalen Schulbildung nicht gewährleistet. So könnte beispielsweise die mehrsprachige Bildung in FBBE mit der Förderung der luxemburgischen und der französischen Sprache eine solide Grundlage für die Alphabetisierung in Französisch bilden, allerdings fehlt noch immer die ausdrückliche Förderung der derzeitigen Unterrichtssprache für den Lese- und Schriftspracherwerb, Deutsch, in Zyklus 2. Daraus ergibt sich die dringende Forderung, die sprachlichen Anforderungen in den Lehrplänen und Richtlinien zu überarbeiten - die mehrsprachige Bildung der FBBE in der formalen Schulbildung weiterführend zu unterstützen (z.B. europäische und internationale Schulen oder Alphabetisierung auf Französisch) und Deutsch bereits in der FBBE explizit zu fördern, um eine solide Grundlage für die Alphabetisierung auf Deutsch zu schaffen.

EXECUTIVE SUMMARY (FR)

- La population scolaire luxembourgeoise est très diversifiée en termes de contexte linguistique et familial et présente des disparités au niveau des performances d'apprentissage dès le Cycle 2.1. Ces différences de performance pourraient être accentuées par les exigences linguistiques élevées du système scolaire traditionnel luxembourgeois. **L'éducation et l'accueil des jeunes enfants (EAJE),** qui se réfère notamment aux crèches, au précoce et au Cycle 1, fait actuellement objet de discussions entre les chercheurs, les acteurs politiques et le grand public comme étant un mécanisme possible pour réduire ces écarts.
- Une grande partie de la littérature scientifique indique un lien positif entre l'EAJE et le développement de l'enfant. Néanmoins, les résultats varient considérablement en fonction des caractéristiques des structures EAJE, ainsi que des caractéristiques des enfants et de leurs familles.
- Pour ce rapport, nous avons eu recours aux données du monitoring scolaire national «ÉpStan» des années 2015 à 2021, y compris les données de performance des élèves du Cycle 2.1 dans les trois domaines d'apprentissage évalués - compréhension orale en luxembourgeois, précurseurs de la compréhension de l'écrit, et mathématiques - ainsi que les données issues des questionnaires adressés aux élèves et aux parents. En outre, le rapport présente également les données ÉpStan de 2022 sur la compréhension orale en allemand et en luxembourgeois et sur l'exposition des élèves aux langues en dehors de l'école.
- **Qui fréquente quelle structure EAJE au Luxembourg ?** Nous constatons que la fréquentation des structures EAJE est globalement élevée. En moyenne, l'intensité et la durée de la fréquentation des crèches sont modérées. Le contexte familial (statut socio-économique, contexte migratoire et langues parlées à la maison) interagit de manière complexe avec la fréquentation des structures EAJE. Par exemple, les enfants qui parlent portugais ou français à la maison et qui sont issus de familles socio-économiquement favorisées, passent plus d'heures par semaine à la crèche que leurs pairs (également issus de familles socio-économiquement favorisées) qui parlent luxembourgeois à la maison.. En ce qui concerne l'exposition à la langue au niveau de l'EAJE, le luxembourgeois semble jouer un rôle dominant pour la plupart des enfants.
- **Comment la fréquentation des structures EAJE et le contexte familial sont-ils liés aux performances scolaires ?** Le constat le plus important est que les structures EAJE non formelles (crèche) et formelles (précoce et Cycle 1) ont des effets positifs, faibles à modérés, sur les performances dans les trois domaines d'apprentissage précités. En analysant plus en détail la fréquentation des crèches, on voit que l'intensité de fréquentation a des effets différents pour les enfants lusophones et les enfants luxembourgeois - seuls les enfants lusophones semblent bénéficier d'une intensité de fréquentation plus élevée des crèches. En général et sans surprise, les enfants qui fréquentaient une crèche où l'on parlait le luxembourgeois, ont obtenu

des performances plus élevées en compréhension orale en luxembourgeois. Les écarts de performances scolaires bien connus en fonction du milieu familial ont été confirmés – dans le sens où les enfants qui sont autochtones, qui parlent le luxembourgeois à la maison, et issus de familles socio-économiquement favorisées sont privilégiés.

- **Les différences de performance observées entre les enfants appartenant à des groupes linguistiques différents sont-elles les mêmes pour la compréhension orale en luxembourgeois et en allemand ?** Les performances observées pour la compréhension orale en allemand se différencient encore plus en fonction du contexte linguistique de l'enfant que les performances notées pour la compréhension orale en luxembourgeois. Ce résultat remet en question généralisée le transfert au niveau des compétences linguistiques du luxembourgeois vers l'allemand qui serait valable au même degré pour tous les enfants.
- En conclusion, ce rapport met l'accent sur l'EAJE en tant que **variable d'ajustement importante** pour le développement des apprentissages et souligne la nécessité d'un recueil de données plus approfondi sur la qualité au niveau de l'EAJE. Une assurance qualité englobant les aspects structurels (comme p. ex. le ratio enfants-professionnel) et procéduraux (comme p.ex. les caractéristiques des interactions) devrait être réglementée et systématiquement évaluée afin de pouvoir agir comme un mécanisme promoteur du développement positif de l'enfant et de protecteur de l'égalité des chances pour chaque enfant. Un recueil de données plus spécifiques sur les différents aspects de la qualité et les pratiques linguistiques au niveau des structures EAJE permettrait d'obtenir des informations supplémentaires sur les effets potentiels des nouvelles réformes implémentées au niveau du système éducatif. Par ailleurs, le présent rapport a également révélé une relation négative significative entre les performances d'apprentissage des enfants et la pratique de l'allongement de cycle au niveau du Cycle 1, ce qui appelle à une révision en profondeur de cette procédure fréquemment utilisée au Luxembourg.
- Finalement, une continuité au niveau des pratiques de langues entre l'EAJE et la scolarité subséquente est primordiale. Cet alignement n'est actuellement pas garanti en raison d'une approche linguistique plus souple au niveau de l'EAJE suivie de pratiques linguistiques plus rigides au niveau de l'enseignement formel. Ainsi, l'éducation plurilingue introduite au niveau de l'EAJE, avec une promotion simultanée du luxembourgeois et du français, pourrait constituer une base solide pour l'alphabétisation en français, pourtant, il manque la promotion explicite de la langue d'alphabétisation actuellement en place au niveau du Cycle 2, qui est l'allemand. Il en résulte une urgence à réviser les programmes et les directives d'apprentissage linguistique – notamment en soutenant davantage une éducation plurilingue au niveau de l'enseignement formel (comme p.ex. les écoles européennes et internationales ou l'alphabétisation en français) et en promouvant explicitement l'allemand au niveau de l'EAJE afin de créer une base solide pour une alphabétisation subséquente dans cette langue.

PREFACE

Early childhood education and care (ECEC) is more relevant than ever in our societies. Most importantly, the aims and values of ECEC changed largely within the last decades: While the main value of early childhood **care** used to be maximally child-related, for example by providing room for non-regimented child development (e.g., of language or self-regulation skills) and free play, today, the aspect of **education** is also in focus. Education in early childhood nowadays means the development of social and motor skills, language, literacy, and mathematical skills in order to better prepare the children for school.

Over the last centuries, the relevance of language and literacy skills have been increasing to meet communication needs in our changing societies. **Literacy skills** became core skills in society towards the end of the last century as we transitioned from an industrial economy towards a knowledge-based service economy. During the first two decades of the current century, the demands for literate communication skills have further increased due to globalization and digitalization.

The high speed of the development is observable when we take one step back into history: It is only since the end of the 19th century that the acquisition of reading and writing is seen as an individual and social necessity which leads to the obligation of elementary school overall Europe. Today, literacy skills are key for individual, societal and economic-level **development**: "an open-sesame for nearly all life situations" (UNESCO, 2005).

There is consensus across Europe not only on the necessity of development of ECEC but also on **key characteristics** of ECEC attendance: type of service, duration, intensity, and quality. With the knowledge of these characteristics, it becomes possible to systematically monitor the input (characteristics) and outcome (effects) of the ECEC system. This report presents the attendance and effects of ECEC in Luxembourg on language (Luxembourgish), early literacy and mathematics performances measured at the beginning of Cycle 2 (grade 1) with the Luxembourg School Monitoring Programme *Épreuves Standardisées* (ÉpStan) while taking the children's family background into account.

In chapter 1 of the report, we summarize the disparate achievement of students in Luxembourg that reflects inequalities in terms of language and socioeconomic background and the current efforts to resolve these inequalities. In Chapter 2, we introduce ECEC, describe the ECEC landscape in Luxembourg and provide an insight into international research on attendance and associated effects of key characteristics of ECEC. In Chapters 3 to 5, we present in detail the empirical analyses of ECEC in Luxembourg as well as the rationale and the methodology used in the analyses. To conclude the report, the results are summarized and further interpreted in a discussion that also encompasses some notes on the limitations and implications of this study.

1. INTRODUCTION TO ACHIEVEMENT GAPS IN LUXEMBOURG AND POSSIBLE MECHANISMS TO REDUCE THEM

Since 2000, repeated results from the Programme for the International Student Assessment (PISA) and recent data from the national School Monitoring Programme ÉpStan have shown significant differences in key school competencies between student groups in Luxembourgish elementary and secondary schools (Hoffmann et al., 2018; Hornung et al., 2021; Martin et al., 2015; MENFP/SCRIPT, 2000; Sonnleitner et al., 2021).

As seen in the standardized test scores from ÉpStan from 2014 to 2019, the students show essential basic precursor skills in mathematics (e.g., counting and numbers) and language (e.g., phonological awareness, Luxembourgish language comprehension) at the beginning of their formal schooling in Cycle 2. However, the performances already differ significantly between different student groups. Over the years, these **performance gaps** grow progressively wider (LUCET, 2022). Many students, especially those from families with lower socioeconomic status, migration background or home languages other than the instruction languages, do not reach the required minimum standard in German reading comprehension and mathematics in Cycle 3 (Hoffmann et al., 2018; Hornung et al., 2021) nor in German and French reading comprehension and mathematics in Grade 9 (Sonnleitner et al., 2018, 2021).

These achievement gaps between students of different socioeconomic, migration and language backgrounds are also frequently found in other school systems around the globe. The achievement gap based on **socioeconomic status** is especially well-researched and has been documented for decades in various contexts (Broer et al., 2019; Chmielewski, 2019; Sandsør et al., 2021; Sirin, 2005). Meta-analytic results indicate small to medium effects of socioeconomic status (Korous et al., 2022; Letourneau et al., 2011), while there is some evidence that the achievement gap widens with children's age (Feinstein, 2000). Socioeconomic status was found to be connected to early language development, for example vocabulary (Hart & Risley, 1995), language problems and delays (Ribeiro et al., 2022), and literacy development (Ertel et al., 2021; Hemmerechts et al., 2017). Moreover, socioeconomic status has also been shown to impact early mathematical development (Jordan et al., 2006; Starkey et al., 2004) and later achievement in mathematics (Jordan et al., 2009). The effect of low socioeconomic status on mathematics might be larger for boys than girls (van Zwieten et al., 2021).

Migration background was another aspect to explain the achievement gaps between students: A study working with PISA data reported that in several countries, students with and without a migration background did not perform at the same level. For example, in Luxembourg and neighboring countries (France, Belgium, Germany), both first- and second-generation immigrant students performed worse in mathematics than native

students (Stanat & Christensen, 2006). A German study also found that migration background influenced mathematics and science achievement, when the differences in socioeconomic status and language spoken at home were taken into consideration (Pant et al., 2013).

Several studies also found academic disadvantages for students when the instruction language in school was different to the **language spoken at home** (for a review on effects on language and reading, see Rogde et al., 2019). For example, a large-scale study from South Africa (a country with an even higher diversity in languages than Luxembourg) indicated that students were disadvantaged in their language learning and literacy when the instruction language was different from their home language (Van Staden et al., 2016). A Spanish study found a similar effect of differing home and instruction languages on mathematics performance among first graders in an international school context (Bermejo et al., 2021). The students who learned mathematics in their first and dominant language performed better. The differences in mathematics performance can also be partly explained by reading comprehension in the language of instruction, as shown by a German study on fourth and sixth graders (Paetsch et al., 2016) and a Luxembourgish study on third graders (Greisen et al., 2021). Once the effect of the reading comprehension was taken into account, the disadvantage in mathematics among students with home languages distant from German disappeared (Greisen et al., 2021).

In Luxembourg, the school context is characterized by a very **heterogenous student population**, characterized by 43% of students with a nationality other than Luxembourgish and 67% of elementary school students not speaking Luxembourgish at home (MENJE & SCRIPT, 2022). When the effects of socioeconomic status, migration background and home language accumulate, as for example in many Portuguese speaking children, the achievement gap is especially pronounced, which also leads to more frequent *allongement du cycle* (i.e., grade repetition) for this group of children (Hornung et al., 2021; Sonnleitner et al., 2021). One possible explanation for the heightened difficulties of these students might be the unique and highly **challenging language curriculum** of traditional public schools (Sattler, 2022). In Cycle 1, the instruction language is predominantly Luxembourgish, in order to improve the integration of children with a migration and foreign language background. In Cycle 2, the instruction language switches to German which remains the instruction language for reading, writing and mathematics until secondary school. Luxembourgish, German, and French are taught in specific language lessons throughout school (MENJE, n.d., 2020), while English is introduced later in grade 8. Due to many linguistic similarities between Luxembourgish and German, people assumed for many decades that children would quickly learn German in Cycle 2 without prior German language training. A prevailing argument was that the children's acquired skills in Luxembourgish would build a bridge to acquire

German (MENJE, 2020). The assumption of a transfer has not been confirmed scientifically, as of yet. Some researchers have questioned this assumption and have observed that children with a home language other than Luxembourgish and German may not transfer their language skills from Luxembourgish to German (Hoffmann et al., 2018). More importantly, the current multilingual curriculum and practices lead to **difficulties in language and literacy acquisition for many children**, early on in their school career (Hornung et al., 2021). This aspect has also been highlighted in a recent report by the OEJQS, i.e., Observatoire de l'Enfance, de la Jeunesse et de la Qualité scolaire (2022). However, the considerations are far from new – decades ago, Maurer-Hetto and colleagues (1991) described their premonition that especially Portuguese speaking children would encounter severe school difficulties due to the prevailing instruction languages in fundamental schools.

Over the decades, several **possible solutions** have been proposed by policymakers in order to respond to the challenges in the traditional education system. There are currently two strands of solutions being proposed by researchers and practitioners. On the one hand, it could help to increase the **flexibility in the language curriculum** and as such, the language of instruction. On the other hand, **starting early** could promote and strengthen language skills that are needed for literacy acquisition in the public school system.

Regarding **flexibility**, the ONQS recently recommended to thoroughly review the school curriculum in the Cycles 1 and 2 in general and more specifically the language policy (ONQS, 2022). More than three decades ago, Maurer-Hetto and colleagues (1991) suggested designing new teaching methods such as introducing and learning German as a second language and not as a first instruction language. Prompted by the repeated recommendation of several actors in the educational field, a recent pilot project is currently introducing French as the instruction language to learn reading, writing and mathematics in Cycle 2 (MENJE, 2022).

Even more language flexibility has been offered through the introduction and current expansion of several **European and international public schools**. They offer students and their parents (this includes legal guardians throughout the report) a greater autonomy by letting them choose between sections with either English, French or German as first instruction language (MENJE, 2020). In the school year 2018/19, 12% of the student population in Luxembourg attended a European or international public or private school, while the number of students has rapidly increased to 16,5% in the school year 2021/22, indicating a great demand for the few available places (Backes & Lenz, 2021; MENJE & SCRIPT, 2022).

Another approach towards remediating achievement gaps stems from the concept of an **early start**, as "starting behind often means staying behind" (OECD, 2020a, p. 28). This

perspective is also the foundation of early childhood education and care (ECEC). High quality ECEC has been shown as key for later academic success and reducing societal and economic inequalities by international research evidence (Bennett, 2012). More detailed information on the effects of ECEC can be found in the next chapter (see p. 16).

Luxembourg's ECEC landscape encompasses a variety of services in the **non-formal** and **formal** domain. Non-formal ECEC in Luxembourg encompasses services outside of family care and school settings, for instance *crèche*, *Maison Relais*, *Foyer Scolaire* or parental assistants. Formal ECEC in Luxembourg refers to early education services in schools targeted at 3- to 6-year-olds, which embodies the optional year for 3- to 4-year-olds in *précoce* and the two compulsory preschool years in Cycle 1.

From 2009 on, a reform by the Luxembourgish government reduced the costs of ECEC for all parents by introducing three free hours of non-formal ECEC for children (age 0-3) with the *Chèque Service Accueil* (CSA, voucher system). In 2017, a new **reform** increased the free daycare hours from 3 to 20 hours, adjusting the age range to age 1-4. This reform may have facilitated an early start into non-formal educational and care settings where children could interact and communicate with peers and qualified educators in an enriched environment. An early start in ECEC may therefore help reduce the gap between children from different socioeconomic and language backgrounds.

The aforementioned 2017 reform was further accompanied by an early **plurilingual education program** ("*programme d' éducation plurilingue*"). This program focused on promoting Luxembourgish and French for all children between the ages of 1 to 6 in the nonformal as well as the formal ECEC sector while also valuing the child's home language (MENJE et al., 2021). The reform targeted all kinds of ECEC settings, including *crèche*, *précoce*, Cycle 1, *Maison Relais*, and *Foyer Scolaire*. The plurilingual education program was introduced as a crucial step to bring the Luxembourgish and French language closer to families with other home languages before starting compulsory preschool in Cycle 1. Nevertheless, one crucial instruction language, German, is missing in ECEC contexts. Weth (2018) questions this practice since good oral language skills are vital for later literacy acquisition. Supporting German language learning in non-formal ECEC or at least Cycle 1 would help children to build an essential base for literacy acquisition in the instruction language German in Cycle 2 (first grade).

In the formal ECEC domain (Cycle 1), the need for early education and support has already been recognized, leading to the implementation of **specific learning programs** that foster literacy and mathematics precursor skills at an early age. Good examples are the national programs SILA (promoting phonological awareness) and MAGRID (a language-free mathematics learning tool) which are research based and promoted by SCRIPT (MENJE).

The present report focuses mainly on ECEC in Luxembourg and its associations with later learning performance. We therefore define ECEC more in depth below, review international evidence on attendance levels and summarize the effects of ECEC in more detail.

Spotlight

ÉpStan find disparities between students of different family backgrounds in Luxembourg.

Achievement gaps might be heightened by the highly demanding language curriculum in the Luxembourgish school system.

Several possible mechanisms to reduce the gaps are currently discussed by researchers and policy makers.

2. THEORETICAL BACKGROUND ON EARLY CHILDHOOD EDUCATION AND CARE

2.1 DEFINITION

Early Childhood Education and Care (ECEC) includes "any regulated arrangement that provides education and care to children from birth to compulsory elementary school age" (European Commission, 2022) and is prescribed as a children's right by the EU and the UN. ECEC can span from supervision in private or public daycare centers to preschools.

In Luxembourg, children from birth to 4 years can attend *crèches* (daycare centers) or join independent caregivers who look after a small group of children ("*Dageselteren*"). From age 3 to 4, children can attend *précoce* (voluntary preschool), while at age 4, Cycle 1 (compulsory preschool) is obligatory for all children. Formal literacy acquisition and mathematics in Luxembourg starts at the age of 6 with Cycle 2 (first grade).

2.2 ECEC LANDSCAPE IN LUXEMBOURG

With the advent of the **CSA voucher service** and further subsidies, the ECEC system in Luxembourg is one of the most affordable in comparison to other countries (OECD, 2022b, p. 9). The CSA has further strengthened the private sector of the ECEC system in Luxembourg, that has a long tradition in the country – meaning that there are many private institutions offering ECEC and especially very young children are likely to attend a commercial ECEC setting (OECD, 2022b). This results in a double "split system", of public and private ECEC services (e.g., *crèches*), as well as formal and non-formal structures (Bollig et al., 2016, p. 7; Honig et al., 2015). The CSA vouchers being valid for both public and private ECEC allows parents to choose between different market options, according to their cultural heritage, language preferences and socioeconomic circumstances (Honig et al., 2015). ECEC services in Luxembourg are of varying quality and resources, leading to a highly **heterogenous landscape** of possibilities (OECD, 2022b). This diversity in ECEC services is associated with difficulties in defining criteria for service quality at a national level and monitoring them.

In the following sections, we present findings from various international studies on attendance in ECEC and effects of ECEC.

2.3 ATTENDANCE IN ECEC

A report from 2022 shows that in OECD countries, on average, 25% of children below the age of 3 attend ECEC (OECD, 2022b). In Luxembourg, this number is significantly higher. Here, around 61% of **children under the age of 3** attended ECEC in 2019. This is comparable to Germany, where 67% of two-year olds attended ECEC (OECD, 2020b). In Denmark and Norway, this number rises to 90% of all two-year olds. However, looking at children under 1 year of age, parents mostly do not choose to enroll their children in ECEC in Denmark, Germany and Norway (OECD, 2020b).

Spotlight

ECEC attendance in Luxembourg is relatively high compared to other countries, especially for very young children.

International research shows that attendance in ECEC differs depending on family background, in the way that disadvantaged children attend ECEC less than others.

For slightly **older children**, the numbers are higher - as internationally, preschools usually start at age 3. The OECD average of ECEC attendance is 77% for three-year olds, 90% for four-year olds, and 96% for five-year olds. In Luxembourg, the respective numbers are 71% (for 3 year olds), 98% (for four-year olds) and 99% (for five-year olds) (OECD, 2022a) [1]. However, other reports have estimated the attendance of *précoce* in Luxembourg (at the age of 3) at 87% in 2017 (OECD, 2022b).

The attendance of ECEC also differs depending on the family background.

In several EU countries, a **lower socioeconomic status** is associated with **lower attendance rates** of ECEC (Flisi & Blasko, 2019). Cadima et al. (2020) noticed that this trend was found in nearly all OECD countries, even when the correlation between socioeconomic status and attendance did not reach significance. In Luxembourg, the association between socioeconomic status and ECEC attendance (broadly operationalized as any official arrangement such as preschool, *crèche* and *Dageselteren*) was not significant (Flisi & Blasko, 2019). A systematic review on European countries reported that families with lower socioeconomic status tend to have less access to high quality ECEC (Vandenbroeck & Lazzari, 2014).

While one EU study (Ünver et al., 2021) did not find a statistically significant effect of **migration background** on ECEC attendance (in weekly hours), it is likely that migration background could influence ECEC attendance in either direction. For instance, language barriers, little

[1] These numbers are subject to a certain degree of uncertainty as it is not sure which ECEC services were included in the data.

knowledge of the local education system, cultural preferences and values, and lower availability of alternative family care could all play a part here (OECD, 2022b).

In a German study, greater **public subsidies** and fewer parental costs of ECEC were only connected to a greater use of ECEC by disadvantaged children from the ages 2 to 3 (Busse & Gathmann, 2020). Parents of older children did not respond to the introduction of free childcare in this study. An EU-level study also found that very young children (0-2 year olds) from disadvantaged families were not attending ECEC more frequently after greater public subsidies (Ünver et al., 2021). In contrast, a 2009 reform in Luxembourg reduced parental costs by introducing 3 free ECEC hours. It significantly increased the probability of using ECEC for longer hours among parents with children under 3 years of age (Bousselin, 2019).

2.4 EFFECTS OF ECEC

Participating in ECEC seems to have largely **positive effects on child development**, as several reviews show (Bennett, 2012; Ruhm & Waldfogel, 2012). There is, however, some uncertainty regarding the **duration of the effect**. While stable positive effects could be found consistently in the short term (Burger, 2010; DeAngelis et al., 2020), some studies show that ECEC benefits fade out in late childhood (Blanden et al., 2016; Little et al., 2020; Puma et al., 2012). Other studies, however, have also shown longitudinal effects of increased attendance in ECEC (operationalized by individual or aggregated measures) on individual (e.g., higher school qualification level and later income) as well as societal outcomes (e.g., lower crime rates), (Anders et al., 2019; Havnes & Mogstad, 2011; Larose et al., 2021).

ECEC characteristics, such as type of childcare, duration, and intensity of attendance, moderated by family background variables such as socioeconomic status, have different patterns of effects on cognitive development. In the following paragraphs, we summarize some of the major findings on these aspects.

TYPE OF ECEC

We differentiate between different types of ECEC by the age of children attending.

ECEC FOR 0-3 YEAR OLDS

For very young children, the literature distinguishes between group- or center-based ECEC (for example *crèche*, daycare centers, or Dageselteren) and family care by relatives in the home environment. In general, there are fewer studies available for this age group and the **results are less consistent** than for older children: A comprehensive review by Melhuish (2015) finds negative, positive, as well as null effects for ECEC, most likely depending on the child's age of entry, quality of ECEC service and relative balance with the home care environment (i.e., intensity and duration of ECEC). In Norway, for example, center-based childcare before the age of 2 had a positive effect on early language at the age of three (Dearing et al., 2018) and age six to seven, as well as early skills in mathematics at age six to seven (Drange & Havnes, 2015). Positive short-

term effects could also be found in a UK study (Hansen & Hawkes, 2009), where young children's ECEC attendance was associated with school readiness at the age of three.

Especially children from **disadvantaged families** benefit from attending early ECEC: Laurin et al. (2015) examined data of children from low socio-economic background who either attended ECEC from 5 months on or did not attend ECEC at all. They found higher academic achievement for those who attended. Furthermore, Larose and colleagues (2021) found that for children growing up in adversity, attending a center daycare was a protective factor: it led to higher cognitive development, which was linked to fewer disruptive behaviors. Socioeconomically **advantaged families** on the other hand, might experience weaker or even negative effects of early ECEC attendance (before the age of 3) on cognitive and language development of the child. Here, **ECEC quality** seems to be the deciding factor: high quality care did not have a strong effect on cognitive and language development of children from advantaged families, while poor quality care was connected to lower development of language and cognition of these children, as well as increased antisocial behavior (Melhuish, 2004).

Spotlight

ECEC has positive effects for children under and over the age of three, however, the effects seem more stable for the older age group.

For both groups, service quality has a critical impact on ECEC outcomes and disadvantaged children benefit more than advantaged children.

ECEC FOR 3-6 YEAR OLDS

ECEC at this age often refers to **preschool**, a more "schoolified" and structured approach to education and care, preparing children for formal schooling at age 6. In Luxembourg, children of this age group attend non-formal (e.g., *crèche*) or/and formal ECEC (*précoce*, Cycle 1).

In general, international studies consistently show that ECEC attendance of three- and four-year old's has **positive effects on cognitive and language development** (for reviews, see Burger, 2010; Melhuish et al., 2015). A meta-analysis (combining multiple studies) found that preschool attendance also has positive effects on socio-emotional factors, academic achievement, and progress (Camilli et al., 2010). PISA results indicate a positive effect on reading scores at age 15 when children attended some kind of pre-elementary school education. This effect was roughly equivalent to the effect of one year of schooling (OECD, 2011).

Numerous studies demonstrate that also in this age group, children from **disadvantaged families benefit more strongly from attending ECEC**, e.g., children with a migration background (Spiess et al., 2003), with a home language other than the instructional language (Ansari et al., 2021), or from families

with low socioeconomic status (Sierens et al., 2020). This is especially true when the ECEC program is universal instead of targeted at a specific population, mixing children of different social backgrounds (Lazzari & Vandenbroeck, 2013). For example, a policy reform in France that increased the universal attendance of three- and four-year olds in ECEC, led to improved school outcomes and reduced socioeconomic inequalities by especially benefitting children from disadvantaged families (Dumas & Lefranc, 2010). A review reported that for the age group of three-year old onwards, most evidence shows that **preschool attendance has positive effects** on educational and social development **for children of all backgrounds**. (Melhuish et al., 2015).

Nevertheless, it is not known if the **socioeconomic gap** between children can truly be reduced by ECEC attendance. An Australian study, for example, showed that ECEC attendance for children from families with lower socioeconomic status only reduced the socioeconomic gap by 2.1 percent (Goldfeld et al., 2021). In the same vein, Balladares and Kankaraš (2020) could not find a reduced gap in PISA outcomes between advantaged and disadvantaged students who attended a preschool program in OECD countries.

INTENSITY AND DURATION OF ECEC ATTENDANCE

Many reviews, meta-analyses and studies investigate what duration and intensity of ECEC attendance bring the best results for the development of children.

INTENSITY OF WEEKLY ECEC ATTENDANCE

Regarding intensity, that is, how many hours per week the child is attending ECEC, the literature yields **mixed results**. This likely stems from the quasi-experimental study designs often used in these studies, in which attendance, whether half- or full-day, cannot be randomly assigned. Consequently, attendance is associated with confounding factors such as family background (Melhuish et al., 2015).

On the one hand, several studies have found an advantage of attending ECEC programs with a **lower intensity**. These studies either did not show evidence that full-day attendance was associated with better child development than half-day attendance (Sylva et al., 2004), or even reported negative effects of a full-day ECEC program on math achievement in fifth grade when socio-emotional skills were statistically held constant (Le et al., 2006). In a U.S. study, higher intensity of ECEC attendance had no cognitive benefits for children from advantaged families, while for them, low to moderate ECEC intensity seemed to be connected to higher early literacy and numeracy at age 5. Children from low income families, however, benefitted from a higher ECEC intensity (Loeb et al., 2007a).

On the other hand, some more recent research indicates that an **increasing intensity** of attendance might be connected to greater effects on cognitive as well as language development, even when statistically holding

the socioeconomic status constant (Barnes & Melhuish, 2017; Luijk et al., 2015; van Huizen & Plantenga, 2018). If children attended ECEC for more hours in the first year of their life, the short-term effect on their language at the age 1 to 1.5 was negative. This negative effect, however, was reversed at a later age, meaning that their language skills were then better than the skills of those who entered ECEC after their first birthday (Luijk et al., 2015). This reversal could point to a phase of initial adaptation to the new language environment, as the authors suggest. A secondary data analysis on specialized programs for disadvantaged children, for example Headstart in the US, demonstrated that fewer absences were also associated with stronger gains in early literacy and numeracy. However, the authors did not find a reliable or consistent association between the amount of hours per week in ECEC and academic skills (Burchinal et al., 2016; Xue et al., 2016).

Spotlight

Studies indicate that children benefit most from moderate intensity of ECEC attendance.

The pattern, however, is not completely clear and may depend on family background.

The optimal intensity of weekly attendance lies probably somewhere in the middle: A Swiss study found the best results for language skills when children with a migration background who did not speak one of the national languages attended early out-of-family care (childminders and daycare centers between 18 months and 3 years) for 21 to 28 hours, while more or fewer hours were associated with lower results (Grob et al., 2014). Similarly, a PISA study on several OECD countries found a curvilinear relationship between weekly hours of preschool attendance and later PISA scores, where the **optimal range of attendance was between 20 and 40 hours per week** (Balladares & Kankaraš, 2020), while more or fewer hours were associated with lower performance scores.

DURATION OF ECEC ATTENDANCE IN YEARS

In this part, we focus on the effect of duration in ECEC, meaning the number of years spent in ECEC. It is important to keep in mind that duration is often operationalised as **entrance age** in the ECEC literature - in most cases, children do not stop attending ECEC after starting. A meta-analysis on U.S. ECEC programs from 1960 to 2007 found that programs with an earlier entrance age in comparison to later entrance ages had slightly larger positive effects on developmental outcomes (Li et al., 2020). Surprisingly, programs with longer duration had smaller average effect sizes than shorter duration programs (Li et al., 2020). In general, effects of different starting ages are mostly moderate and tend to fade out in the long run (Melhuish et al., 2015; Sammons et al., 2008).

Based on earlier studies, the association between duration of ECEC attendance and child development appears to be **positive** (Caille, 2001). For example, starting early in ECEC was related to higher cognitive

development at age 3. The effect decreased over time, but persisted throughout grade 1 (Eryigit-Mzwamuse & Barnes, 2014). More long-term effects were observed in a Swedish study, where younger entrance age in ECEC correlated with higher school achievement at ages 8 and 13 (Andersson, 1992).

Another study observed that a starting age between 2 and 3 years, on the one hand, may yield the greatest benefits for math and reading achievement (Loeb et al., 2007b). However, it also appeared to increase behavioral problems among children (Loeb et al., 2007a).

Eryigit-Mzwamuse and Barnes (2014) investigated different **patterns of ECEC attendance**. For this purpose, they compared different groups of children: for example, children in continuous care in daycare centers, children who switched from maternal to daycare centers at age 3, and children who attended multiple types of care (maternal, non-maternal home-based, and center-based). While the group in continuous care in daycare centers showed advantages in language development at age 3, this effect did not last – about a year later, the advantage had faded. There was no evidence of a different cognitive or language development for children who switched to center-based care later or who received multiple types of care.

Spotlight

The optimal duration of ECEC appears to depend on family background factors.

Disadvantaged children benefit more from longer duration in ECEC while advantaged children benefit more from fewer years in ECEC.

By contrast, a Dutch study (Driessen, 2004) investigating the effects of daycare and preschool from 1996 to 2000 did not find any association between different ECEC durations and later cognitive outcomes (language and mathematics in elementary school). The "diverse and highly fragmented" (Driessen, 2004, p. 670) ECEC system in the Netherlands is discussed by the authors as a possible explanation.

Family background might be another factor to explain the incongruity between the results. For instance, very early ECEC attendance had a positive effect on **school readiness** only among German children of disadvantaged families (Felfe & Lalive, 2014). Similar results were observed in a Dutch study in which a higher number of preschool years resulted in better reading skills in grade 3 only among socioeconomically disadvantaged children (Sierens et al., 2020). Children from advantaged families, however, showed better reading achievement with low to moderate ECEC duration (Sierens et al., 2020).

LANGUAGES IN ECEC

As ECEC settings in Luxembourg are overwhelmingly **plurilingual** in their practices (Kirsch & Aleksić, 2021), the question arises whether the contact with specific languages has a positive influence on young children's development. Especially for those who do not

speak Luxembourgish or German, a critical question arises: Do these children benefit most from ECEC in Luxembourgish, in the family language or from multilingual offers?

There has been much scientific **debate** on the question of whether bilingual education programs that foster the children's first language (L1) as well as the majority instruction language (here: L2[2]) are helpful or detrimental to L1 and/or L2 development (see Gogolin & Neumann, 2009). Underlying this debate are also differing research methods (e.g., qualitative vs. quantitative), as well as different foci of research questions (e.g., describing processes or testing outcomes).

On the one side of the debate, the **interdependence theory** (Cummins, 1978) suggests negative effects on school achievement and L2 learning, if a certain level has not been reached in the L1 first. Researchers on the other side of the debate have stressed that spending more time on the L1 reduces the time to learn an L2 (time-on-task principle) (Rossell & Baker, 1996). This has been phrased as a "**zero-sum-problem**" by Esser (2009).

There is a shortage of high-quality studies (longitudinal, randomized, etc.) that have reliably investigated the question of **bilingual education in ECEC** (Slavin & Cheung, 2005). A meta-meta-analysis of 128 studies found a small, but positive, effect of bilingual education on school learning. The effect sizes of the individual studies varied widely, due to large differences between programs (Hattie, 2010). When looking at language outcomes, studies looking into specialized programs (offering L1 support to promote L2 to bilingual children) could not find a (positive or negative) effect or only found a very small positive effect from L1 proficiency level on L2 acquisition (Gogolin, 2020; Söhn, 2005). Another review finds that foreign language programs in ECEC do not seem to negatively impact L1 acquisition of children (see Thieme et al., 2022).

Spotlight

School language (L2) should be promoted already in early years to allow development of conceptual learning in language and mathematical related literacies.

Additional support of L1 in ECEC is much debated, needs further investigation as there are no clear results for school success yet.

What seems to be a "minimal consensus" (Tracy, 2009) between both sides of the debate is the necessity of good skills in the instruction languages (L2) to ensure equal opportunities and educational equality. To promote this, **L2 skills should already be supported in ECEC** (Tracy, 2009; Weth, 2018).

[2] L1 and L2 are used heuristically here to indicate either one or more family languages (L1) and one and more instruction languages (L2).

3. THE PRESENT REPORT

The often-highlighted **educational disparities** in Luxembourg have currently received great interest from policy makers. The present report has been commissioned by the LUCET steering committee, consisting of University and Ministerial stakeholders, to investigate ECEC as an approach that might mitigate the disparities by promoting early access to education and language.

To date, there are **no systematic quantitative studies** on the outcomes of ECEC (e.g., as a protective factor against achievement gaps) in Luxembourg. The aim of this study is therefore to investigate whether the international findings on influences and effects of ECEC attendance can be replicated in the diverse and multilingual school context of Luxembourg.

As Luxembourg has implemented a thorough system of educational monitoring in its country (ÉpStan), there is a unique opportunity to quantitatively evaluate the outcomes of ECEC using **large-scale and full-cohort data over several years**, starting in 2015. While we did not have access to data on ECEC quality, the available broad data on ECEC attendance and characteristics, as well as the detailed data on family background and performance in the three learning domains Luxembourgish listening comprehension, early literacy and mathematics allow us to gain an overview and new insights on the role of ECEC in Luxembourg.

Additionally, to the three aforementioned learning domains, a **new language test** evaluating German listening comprehension, a key precursor skill of German literacy acquisition, was introduced in 2022. With this, we aim to further investigate the common assumption of a transfer from Luxembourgish to German.

The findings of this report might thus be able to support future **evidence-based decisions** in educational policies, inform stakeholders (parents, educators, teachers, and policy-makers) on benefits and drawbacks of ECEC attendance and characteristics, and in the long run, promote efforts to reduce educational inequalities and improve learning development.

3.1 RESEARCH QUESTIONS

Based on data from the ÉpStan from 2015 to 2021, two main questions on ECEC will be analyzed:

1. **Who attends which type of ECEC in Luxembourg?**
   We explore the general attendance in two different ECEC types (*crèche* and *précoce*[3,4]), and ECEC characteristics such as intensity and duration of *crèche* attendance as well as languages used in *crèches*. We also investigate whether family background variables (socioeconomic status, migration background and home language group) are associated with ECEC attendance and characteristics. Furthermore, we look at preliminary trends of ECEC attendance over the years, spanning until the implementation of the ECEC reform (CSA and "*education plurilingue*") in 2017.
2. **How are ECEC attendance and family background associated with learning performance in Cycle 2?**
   We analyze the relative contribution of attendance in ECEC and family background variables to children's language and mathematics performances at the beginning of formal schooling in Cycle 2. Here, the relative effects of ECEC type and characteristics (intensity, duration, and languages in ECEC) on learning performance are explored. Additionally, we investigate whether specific ECEC characteristics are especially beneficial for the learning performance of certain groups of children.

Based on data from the 2022 ÉpStan, we further analyze one adjunct research question on a transfer from Luxembourgish to German:

3. **Is the pattern of differences between children of different home language groups the same in Luxembourgish and German listening comprehension?**
   We compare the differences in the performance between Luxembourgish and German listening comprehension of first graders between the three most frequent home language groups. We investigate whether the relative differences between home language groups in Luxembourgish listening comprehension can be found in German listening comprehension.

[3] We will keep using the French terminology to ease readability and to stay consistent.

[4] We exclude Cycle 1 here, as it is mandatory for all 4- and 5-year-olds.

4. METHODOLOGY

For the analysis, we draw back on the longitudinal cohort from the **School Monitoring Programme, *Épreuves Standardisées* (ÉpStan)**, with a total of 45.795 students assessed in Grade 1 over the years 2015 to 2022[5]. The cohorts consist of about 5,000 students per year. The competency tests at the beginning of Cycle 2 are administered to all children by their teachers and aim to assess the competencies required for successful attendance of Cycle 2. Between 2015 and 2021, the children took tests in the following three learning domains: **Luxembourgish listening comprehension, early literacy, and mathematics**. In 2022, a fourth competency test in **German listening comprehension** was administered. Further information on the children, their family background and ECEC attendance is gained from student and parent questionnaires, allowing a deeper insight into the student population.

4.1 SAMPLE OVERVIEW

For first graders, the socioeconomic background seems to be increasing in Luxembourg throughout 2015 to 2021 (see Figure 1). The **socioeconomic status** was measured based on the highest parental occupation (International Socio-Economic Index of Occupational Status, isei- index).

Moreover, the Luxembourgish student population is increasingly becoming diverse regarding their **migration** history. From all first graders in 2021, about 46% are natives, i.e., they and at least one parent were born in Luxembourg. More than half of the children (54%) in 2021 either have been born outside Luxembourg themselves (first generation) or had parents that were born outside Luxembourg (second generation). These percentages stay more or less stable across the selected time period (see Figure 2).

The diversity of the student population becomes even more apparent when focusing on their **home languages** (see Figure 3). We grouped all children based on the language

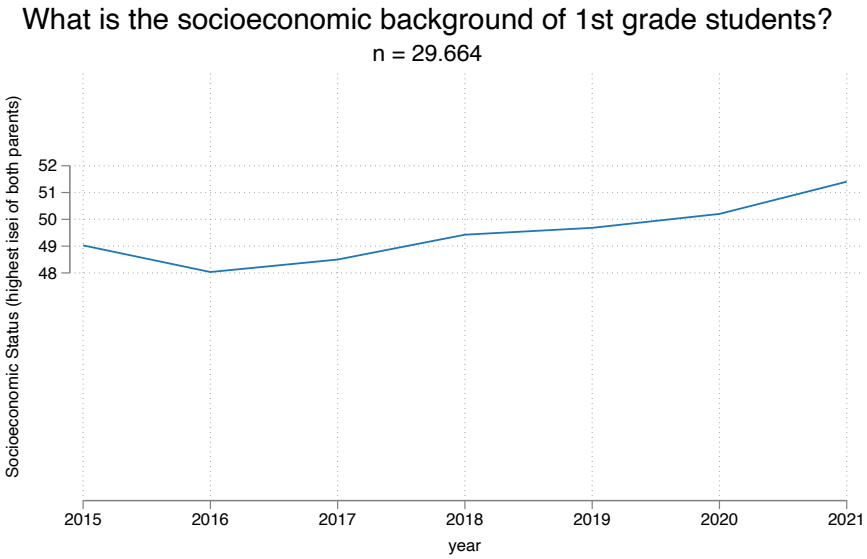


Figure 1. Trend of socioeconomic background (sample of Luxembourg's first graders in 2015-2021)

[5] For specific analyses, the sample size varies.

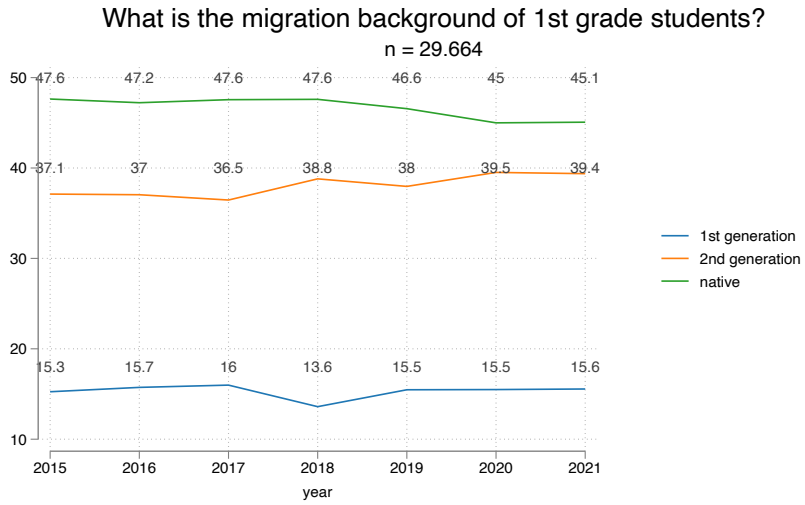


Figure 2. Trend of migration background (sample of Luxembourg's first graders in 2015-2021)

spoken most with their parents. These were four groups (Luxembourgish*, French, Portuguese, South Slavic languages) that mainly spoke one language with their parents and the two most common groups that spoke two languages (Luxembourgish*/ French and Luxembourgish*/ Portuguese) with their parents. Very few children reported German as home language (about 5%) and there were no significant differences between German and Luxembourgish speaking children in their Luxembourgish and German listening comprehension. Therefore, we grouped both languages together. To ease readability, we only refer to this group as Luxembourgish* speaking from here on.

In 2021, 32% of the first graders in our sample spoke Luxembourgish*; 16% spoke Portuguese and 12% spoke French with both parents. Whereas the home language groups with only Luxembourgish* and only Portuguese are declining over the six last years, "other" home languages are steadily increasing from 20% in 2015 to 28% in 2021. These are children that speak a language combination at home not included in the previously described groups. This reflects the increasing language diversity in families.

The multilingual nature of school and family contexts leads to children being in **contact with varying languages in different situations**. In 2022, the ÉpStan parent questionnaire aimed

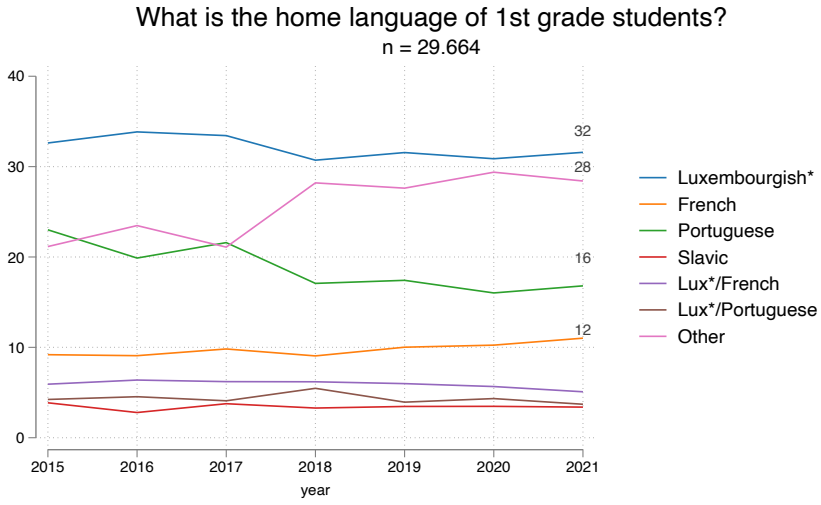
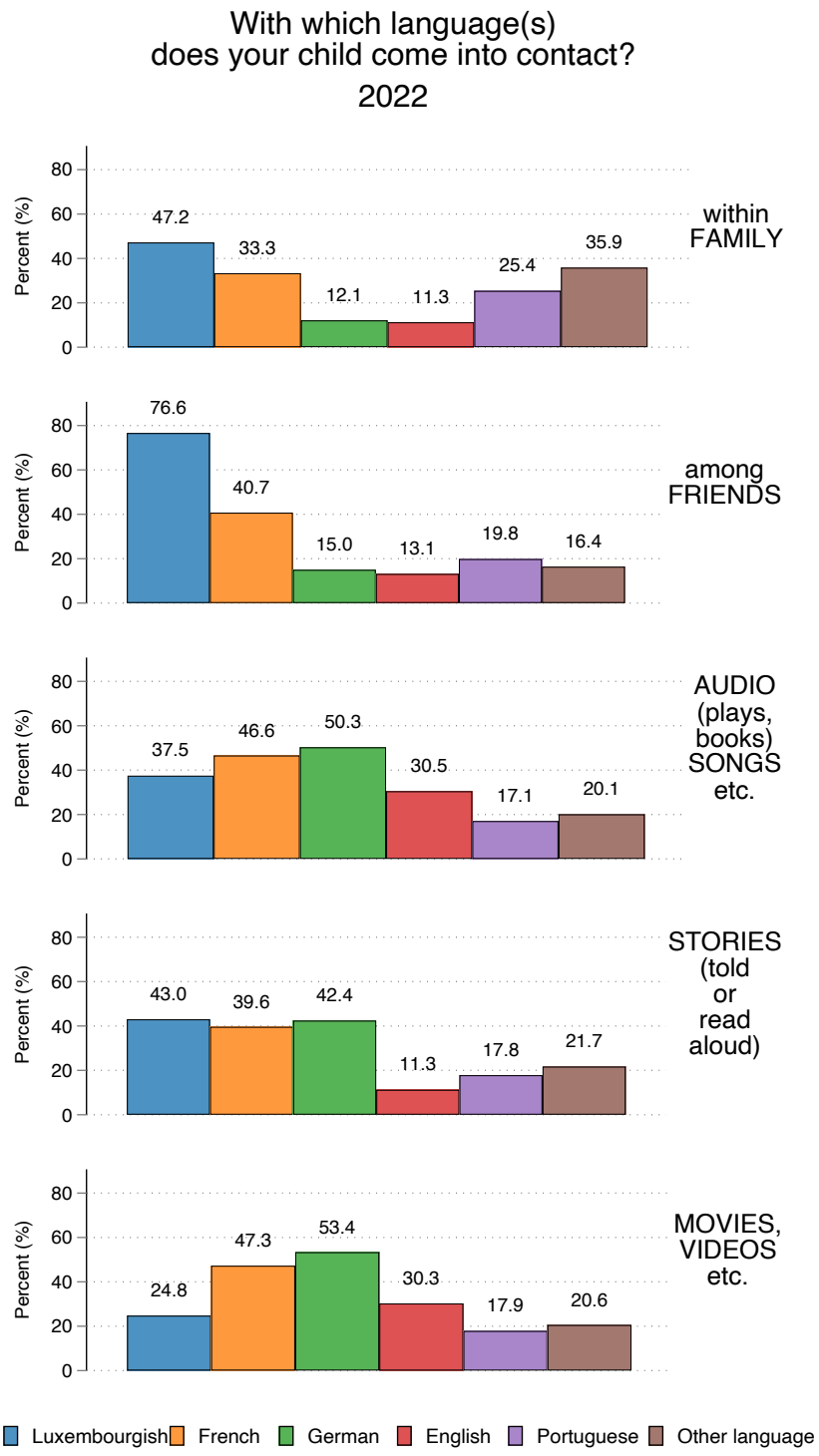


Figure 3. Trend of home language (sample of Luxembourg's first graders in 2015-2021)

to investigate everyday language activities of first graders[6] and provides a valuable insight in this topic.

In Figure 4, we see that nearly half of first graders encounter Luxembourgish in family contexts (e.g., parents and siblings), even though only one third of first graders speak Luxembourgish as first language at home (MENJE & SCRIPT, 2022). **Among friends**, Luxembourgish is even more widely used: 77% of the parents indicated that their children speak Luxembourgish with friends. This is a remarkable fact and may be a result of fostering Luxembourgish in ECEC, particularly in *précoce* and Cycle 1. The consequence is that the vast majority of Luxembourg's first graders speak Luxembourgish with their peers. At the beginning of formal schooling, Luxembourgish appears to be the predominant language among children of the same age.

In the context of **media** (audio and movies), most children are exposed to German (50 - 53%) and French (47%). However, in stories told read or read aloud,



Note: N = 5.706

Figure 4. Contact with languages in different contexts (sample of Luxembourg's first graders in 2022)

[6] Notably, current data of SNJ look into similar questions related to languages within the family and in media, reported by parents whose children attended *crèches* at the moment of data collection (see SNJ, 2023).

Luxembourgish, German and French are similarly represented (around 40%).

These descriptive results indicate that the predominance of Luxembourgish among peers holds irrespectively of the child's home language background. However, for media consumption and stories told or read, the preferred language is often the family language: French families mainly watch movies in French, Portuguese families watch them in Portuguese, and Luxembourgish* families choose to watch them in German or Luxembourgish (see additional figures in appendix, from Figure 30 to Figure 35).

4.2 MEASURES

ÉPSTAN COMPETENCY TESTS

The ÉpStan competency tests examine whether the educational goals from the previous learning cycle have been achieved in the respective grade levels. As described in the Technical Report (Fischbach et al., 2014), items of the performance tests are developed by teams of researchers, teachers, and members of the MENJE, ensuring that the difficulties are appropriate for the age group, the assessment is standardized, and the contents are linked to the key competencies as defined by the national curriculum (*Bildungsstandards*, *Plan d'Études*). To be able to analyze trends and compare students' performance over time, it is necessary to place the results of the different tests across the years on one scale. For this, a five-step procedure (see Nagy & Neumann, 2010) is followed, that included ensuring Rasch compliance, analyzing differential item functioning as well as sensitivity, and estimating person parameters.

More concretely, the tests at the beginning of Cycle 2 examine whether the learning goals of Cycle 1 have been achieved. Since 2014, Luxembourgish listening comprehension, early literacy precursors and mathematics have been assessed at the beginning of Cycle 2. All test items have been presented in Luxembourgish as the instruction language in the previous learning Cycle 1 is Luxembourgish. In 2022 German listening comprehension has been added to the competency test framework in Cycle 2 in order to evaluate children's German listening comprehension, the instruction language in Cycle 2. The four competency tests are briefly described below. Test item examples can also be looked up at the epstan.lu website in the download area.

LUXEMBOURGISH LISTENING COMPREHENSION

The test evaluating Luxembourgish listening comprehension assesses different sub-skills. These are for instance understanding an interlocutor, global and selective text comprehension (identifying the main idea and key details) and listening strategies (e.g., recognizing background noises). The test provides different text formats (e.g., conversations, stories) dealing with familiar topics such as animals, nature, family, sports, or school. Texts and instructions are presented on CD or via an audio streaming platform.

EARLY LITERACY PRECURSORS

The test evaluating early literacy precursors is assessing different sub-skills. These are for

instance constructing and using language units (i.e., phonological awareness, e.g., identifying the initial sound of a word), visual discrimination (e.g., matching or copying symbols such as letters) and understanding the alphabetic principle (e.g., letter knowledge, reading or writing syllables). The test is presented on CD or via an audio streaming platform.

MATHEMATICS

The test evaluating mathematical skills assesses sub-skills in the competency areas: "numbers and operations", "space and shape" and "sizes and measures". To ease the understanding of tasks and instructions and to reduce the influence of language, many illustrations, examples as well as brief instructions are used.

GERMAN LISTENING COMPREHENSION

The test evaluating German listening comprehension was newly implemented in 2022 and assesses different subskills such as for instance word and sentence comprehension, global and selective text comprehension (identifying the main idea and key details) and listening strategies. The presented texts and stories are nevertheless shorter, and the language (i.e., vocabulary and syntax) is less complex than the language used in the Luxembourgish listening comprehension test. Texts are presented in different text formats (e.g., conversations, short stories) and presented on CD or via an audio streaming platform.

STUDENT AND PARENT QUESTIONNAIRES

Student and parent questionnaires are distributed at the same time as the competency tests in mid-November are administered. The rate of return is high (96% for students, 92% for parents). While student questionnaires are usually administered in the instruction language German (translations are available for teachers), parent questionnaires can be answered in one of the four languages German, French, Portuguese, and English.

The **student questionnaires** collect information about some aspects of family background and socio-emotional variables. For this report here, we used data on child's gender and home languages.

The **parent questionnaires** give additional information on family background, as well as previous ECEC attendance of the child. For this report, we included parents' occupation and migration background, the type of ECEC (i.e., *crèche*, *précoce,* Cycle 1) attended by their child, possible *allongement de cycle* in Cycle 1, as well as the language(s) spoken in *crèche*. From 2018 on, information on intensity and duration of crèche attendance was also included in the parent questionnaire.

In 2022, questions on children's everyday language use at home, with friends and in media were added to the parent questionnaires.

4.3 ANALYSIS STRATEGY

This report aims to identify which children attended which types of ECEC and which children seem to benefit from ECEC regarding

their learning performance at the beginning of Cycle 2. The report is doing so by applying **multivariate analyses** that consider various interrelated variables for ECEC and for learning performance. The advantage of multivariate over bivariate analysis is that it allows to isolate different influencing variables from each other. We can thus draw conclusions on what the association between ECEC attendance and performance is, even if we consider that children live in different socioeconomic home situations (which, in turn, are known to be strongly related to performance).

For research question 1 **(Who attends which type of ECEC in Luxembourg?)**, we apply multinomial logistic regressions for the attendance in different types of ECEC and for the attendance in *crèches* with specific languages. In both estimations, we control for the child's socioeconomic, migration and home language background, as well as the child's gender. As between 2015 and 2021, due to the ECEC reform in 2017 ("*éducation plurilingue*"), the availability of different types of ECEC or languages in *crèches* might have changed, we also account for possible trend effects by integrating time dummies. In order to analyze possible different effects of socioeconomic status for each home language group, we integrate interaction effects in the estimations on ECEC duration and intensity (from 2019 to 2021). The results of the estimations are reported as marginal effects and visualized in figures.

For research question 2 **(How are ECEC attendance and family background associated with learning performance in Cycle 2?)**, we apply multivariate regression analyses and estimate the effect of ECEC and different background variables on Luxembourgish listening comprehension, early literacy, and mathematics performances. In particular, the predictors in our analyses are attendance of different types of ECEC, attendance of Cycle 1 in Luxembourg, socioeconomic and migration background of the family, home language, age, and gender of the child as well as *allongement de cycle* and year of data collection. ECEC effects are further examined by integrating *crèche* languages as predictors for learning performance. In order to analyze potential different effects of ECEC intensity and duration on performance, depending on the home language group, we estimate interaction effects on behalf of data from 2019 to 2021 that includes information on ECEC duration and intensity. In order to analyze possibly different effects of ECEC intensity and duration on performance, depending on the home language group, we estimate interaction effects on behalf of data from exclusively 2019 to 2021 that includes information on ECEC duration and intensity. Additionally, we rerun the estimations of the effect of ECEC type for different subgroups (high and low socioeconomic status, migration background and home language).

The results of the estimations on performance are reported as marginal effects (visualized in plots) and standardized coefficients with a mean of zero and a standard deviation of one. The standardized coefficients allow straight-forward comparison of the effect sizes of

different variables which we visualize in a tile diagram (Figures 26 - 28).

For research question 3 **(Is the pattern of differences between children of different home language groups the same in Luxembourgish and German listening comprehension?)**, we compare the differences between the Luxembourgish and German listening scores of students across language groups – both, from socioeconomically advantaged and dis-advantaged families – and report the results of a Bonferroni multiple-comparison test.

5. RESULTS

Chapter 5 presents the results of the estimations on the probability to attend a certain ECEC institution and the estimation on the association between ECEC and learning performances, as well as additional analyses on the Luxembourgish-German transfer. While key results are illustrated by figures, more detailed results can be found in tables in the appendix (see p. v).

5.1 ATTENDANCE IN ECEC IN LUXEMBOURG

5.1.1 TYPE OF ECEC

In the most recent data collection in 2021, 53% of all parents reported that their first graders had attended *crèche* as well as *précoce* in the years before (i.e., at least 3 years before 2021). 29% only had attended *crèche* and 17% only had attended *précoce*. Only a very small proportion of under 1% attended neither ECEC type (see Figure 5). These numbers show the high attendance in ECEC in Luxembourg.

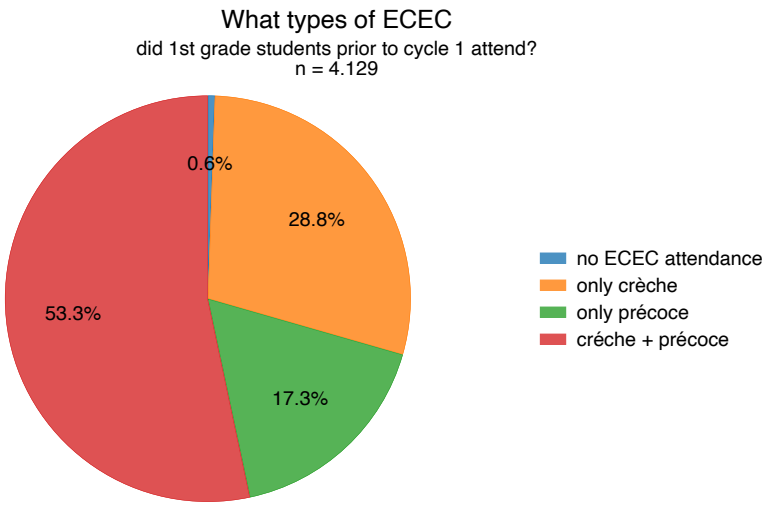


Figure 5. Attendance in ECEC by type (sample of Luxembourg's first graders in 2021)

WHAT FAMILIES CHOOSE WHAT TYPE OF ECEC?

Overall, family characteristics (e.g., socioeconomic status, migration background and home language group) are associated with the attended combination of types of ECEC.

With increasing **socioeconomic status,** the probability that children attended both *crèche* and *précoce* increases and the probability that families chose exclusively *précoce* as type of ECEC decreases.

Native and second generation families showed similar choices regarding ECEC type. Families that recently **migrated** to Luxembourg (first generation) were 19% more likely to send their children only to *crèche* and less likely to send their children to *précoce* (see Figure 6). An explanation for this difference might be the greater offer of languages and flexible hours that *crèches* provide in comparison to *précoce*.

French speaking children more often attended both *crèche* and *précoce* compared to the Luxembourgish* speaking children (11% greater likelihood). Portuguese speaking families showed

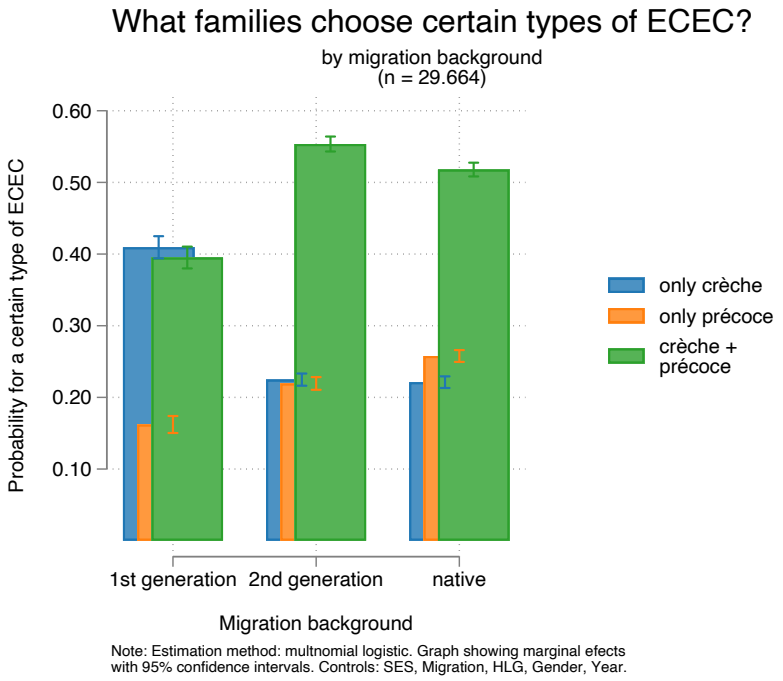


Figure 6. Probability of families choosing a particular combination of ECEC types by migration background (sample of Luxembourg's first graders in 2015-2021)

similar tendencies than French speaking families (for full estimation results including other **home language groups**, see Table 1 in the appendix).

5.1.2 DURATION AND INTENSITY

Data from 2021 shows that if first graders had previously attended *crèche*, they had attended for an average of **3 years and an intensity of 31 to 40 hours weekly** (see Figure 7 and Figure 8). These numbers show that attendance in ECEC in Luxembourg is high and starts early.

In the next paragraphs, we look at the duration and intensity of attendance, as differentiated by family background variables.

DURATION BY FAMILY BACKGROUND

The duration of *crèche* attendance, that is the **number of years** attended, is linked to the family's socioeconomic status, migration background and home language (see Table 2 in the appendix for detailed numbers). When **interactions** between socioeconomic status and home language are controlled for, we find that first generation children attended *crèche* for fewer years than natives, as they might have only entered the country later in life. Luxembourgish* speaking children, in general, do not differ in their duration of *crèche* attendance to other language groups, except in regard to Portuguese speaking children who attended *crèche* for more years. This difference is especially pronounced for families with a low socioeconomic status. This can be seen in Figure 9, where we depict only the three most common home language groups. The result might reflect social or work conditions or cultural habits of families with different socioeconomic and language backgrounds.

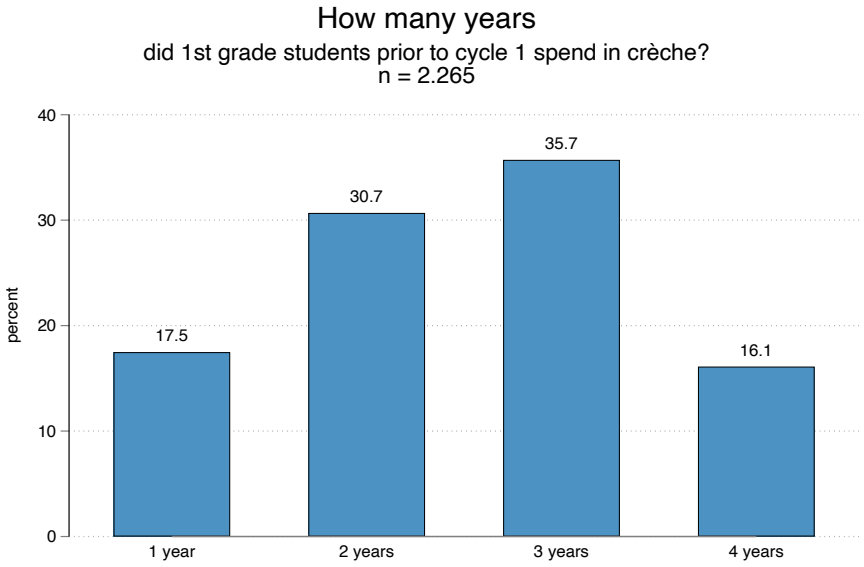


Figure 7. Duration of *crèche* attendance (sample of Luxembourg's first graders in 2019-2021)

INTENSITY BY FAMILY BACKGROUND

The intensity of attendance, that is, **average hours per week**, is linked to socioeconomic status, migration background and home language group. Among children that attended *crèche*, those children with a migration background (first or second generation) spent more hours per week in *crèche* than children whose parents were both born in Luxembourg. Here, native families might have a larger family network to provide childcare.

We find that socio-economic status interacts with home language in regard to intensity of ECEC attendance (see Figure 10). While Luxembourgish* speaking children from high socioeconomic families attended *crèche* for fewer hours, Luxembourgish* speaking families with lower socio-economic status tended to rely on *crèches* for more hours per week. This effect is reversed for Portuguese and French speaking families: here, higher socioeconomic status is associated with more hours in a *crèche* per week. This **interaction** is not significant for all other home language groups (not illustrated in Figure 10).

This pattern may reflect differences in the parents' social and work conditions.

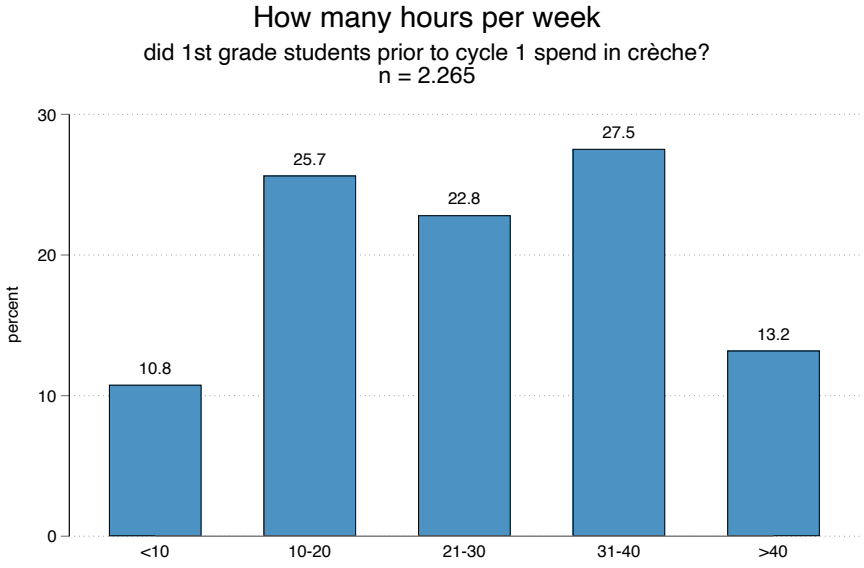


Figure 8. Intensity of *crèche* attendance (sample of Luxembourg's first graders in 2019-2021)

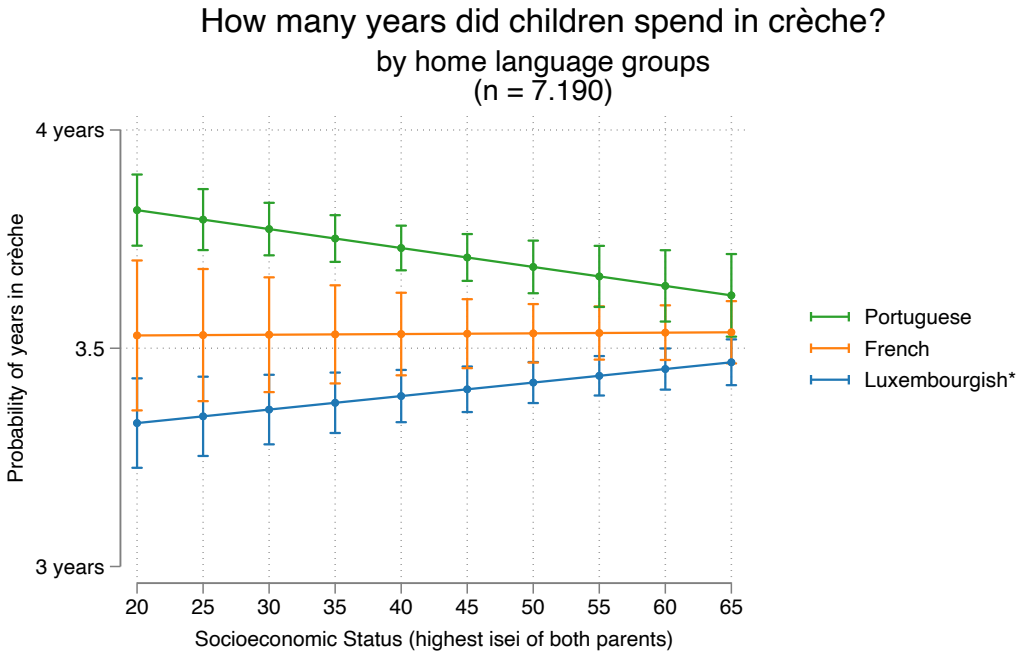


Figure 9. Predicted duration of ECEC attendance in Luxembourg by socioeconomic status and home language group (sample of Luxembourg's first graders in 2019-2021)

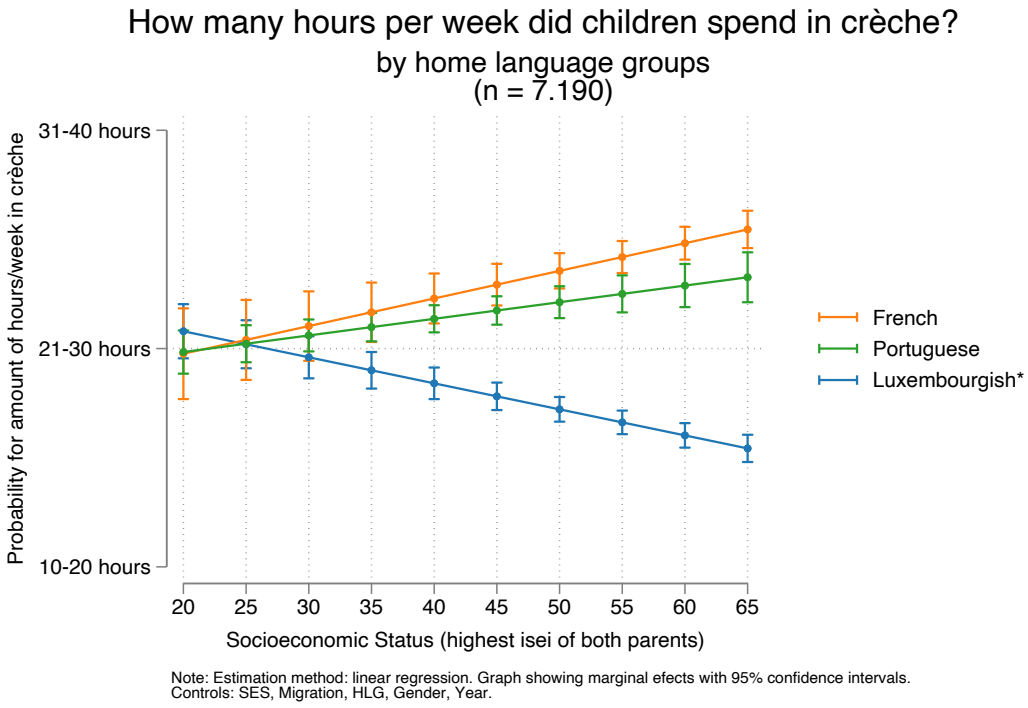


Figure 10. Predicted intensity of ECEC attendance in Luxembourg by socioeconomic status and home language group (sample of Luxembourg's first graders in 2019-2021)

5.1.3 CRÈCHE LANGUAGES

As assessed in 2021, most parents of first graders reported that *crèches* used Luxembourgish*[7] in combination with French to communicate with the children when attending ECEC in the years before. *Crèches* that only used Luxembourgish* were reported nearly as often (31,8%). Only 12,5% of parents reported that only French was spoken in *crèche*. A similar fraction of parents reported other language combinations (see Figure 11). Overall, **Luxembourgish** appears to play a substantial role in ECEC for the majority of children.

CRÈCHE LANGUAGE BY FAMILY BACKGROUND

The choice of *crèche* language is linked to **family background** characteristics (see Table 3 in the appendix for detailed numbers). For example, with increasing socioeconomic status, parents were more likely to send their children to *crèches* that offered French or English as languages. Irrespectively from a family's socioeconomic status, native families more often chose Luxembourgish* or bilingual Luxembourgish*/French *crèches* over other *crèche* languages in comparison to families with a migration background. First generation families more often chose *crèches* that offered Portuguese or English than native families.

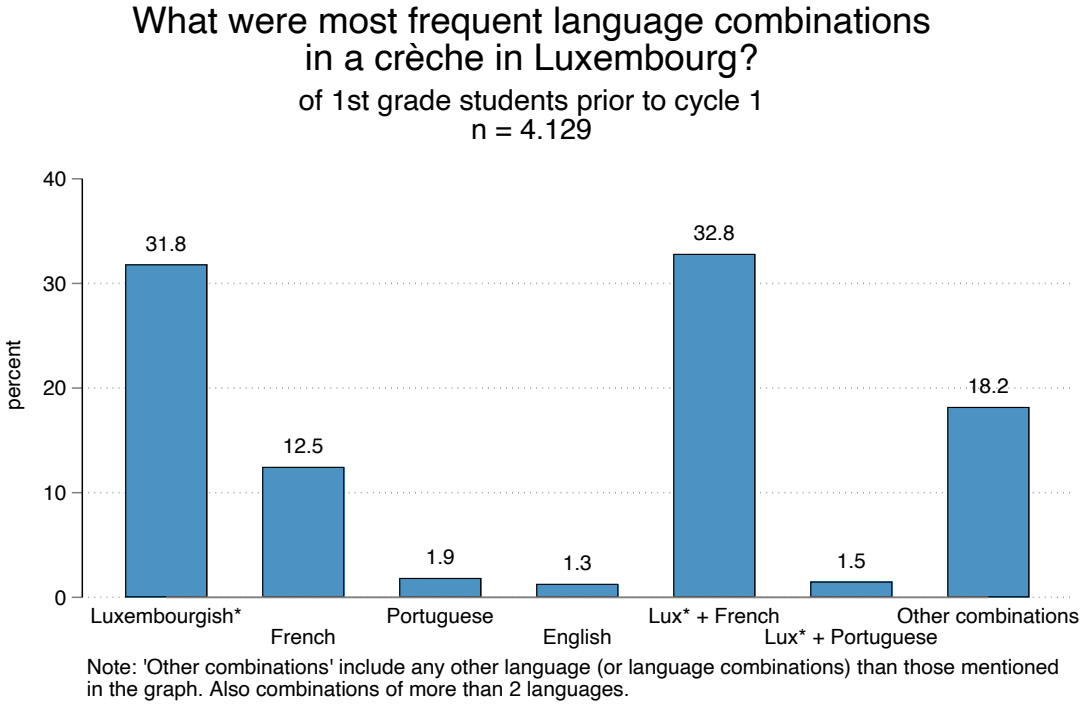


Figure 11. Most common language combinations spoken in *crèches* (sample of Luxembourg's first graders in 2021)

[7] As with the home language group, we included the small number of German speaking *crèches* with the Luxembourgish speaking *crèches*.

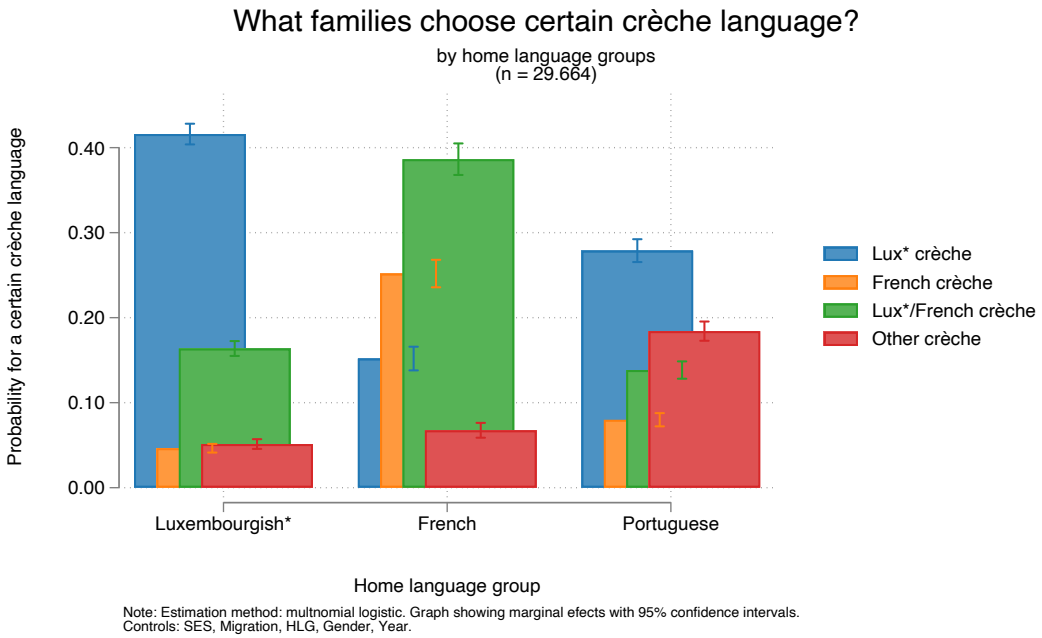


Figure 12. Probability of families to choose *crèches* with specific languages by home language (sample of Luxembourg's first graders in 2015-2021)

In general, after accounting for socioeconomic status and migration background, parents more often chose *crèches* with languages that were similar to or identical with their own **home languages** in comparison to children that do not speak one of the most common home languages ("other" home language group): Luxembourgish* speaking families were more likely to report Luxembourgish* monolingual or bilingual crèches, while French speaking families more often reported bilingual Luxembourgish*/ French or French as *crèche* language (see Figure 12). Portuguese speaking families most often reported Luxembourgish* as *crèche* language followed by other languages, such as Portuguese. Luxembourgish*/French speaking families show the same pattern as the French speaking families. Luxembourgish*/ Portuguese speaking families more often reported Luxembourgish*, Portuguese or Luxembourgish*/Portuguese as *crèche* languages.

The results underline how **Luxembourgish** (monolingual or in combination) appears to be the most dominant language reported in ECEC in Luxembourg so far. This could either reflect a conscious decision of many parents to expose their children in early years to the integration and first instruction language Luxembourgish. Nevertheless, it might also reflect the available structures of many ECEC services as Luxembourgish public *crèches* might be more affordable and locally available than private services with more diverse language offers. It is, however, important, to note that the ECEC data in this report go back to the years of 2009 to 2018. Later language policy developments cannot be portrayed here.

5.1.4 TRENDS FROM 2015 TO 2022

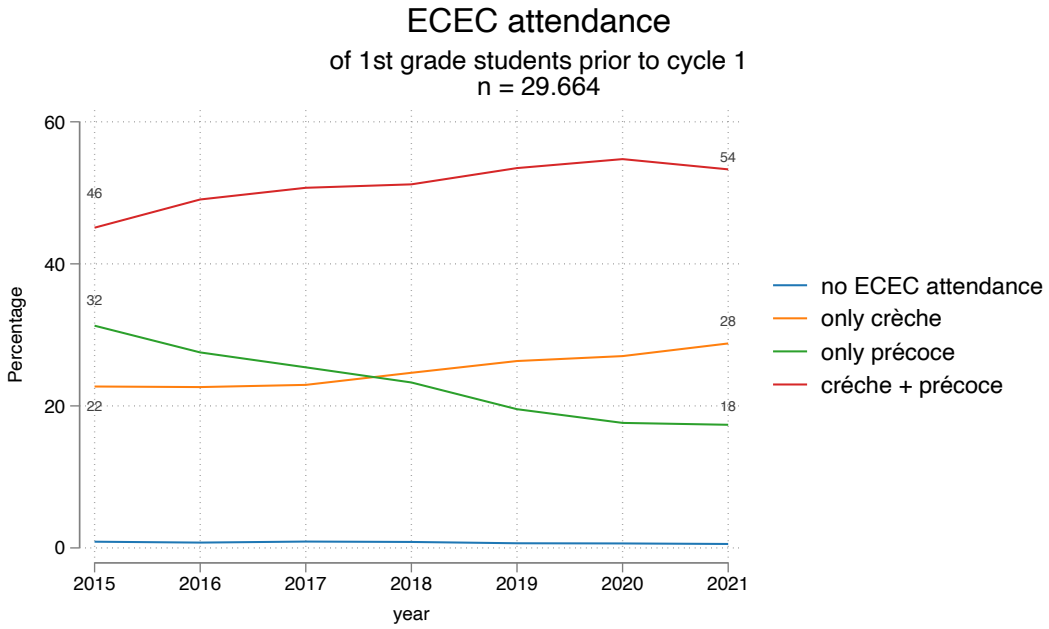


Figure 13. Trend of ECEC attendance by type (sample of Luxembourg's first graders in 2015-2021)

ECEC TYPES

Looking at the development of attendance in different **types of ECEC** in the years between 2015 and 2021, we see that the tendency of first graders to only go to *crèche* or both *crèche* and *précoce* increased. The number of children that only attended *précoce* decreased in recent years (see Figure 13).

INTENSITY AND DURATION OF CRÈCHE ATTENDANCE

Looking at the **intensity** of *crèche* attendance of first graders from 2019 to 2021, no significant changes over the three years can be observed, indicating a stability in demand for childcare hours (see Figure 14). The ÉpStan results of the next years might show whether an increased demand for hours in *crèche* can be found after the implementation of 20 free hours of childcare with the CSA reform in 2017 – impacting first graders of 2020, 2021 and the following years.

The **durations** of crèche attendances over the years from 2019 to 2021 remain similarly stable.

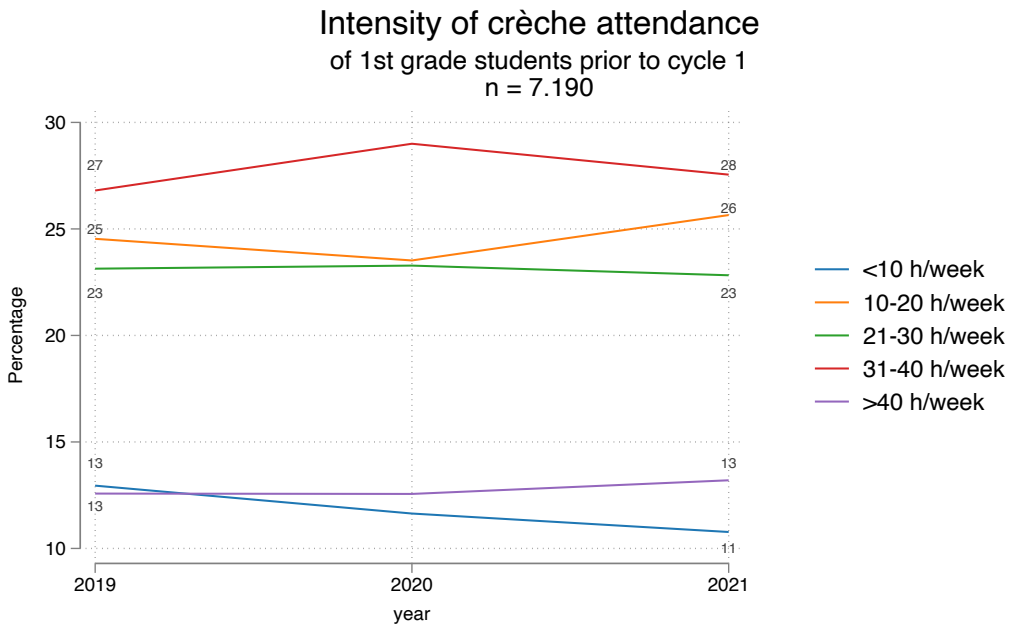


Figure 14. Trend of attendance intensity in *crèches* (sample of Luxembourg's first graders in 2019-2021)

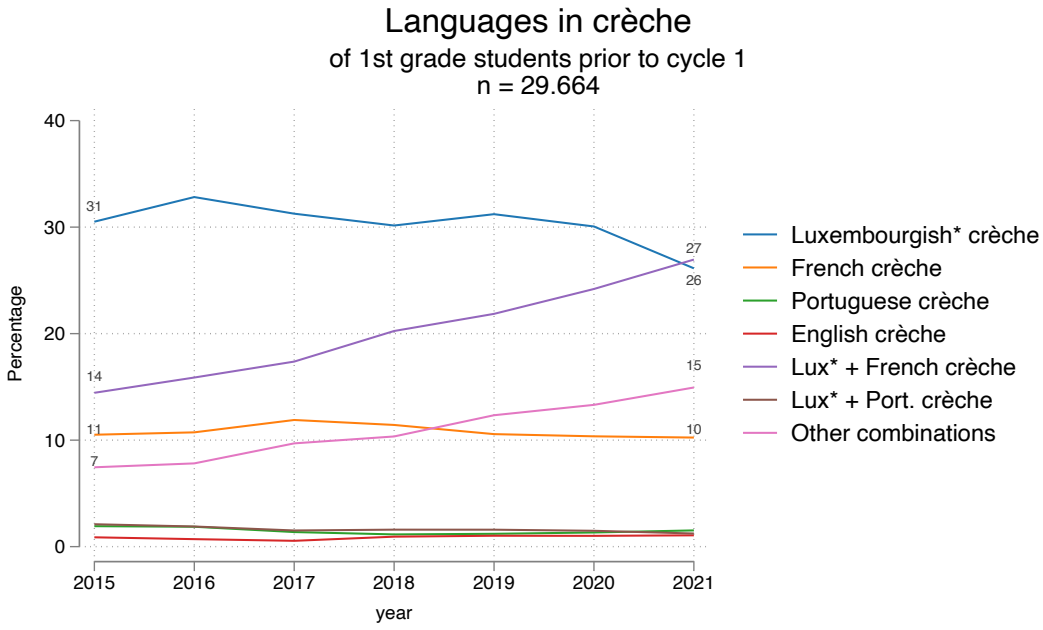


Figure 15. Trend of languages spoken in *crèches* (sample of Luxembourg's first graders in 2015-2021)

LANGUAGES IN CRÈCHE

Looking at the spoken **languages in *crèches***, we see that between 2015 and 2021, a decreasing number of first graders had previously attended *crèches* in which only Luxembourgish* was spoken, while a rising number of parents reported a bilingual combination of Luxembourgish* and French or other plurilingual combinations of languages (see Figure 15). The portrayed time span here mostly encompasses years before the ECEC reform of 2017 ("*éducation plurilingue*"), while the last two survey years (2020 and 2021) also include children that attended *crèche* during the implementation of the reform. This indicates that the visible increase of *crèches* with the bilingual combination of French and Luxembourgish* will probably be further accentuated in future years.

5.2 ASSOCIATIONS WITH LEARNING PERFORMANCE IN CYCLE 2.1

The next section will present the results of our main analysis. In a first step, we present the associations between learning performance and ECEC attendance as well as ECEC characteristics. In a second step, we show how learning performance is connected to family background variables, other control variables, and their interaction with ECEC attendance. Finally, we compare the strengths of the associations of the individual predictors.

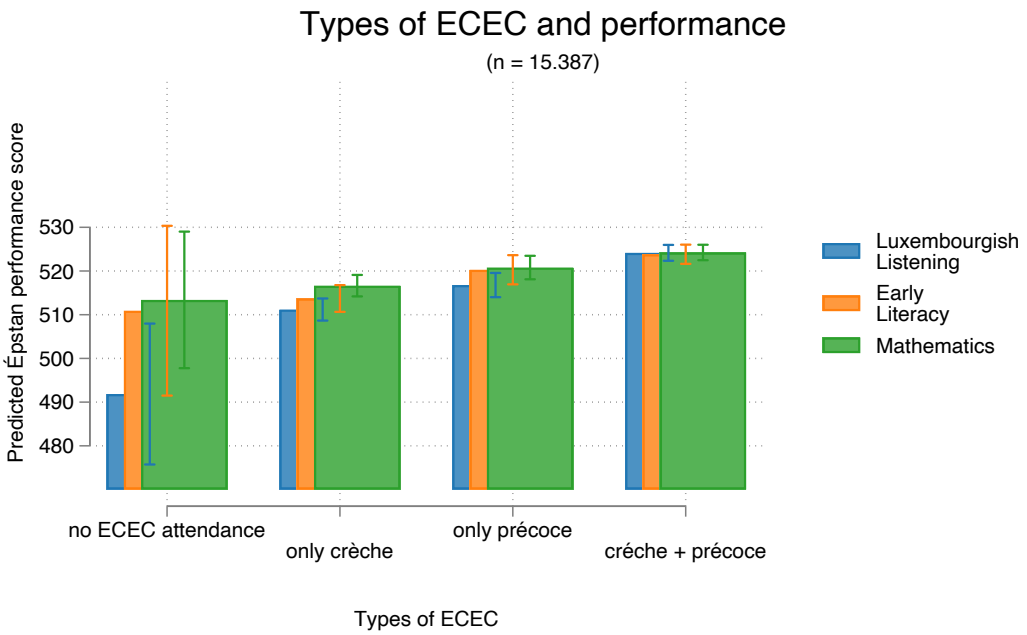
5.2.1 ECEC AND LEARNING PERFORMANCE

We find a significant positive association between ECEC attendance (for *crèche*, *précoce*, and Cycle 1) and learning performance in Cycle 2.1 (see Figure 16). In the following parts, we focus on each of the ECEC types and learning performance in the three learning domains (Luxembourgish listening com-prehension, early literacy, and mathematics).

Holding family background and other controls (i.e., age, gender, *allongement de cycle*, year of data collection) constant, we observe that **attending both *crèche* and *précoce*** is associated with a slightly higher performance than attending either type alone. For example, compared to attending only *crèche*, attendance of both types is associated with a performance increase of 13 points in Luxembourgish listening comprehension, 10 points in early literacy and 8 points in mathematics (see Table 4).

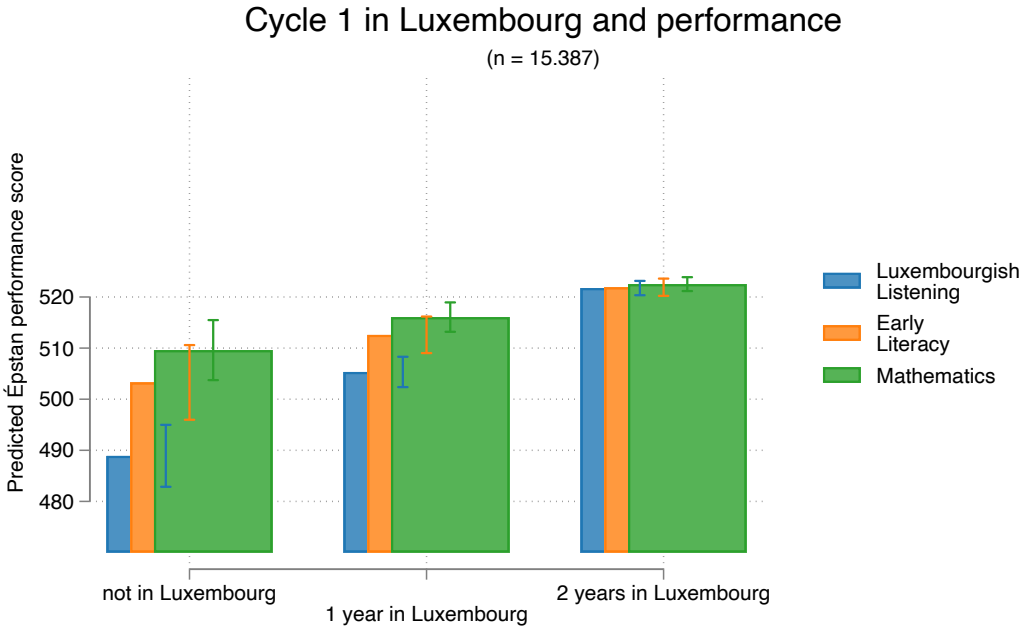
Attending only *précoce* instead of only *crèche* is associated with higher performances in all three learning domains: Scores are respectively 6, 7 and 4 points higher for Luxembourgish listening comprehension, early literacy, and mathematics.

Comparing children who attended **neither ECEC type** to those who attended only *crèche* (see Figure 16), attending only a *crèche* is associated with significantly higher scores in Luxembourgish listening comprehension. ÉpStan scores are 19 points higher for first graders who attended *crèche* than for first graders who attended neither *crèche* nor *précoce*.



Note:
Estimation method: multivariate regression. Graph showing marginal efects with 95% confidence intervals.
Controls: ECEC, Cycle 1, SES, Migration, HLG, Age, Gender, Allongement, Year.

Figure 16. Predicted performance by ECEC type attended (sample of Luxembourg's first graders in 2015-2021)



Note:
Estimation method: multivariate regression. Graph showing marginal efects with 95% confidence intervals.
Controls: ECEC, Cycle 1, SES, Migration, HLG, Age, Gender, Allongement, Year.

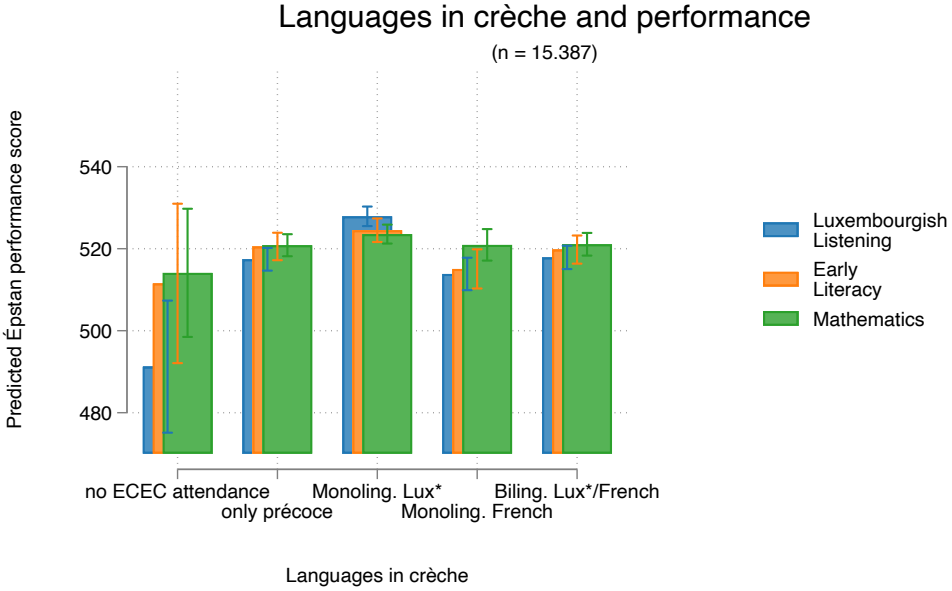
Figure 17. Predicted performance by Cycle 1 attendance (sample of Luxembourg's first graders in 2015-2021)

Due to the low number of children attending neither ECEC type (less than 1% of the whole sample), we find large confidence intervals (see Glossary) of the predicted ÉpStan scores for this group of children and thus need to be careful when drawing comparisons to other groups.

Attendance in Cycle 1 is positively associated with first graders' performance in all three learning domains. Every additional year in Cycle 1 increases the Luxembourgish listening comprehension score by 16 points, early literacy by almost 9 points, and mathematics by 8 points (see Table 4). As Cycle 1 is compulsory for all four and five-year olds, children who attended Cycle 1 for less than two years have probably only recently entered the country. Figure 17 indicates that each additional year helps to improve and reduce the differences between the performances in the three learning domains. This effect is most pronounced for Luxembourgish listening comprehension.

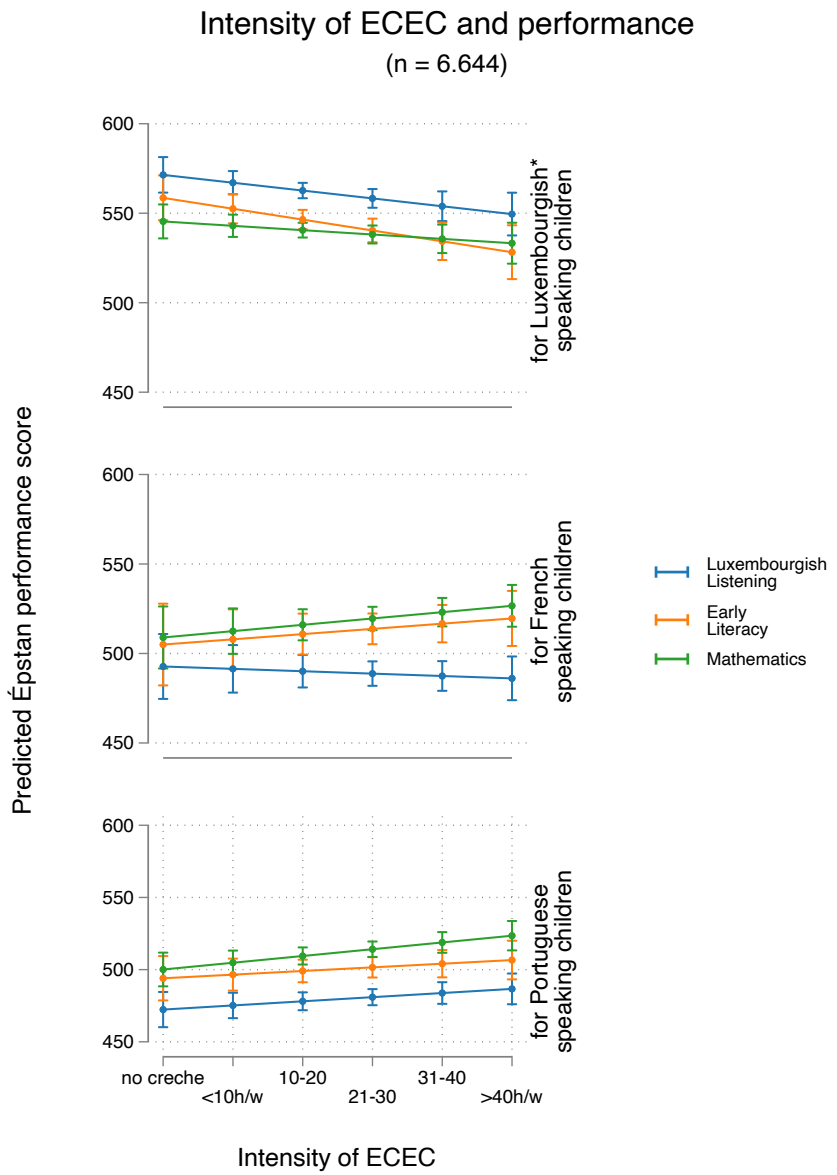
LANGUAGE OF ECEC AND LEARNING PERFORMANCE

Figure 18 depicts the predicted learning performance based on **language combinations** spoken in a *crèche*. Attending a *crèche,* in which Luxembourgish* is spoken, is significantly associated with higher scores in the language domains in comparison to nearly all other language combinations (see also Table 5). The positive association is most pronounced for Luxembourgish listening comprehension (test score differences of 10 – 30 points). Compared to children who attended *crèches* in which only Luxembourgish was spoken, Luxembourgish listening scores of children who attended monolingual French *crèches* were 14 points lower. For children who



Note:
Estimation method: multivariate regression. Graph showing marginal efects with 95% confidence intervals.
Controls: ECEC, Cycle 1, Crèche languages, SES, Migration, HLG, Age, Gender, Allongement, Year.

Figure 18. Predicted performance by *crèche* language (sample of Luxembourg's first graders in 2015-2021)



Note: Estimation method: multivariate regression. Graph showing marginal efects with 95% confidence intervals. Controls: ECEC, Cycle 1, Duration, Intensity, SES, Migration, HLG, Age, Gender, Allongement, Year.

Figure 19. Predicted performance by home language group and *crèche* intensity (sample of Luxembourg's first graders in 2015-2021)

First analyses regarding a potential effect of speaking the same language at home and in *crèche* on learning performance showed no significant benefit of such an alignment. However, as discussed in the limitations (see p. 57), the information on *crèche* language is limited and thus, should be subject of further research with more detailed data.

DURATION AND INTENSITY OF ECEC AND LEARNING PERFORMANCE

For these analyses, only data collected from first graders from 2019 to 2021 could be included as the information on duration and intensity of *crèche* attendance was only collected from 2019 on. The results thus only apply for these three cohorts and should be expanded in future years.

attended Luxembourgish and French bilingual *crèches*, the Luxembourgish listening scores were 10 points lower. The differences in early literacy were not as pronounced (test score differences of 11-9 points), while there were no significant differences in mathematics performance between the most prominent *crèche* language combinations.

Children who attended a *crèche* for more months (that is, a higher **duration**) do not significantly differ in their learning performance from those who attended a *crèche* for fewer months. However, the **intensity** of attendance plays a significant role for performance: The average number of hours spent in *crèche* per week has a different effect on learning performance for Luxem-bourgish* speaking

children than for French or for Portuguese speaking children (significant interaction effect, see Table 6). While Portuguese speaking children show higher performance in all three learning domains with more hours in *crèches*, this is not the case for Luxembourgish* speaking children. As Luxembourgish speaking children on average show generally higher learning performances in both language domains than other home language groups, the performance gap between home language groups is reduced with higher levels of *crèche* intensity (see Figure 19). This suggests that children who only speak Portuguese at home benefit stronger from more hours of crèche attendance in comparison to Luxembourgish* speaking children who might have more exposure to the Luxembourgish language and one-to-one communication and interaction with Luxembourgish speakers at home if not attending a crèche. Meanwhile, **mathematics** performance is only weakly connected to the ECEC intensity. Among French speaking children, a mixed pattern emerges: A higher intensity of crèche attendance is shown to be beneficial only for early literacy performance while this was not observed for the other two learning domains.

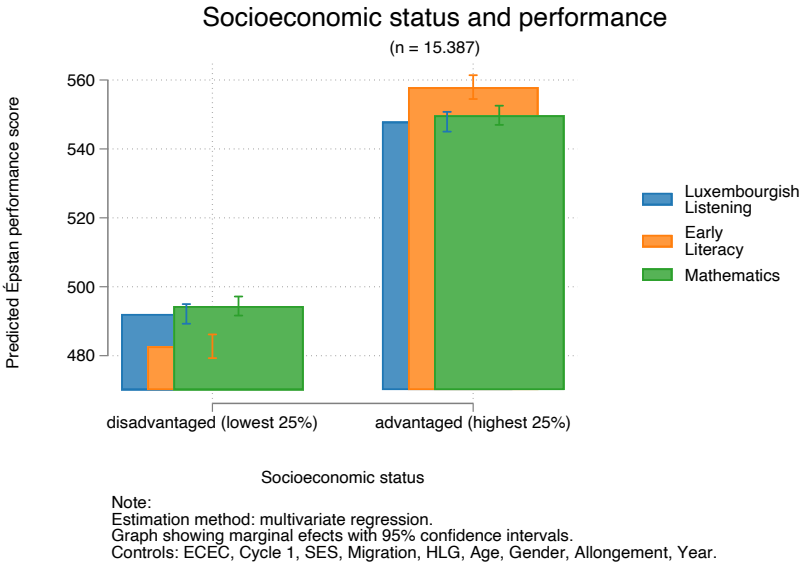
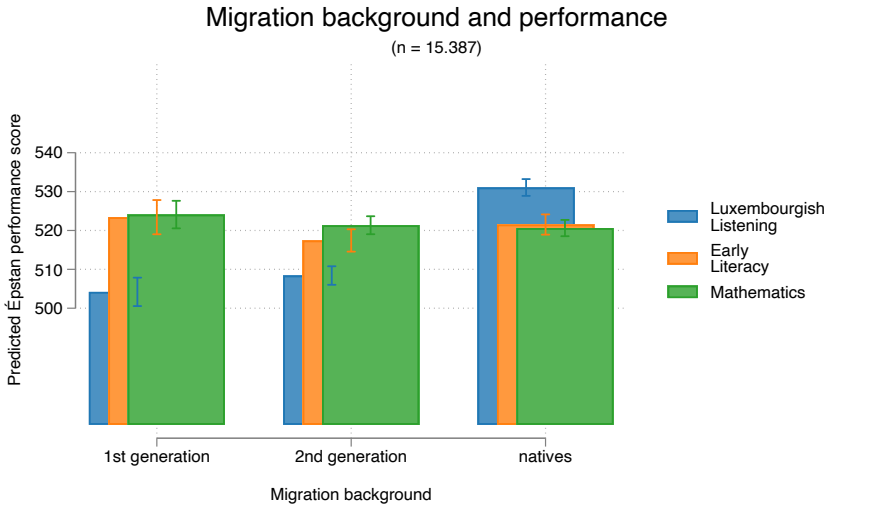


Figure 20. Predicted performance by socioeconomic status (lowest 25% vs. highest 25%) (sample of Luxembourg's first graders in 2015-2021)

5.2.2 FAMILY BACKGROUND, OTHER CONTROLS AND LEARNING PERFORMANCE

We observe significant associations between learning performance and all background variables that we controlled for. These were socioeconomic status, migration background, home language group, gender, age and *allongement de cycle* (see Table 4).

Holding all other variables constant, higher **socioeconomic status** goes hand in hand with higher performances in all three learning domains (see Figure 20). For example, in Luxembourgish listening comprehension, children from families with a high socioeconomic status (highest 25%) reach performance scores that are more than 50 points higher than children from families with a low socioeconomic status (lowest 25%). This gap is especially pronounced for the learning



Note:
Estimation method: multivariate regression. Graph showing marginal efects with 95% confidence intervals.
Controls: ECEC, Cycle 1, SES, Migration, HLG, Age, Gender, Allongement, Year.

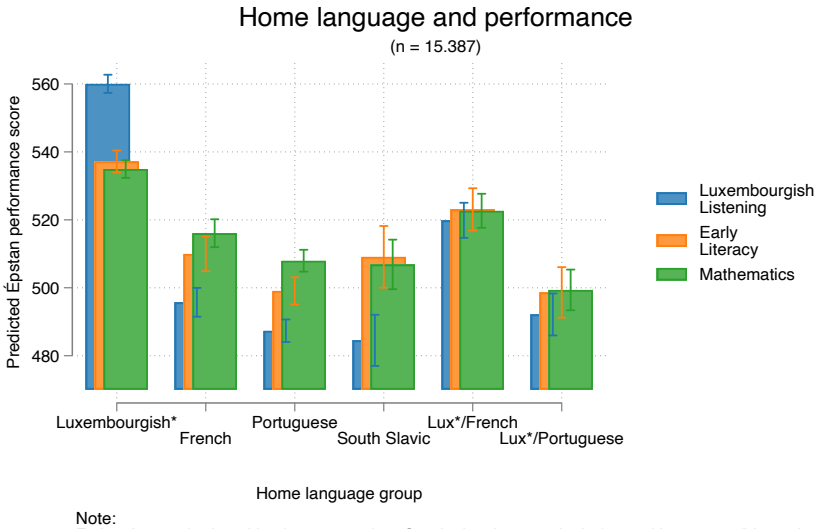
Figure 21. Predicted performance by migration background (sample of Luxembourg's first graders in 2015-2021)

Migration background is significantly connected to Luxembourgish listening comprehension only. Here, children with a migration background of first or second generation both obtain lower scores than native children (23 and 27 points respectively, see Figure 21 and Table 4).

Regarding the **home language groups**, children who speak Luxembourgish* at home have a significant advantage in all learning domains in comparison to all other home language groups. This advantage is greatest in Luxembourgish listening comprehension and most distinct in comparison to children who speak either a South Slavic language or Portuguese with both parents at home (76 and 73 points respectively, see Figure 22).

While similar results have already been reported in the national education report (e.g. Hoffmann et al., 2018), the effects of other potential influencing variables (e.g., *allongement de cycle*, age) have not always been controlled for. Interestingly, here we find similar associations, even after controlling for other background variables.

Regarding other background variables, girls show a better performance in the learning domains related to language (12-15 points), while boys perform better in mathematics (9 points). While these **gender** effects are often found in educational research (see Hadjar & domain of early literacy (difference of over 70 points).



Note:
Estimation method: multivariate regression. Graph showing marginal efects with 95% confidence intervals.
Controls: ECEC, Cycle 1, SES, Migration, HLG, Age, Gender, Allongement, Year.

Figure 22. Predicted performance by home language group (data of Luxembourg's first graders in 2015-2021)

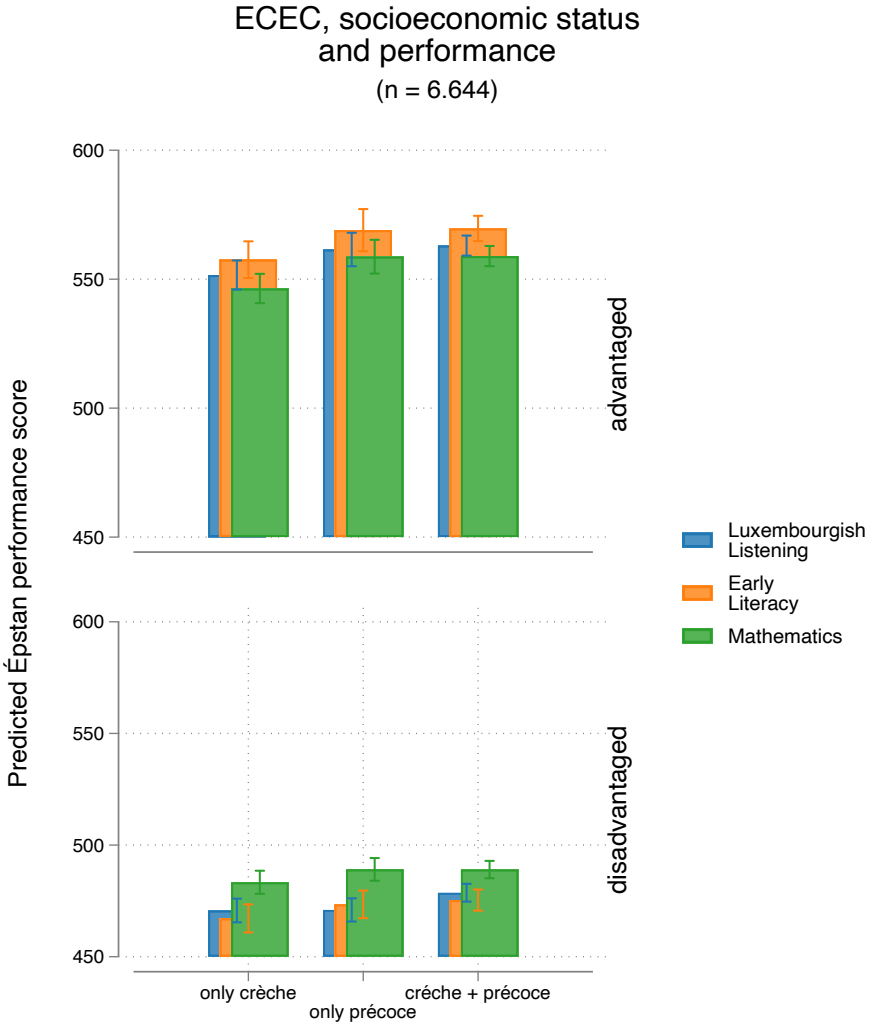
Buchmann, 2016), it is noteworthy to see that they can be found in this early stage of formal schooling (see also Lundberg et al., 2012).

As expected from a developmental perspective, **age** also had a significant association with learning performance: older children, in general, performed better than younger children as they had more time to gain learning experience in language and other domains. However, older children with an ***allongement de cycle*** had lower scores in all three domains (57 points in Luxembourgish listening comprehension, 71 points in early literacy and 61 points in mathematics, see Table 5). Although previous performance and general cognitive skills are not statistically held constant here, our results are in line with the meta-meta-analysis (combining many meta-analyses) by Hattie (2010) who also found strong detrimental effects of grade repetition on learning.

5.2.3 EFFECTS IN SUBGROUPS

The associations between ECEC and learning performance might be different across certain subgroups of children which in turn could provide hints that certain types of ECEC are more favorable in terms of learning performance for vulnerable groups. To explore this, we rerun the estimations for the subgroups of 1) high and low socioeconomic status families, 2) families with and without migration background as well as 3) families with different home languages.

Regarding **socioeconomic status,** we find that both groups (high and low socioeconomic status) benefit most from the combination of *crèche* and *précoce* in comparison to only

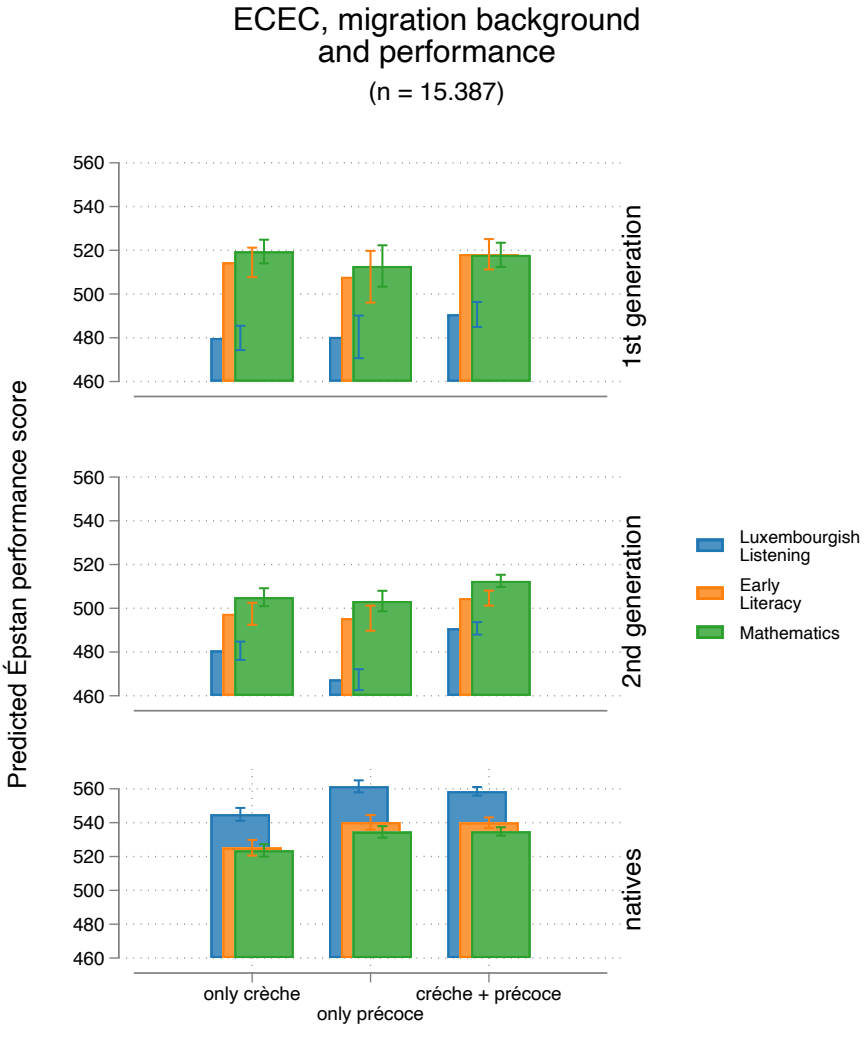


Note:
Estimation method: multivariate regression.
Graph showing marginal efects with 95% confidence intervals.
Controls: ECEC, Cycle 1, SES, Migration, HLG, Age, Gender, Allongement, Year.

Figure 23. Predicted performance by socioeconomic status and ECEC type attended (sample of Luxembourg's first graders in 2015-2021)

crèche (see Figure 23). The performance of children from families with higher socioeconomic status (upper 25%) increases significantly by 11 points in Luxembourgish listening comprehension, 12 points in early literacy and 13 points in mathematics. For children from families with lower socioeconomic status (lower 25%), this increase is 8 points in both language tests, while mathematics performance is not significantly different when children attend both ECEC settings instead of only *crèche*. Attending only *précoce* instead of only crèche significantly benefits children from high socioeconomic families (10-12 points in all learning domains). The results indicate that for children from families with low socioeconomic status, attending both settings of ECEC which probably goes along with a longer continued duration in ECEC, is important to have a positive impact on learning performance (see Table 7 for detailed results).

Regarding **migration background**, native children benefit in all three learning domains when attending only *précoce* or both *crèche* and *précoce* instead of only *crèche*. When attending only *précoce*, their learning performance in Luxembourgish listening comprehension score increases by 17 points, early literacy by 15 points and mathematics by 11 points. When attending both ECEC settings, their scores increase by 14, 15 and 11 points respectively. In comparison, for children who were not born in Luxembourg (first generation), performance scores do not increase when attending only *précoce* instead of only *crèche*. When attending both ECEC settings, their Luxembourgish listening comprehension increases by 11 points. When attending only *précoce* instead of only *crèche*, their Luxembourgish listening comprehension is on average 13 points lower

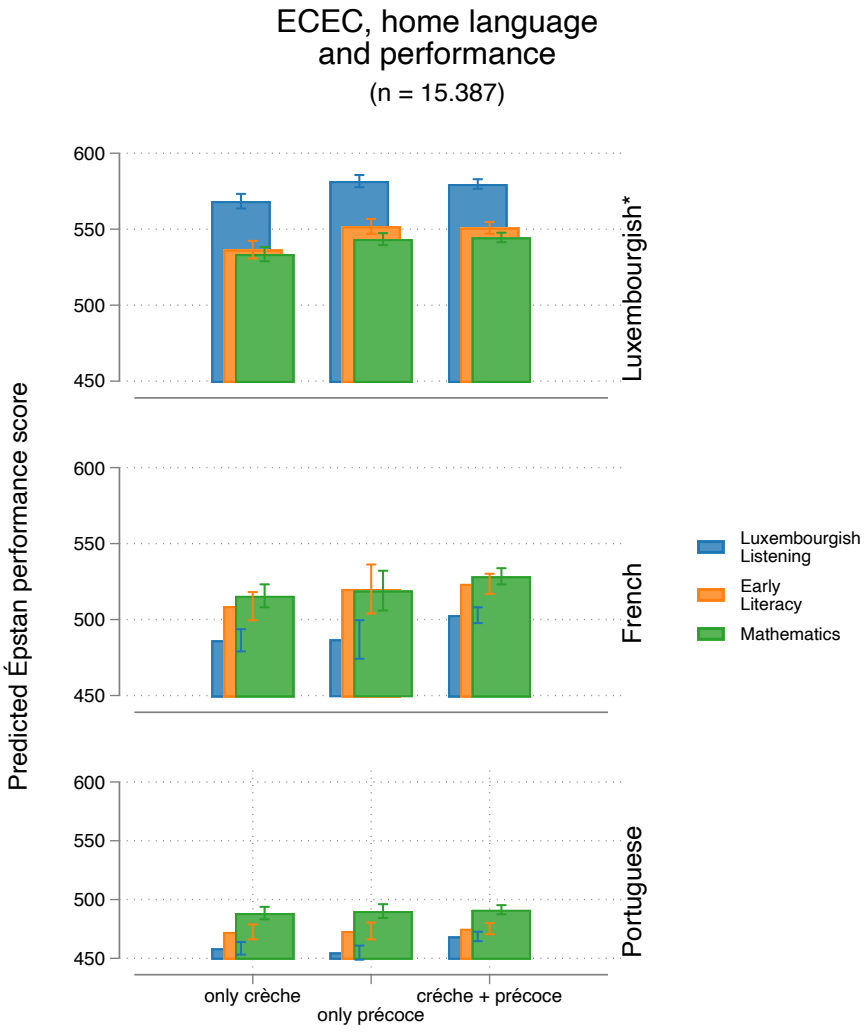


Note:
Estimation method: multivariate regression.
Graph showing marginal efects with 95% confidence intervals.
Controls: ECEC, Cycle 1, SES, Migration, HLG, Age, Gender, Allongement, Year.

Figure 24. Predicted performance by migration background and ECEC type attended (data of Luxembourg's first graders in 2015-2021

than otherwise. Parallel to native children, attending both ECEC settings was beneficial for second generation children in comparison to only *crèche* for all learning domains (increase of 7-10 points). This indicates that higher language input of Luxembourgish promotes higher performances in Luxembourgish listening comprehension (see Figure 24 and Table 8).

When it comes to **home language**, all groups (except South Slavic languages) benefit from attending both ECEC settings instead of only *crèche* (see Table 9 for all home language groups, see Figure 25 for the three most common home language groups). However, Portuguese speaking children only significantly benefit in their Luxembourgish listening comprehension (10 points increase), while the other two groups (Luxembourgish* and French) show better performances in all three learning domains Luxembourgish listening comprehension (11 and 17 points respectively), early literacy (14 and 15 points respectively) and mathematics (11 and 13 points respectively). Attending only *précoce* instead of only *crèche* increases performance in all three domains for Luxembourgish* speaking children (10-15 points). For children who speak a South Slavic language at home, attending only *crèche* instead of neither ECEC type was associated with 83 points higher performance in Luxembourgish listening comprehension.



Note:
Estimation method: multivariate regression.
Graph showing marginal efects with 95% confidence intervals.
Controls: ECEC, Cycle 1, SES, Migration, HLG, Age, Gender, Allongement, Year.

Figure 25. Predicted performance by home language and type of ECEC attended (sample of Luxembourg's first graders in 2015-2021)

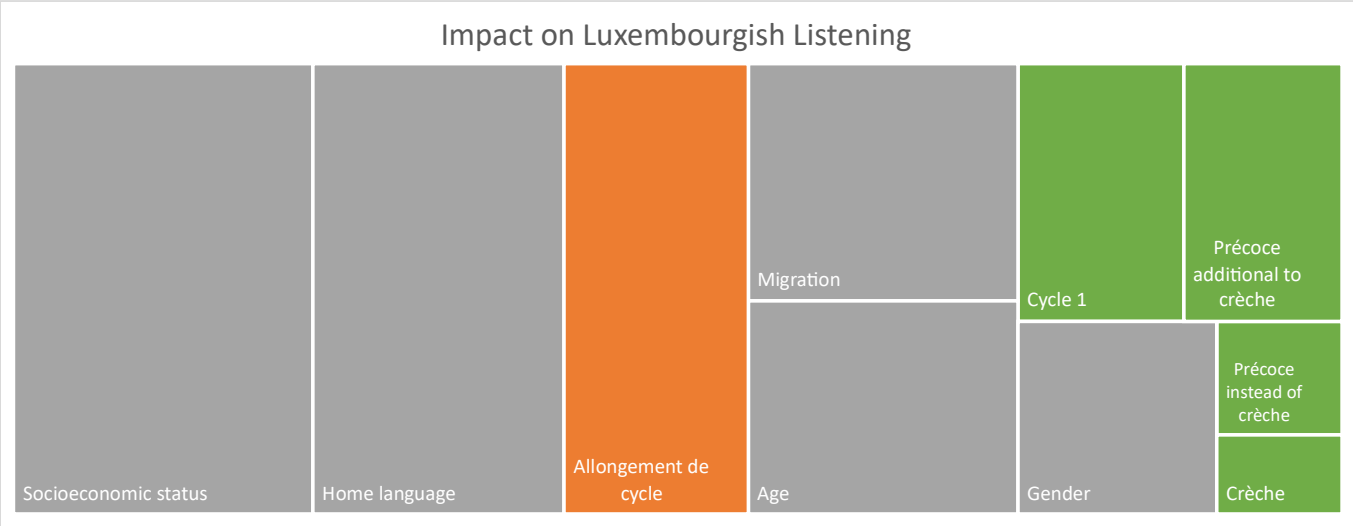


Figure 26. Strength of associations of all variables with Lux. listening (in green: positive associations, in red: negative associations, in grey: parameters that lie outside the influence of school policies)

5.2.4 COMPARISON OF ASSOCIATIONS

In the following part, we compare the strength of the associations of different ECEC characteristics and background variables with learning performance in each of the three learning domains. For this, we refer to standardized regression coefficients (beta coefficient, see Glossary). The higher the absolute value of the beta coefficient, the stronger the association. Exact numbers on the standardized coefficients can be found in Table 10.

Figures 26 to 28 are rough and abstract depictions of how the **strength of associations of different variables** compare (strength of association decreases from left to right). It becomes apparent for all learning domains that family background variables (such as socioeconomic status and home language) and child-related variables (such as age and gender) in grey have the strongest associations with learning performance. Variables that are more easily influenced by policy makers, teachers, and parents, such as attendance in ECEC have a weaker association with learning performance. However, the negative association of *allongement de cycle* and learning performance is relatively strong. When comparing the different learning domains, home language group and migration background have a stronger association with Luxembourgish listening comprehension than with mathematics or early literacy. For mathematics and early literacy, *allongement de cycle* and age have the second largest associations with performance after socioeconomic status (negative for *allongement de cycle*, positive for age).

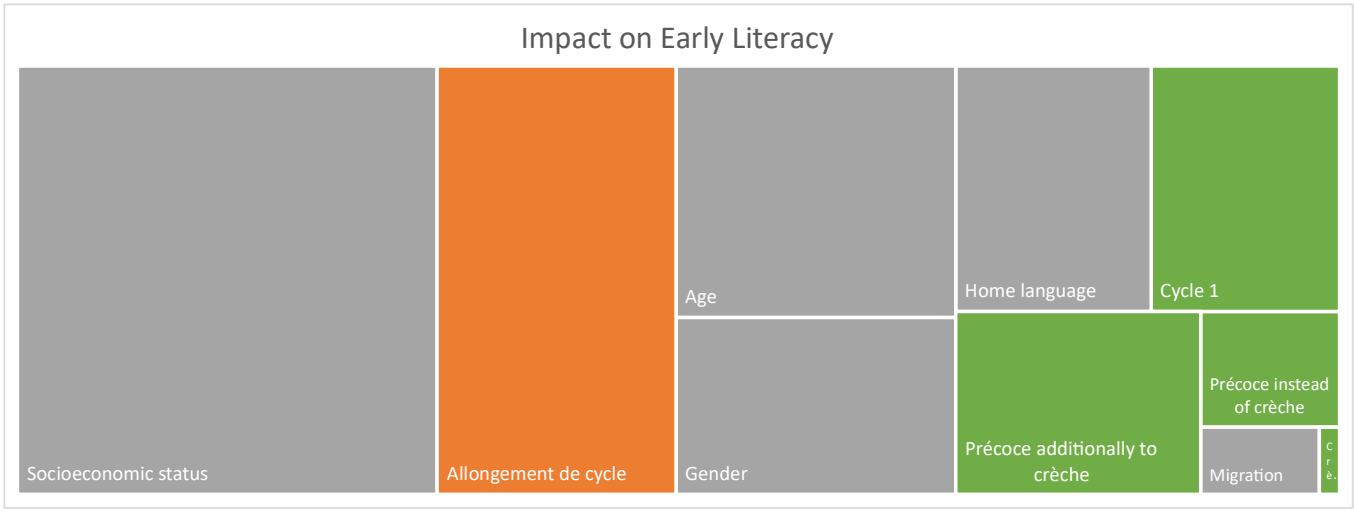


Figure 27. Strength of associations of all variables with Early literacy (in green: positive associations, in red: negative associations, in grey: parameters that lie outside the influence of school policies)

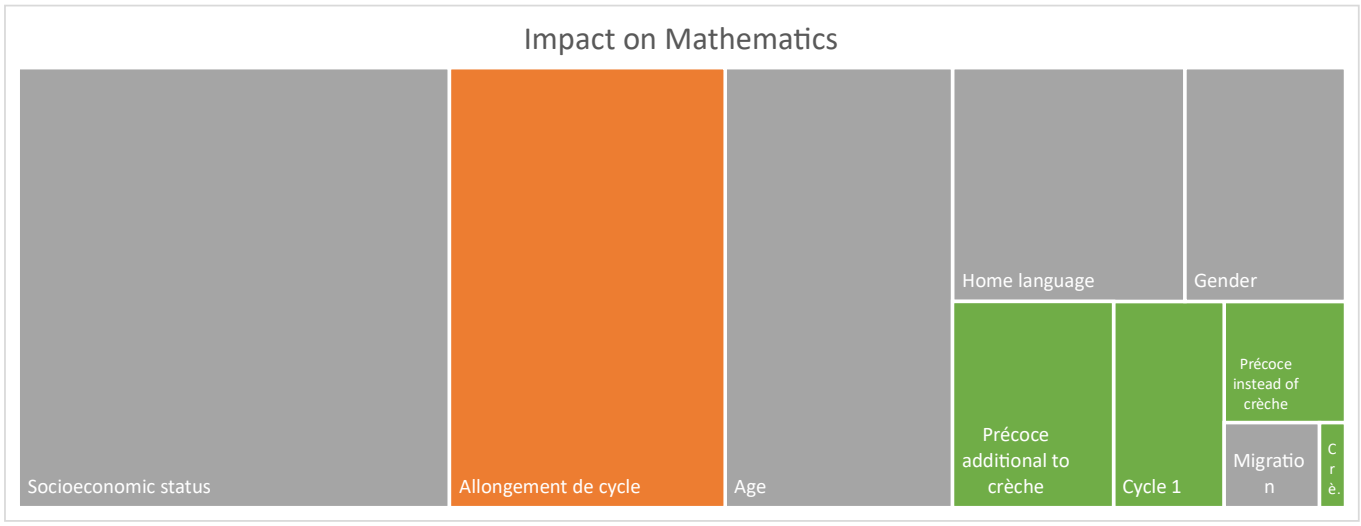


Figure 28. Strength of associations of all variables with Mathematics (in green: positive associations, in red: negative associations, in grey: parameters that lie outside the influence of school policies)

5.3 COMPARING PERFORMANCES IN LUXEMBOURGISH AND GERMAN LISTENING COMPREHENSION

In general, similar to Luxembourgish listening comprehension, **German listening comprehension** differs by socioeconomic status and home language group of the children. Children who speak Luxembourgish* at home, show slightly better performances in German listening comprehension test than in Luxembourgish listening comprehension. This can be explained by the easier units and texts used in the German listening comprehension test. However, this pattern cannot be found among monolingual French and Portuguese speaking children (see Figure 29). Children who speak only French or Portuguese at home obtain lower scores in German listening comprehension than in Luxembourgish listening comprehension (see Table 11 and Table 12). The Bonferroni multiple-comparison test reveals that the score differences between French and Luxem-bourgish* as well as between Portuguese and Luxembourgish* speaking students are significant. Additionally, a higher socioeconomic status does not seem to mitigate this pattern. The results show that, depending on the home language background, the assumed Luxembourgish-German transfer is not applicable for all children.

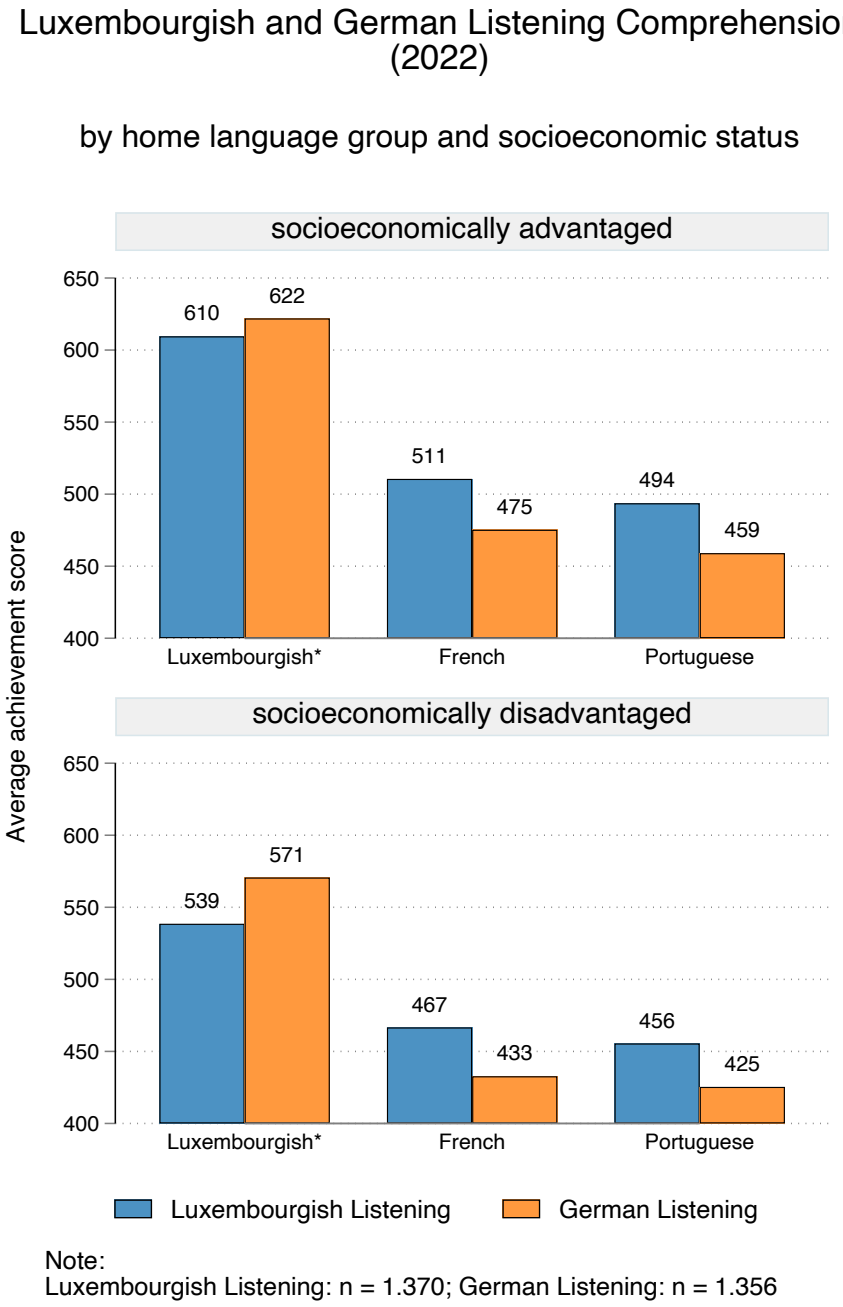


Figure 29. Average performance score in German and Luxembourgish listening comprehension by socioeconomic status and home language group (data of Luxembourg's first graders in 2022)

6. DISCUSSION

6.1 SUMMARY AND INTERPRETATION

The present report points to old and well-known inequalities and achievement gaps in the Luxembourgish school system, highlighting the importance of investigating how these inequalities develop in the early years. As the first report to combine data on ECEC attendance and standardized learning performance (ÉpStan) in Luxembourg, it also yields important insights into the effectiveness of the ECEC system in relation to young children's school and cognitive development. With its new data on children's language exposure in media and the Luxembourgish-German-transfer, more open questions arise for the future.

Below, we discuss the key findings regarding first graders' prior ECEC attendance and its relation to language, literacy, and mathematical learning performance at the beginning of literacy acquisition in the traditional Luxembourgish school system, while also considering the study's limitations, possible recommendations, and outlooks for the future in early education.

POSSIBLE EXPLANATIONS FOR HIGH ATTENDANCE, DURATION, AND INTENSITY IN ECEC

As expected, our results confirmed a **high child attendance** rate in ECEC (*crèche* and/or *précoce*) in Luxembourg. Indeed, only less than 1% attended neither *crèche* nor *précoce*. Although the family background influenced the choice of ECEC type, the majority of children attended both *crèche* and *précoce* (see p. 33). Furthermore, the parent-reported duration and intensity of attendance in early non-formal ECEC (i.e., *crèche*) were moderate to high for most children (i.e., average of 3 years and 31 to 40 hours weekly, see p. 34). This early and high attendance rate may have several possible explanations. Firstly, parents and legal guardians seem to have confidence in ECEC in Luxembourg, in its infrastructures and qualified caregivers, to look after their children safely and carefully in their absence. Secondly, the high duration and intensity of attendance might also be the consequence of financial reasons. On the one hand, with increased costs of living in Luxembourg, both parents might need to work full-time. On the other hand, parents receive substantial **financial support** for participation in non-formal ECEC on a monthly basis. The aforementioned rise from 3 to 20 free (publicly funded) ECEC hours in 2017 led to substantially reduced parental costs and to a small increase of 3 hours in attendance in non-formal ECEC (cf. Bousselin, 2019). This CSA reform turned Luxembourg into a country that has one of the most affordable ECEC systems relative to other OECD countries (OECD, 2022b).

Importantly, **family background** variables had an influence on the ECEC duration and intensity (see p. 33). Interestingly, there was an interplay between different background variables: Luxembourgish* speaking children with a higher socioeconomic status attended non-formal ECEC for fewer hours a week, while Portuguese- and French speaking children with higher socioeconomic status attended non-

formal ECEC for more hours. Differences in intensity might possibly reflect a child's proximate **family environment** (care by other family members such as grandparents) and parents' **different careers and job requirements**. These may increase or decrease the flexibility of working hours, which in turn can affect the time that children attend non-formal ECEC. Furthermore, parents with a higher socioeconomic status who do not speak Luxembourgish at home, might be particularly aware of the importance of early education and exposure to the Luxembourgish language to succeed later in the Luxembourgish school system.

ASSOCIATIONS OF NON-FORMAL ECEC WITH LEARNING PERFORMANCE AND INTERACTIONS WITH FAMILY BACKGROUND

In general, non-formal ECEC (*crèche*) shares a holistic view on child development and education. One of its main pedagogical missions is to promote children's personal initiative, responsibility, and autonomy, to offer a pedagogical framework allowing children to safely explore their environment, and to share learning experiences with others, peers, and educators (MENJE et al., 2021). Based on these guidelines, general language and cognitive development should be intuitively stimulated and fostered on a daily basis in non-formal ECEC settings. Notably, our results showed a relation between *crèche* intensity and learning performances. This relation, however, varies depending on home language background (see p. 44). While Luxembourgish* speaking children showed higher learning performances in all three learning domains when ECEC intensity was low to moderate, **Portuguese speaking children showed higher learning performances with increasing *crèche* intensity**.

Children with a migration background benefited more from the combination of *crèche* and *précoce,* while native children mostly benefited from one year in formal ECEC *(précoce)*. As Luxembourgish is the dominant language in non-formal and formal ECEC, attending both types of **ECEC is especially helpful in promoting Luxembourgish language skills** in children with a migration background.

STRONG ASSOCIATIONS OF FORMAL ECEC WITH LEARNING PERFORMANCE

Formal ECEC attendance (i.e., *précoce* and Cycle 1) was also significantly associated with learning performances. Particularly, the attendance of two years in Cycle 1 in Luxembourg was related to higher learning performances, similar to findings in the international literature (Melhuish et al., 2015). This report does not look into longitudinal ECEC effects on learning outcomes, which will be investigated in future studies with ÉpStan data on grade 3 and 5. For first graders, we found that **the associations between formal ECEC (*précoce* and Cycle 1) and learning performances were stronger than the associations between non-formal ECEC (*crèche*) and learning performances** (see p. 50). This result held for all three learning domains and was especially pronounced for Luxembourgish listening comprehension. Here, it is important to bear in mind that Luxembourgish is the main instruction

language in *précoce* and Cycle 1. The strong association is therefore not surprising.

NO CATCHING UP WITH ALLONGEMENT DE CYCLE

It is a frequent approach in Luxembourg to support children who are falling behind in school and let them catch up on their learning delays by completing a learning cycle in three years instead of two. Nevertheless, the ineffectiveness of this approach similar to grade repetition has been demonstrated in several international (Hattie, 2010) and national studies in older children (Ertel et al., 2021; Hornung et al., 2021; Sonnleitner et al., 2021). To date, no study has investigated the relationship between *allongement de cycle* and learning performances in first graders in Luxembourg. The results here pointed to a negative association in all three learning domains (see p. 47) and thus **question the effectiveness of *allongement de cycle*** in Cycle 1. This frequent procedure should be thoroughly revised in terms of selection (which children are targeted by *allongement de cycle*), quality (which type of support is given during the extra school year) and monitoring the child's learning progress. The effectiveness of a bonus year without offering a targeted intervention program to the child is debatable.

ASSOCIATIONS BETWEEN FAMILY BACKGROUND AND LEARNING PERFORMANCE

In addition to ECEC and *allongement de cycle*, age, gender, and family background strongly influenced first graders' learning performances (see p. 45). In line with other research, **socioeconomic background** was significantly **associated with all three learning performances**, and most strongly with mathematics and early literacy (for a meta-analytic review, see Sirin, 2005). According to Davis-Kean and colleagues (2021), the socioeconomic status influences how parents support and cognitively stimulate their children in and outside their home and it may further shape the beliefs and expectations that parents have regarding their child's learning outcomes. As a result, home learning environments differ widely between parents of different socioeconomic status (Ebert et al., 2020). Importantly, **home learning experiences** predict and support children's later school and social development (Foster et al., 2005; Lehrl et al., 2020). While socioeconomic influences on learning performance are difficult to change, interventions on children's home learning environments (e.g., parental support and training, the use of books, stories and board games) seem promising to support early literacy (Rose et al., 2018; Tamis-LeMonda et al., 2019) and numeracy (LeFevre et al., 2009) at home.

NO SUPPORT FOR THE LUXEMBOURGISH-GERMAN-TRANSFER

The newly available data from 2022 show that children who speak Luxembourgish* at home performed well and significantly higher in basic German listening comprehension than children who speak a different language at home (see p. 52). This result held among families of different socioeconomic status. According to the Luxembourgish education curriculum, the acquisition of proficient Luxembourgish skills

refers to a key competence in Cycle 1 to prepare literacy acquisition in Cycle 2 (MENFP, 2011). The rationale behind it is that to this date, literacy in German and Luxembourgish is perceived as one and it is assumed that learners transfer their language skills in Luxembourgish onto German. Although two distinct languages, Luxembourgish and German share significant similarities in terms of vocabulary and grammar. For children who grow up in a rich literacy context with Luxembourgish as first language, a transfer to German may be possible, However, as almost 70% of the children do not grow up with Luxembourgish at home, a clear distinction and language transfer between these two Germanic languages are much less probable. Therefore, the transfer from Luxembourgish to German has been repeatedly questioned in recent years (for a similar discussion in Switzerland, see Gyger, 2007; for the discussion in Luxembourg, see Hoffmann et al., 2018; Hornung et al., 2021; Weth, 2018). **The present data does not support the transfer assumption.** Most importantly, children who do not grow up with Luxembourgish* at home show lower performance in Luxembourgish listening comprehension and subsequently, poor performance in basic German listening comprehension. Relatedly, many of these children struggle later with German reading comprehension in Cycle 3 and 5 (LUCET, 2022). We therefore urge policy makers to introduce German in Cycle 1 to **familiarize children early on with the instruction language** of Cycles 2 to 4. German comprehension skills are key precursor skills for the successful acquisition of literacy and mathematics in Cycle 2. In line with the literature, vocabulary and listening comprehension of the instruction language are fundamental for the development and comprehension of reading (de Jong & van der Leij, 2002; Rogde et al., 2019; Röthlisberger et al., 2021).

LANGUAGES (AT HOME OR IN CRÈCHE) AND THEIR ASSOCIATIONS WITH LEARNING PERFORMANCE

The data show that coming into **contact with Luxembourgish in *crèches* was related to higher Luxembourgish listening comprehension in Cycle 2** (see p. 43). Luxembourgish was the language most often reported to be spoken in *crèche* (see p. 37). More specifically, the children who attended a monolingual Luxembourgish *crèche* achieved significantly higher performance in Luxembourgish listening comprehension in Cycle 2 than children attending a *crèche* offering other languages or bilingual combinations. However, more research is needed to study this question further.

Additionally, we reported some preliminary findings on language exposure in family and media contexts, indicating that Luxembourgish seemed to be the most used language among first graders when they communicated among friends. While the languages spoken within the family and the languages used in media contexts were more diverse, it appeared that languages used in media reflected the children's home languages (see p. 28). Future research on the effects of language exposure at home might go a long way to shine a light on learning processes among children with more than one home language.

6.2 LIMITATIONS

The results of this study are based on the **rich database** of the national School Monitoring Programme **ÉpStan**. Advantages of this dataset include its sample size, which encompasses eight entire grade cohorts, the high return rate of parent questionnaires and highly reliable performance scores, based on thorough quality assurance procedures. However, while the quality of the performance measures was high, measures of other constructs were more limited.

For the ECEC variables, we only had **parents' self-report**. Detailed information for each individual path through the ECEC landscape was not available as the complexities of attending and switching between several ECEC settings for various durations and intensities could not be easily or efficiently collected via the parent questionnaire. Space for additional items in the questionnaire is limited to ensure high motivation and maximize response rates. Moreover, the questionnaire on ECEC was collected when the children already attended grade 1, thus detailed information may have been hard to remember when answering these retrospective questions. Additionally, effects of a social desirability bias (Grimm, 2010), that may reduce or increase the reported intensity of ECEC attendance, cannot be ruled out as the extensive use of external childcare is still debated in society, as recently seen in Luxembourgish media.

Furthermore, there is near to no data available on what is happening **inside ECEC** structures. While we have basic knowledge on the framework conditions of *crèches* and *précoce*, structures vary widely in their resources, everyday practices, and staff (OECD, 2022b). As noted by Honig et al. (2015, p. 17) "in Luxembourg, care is segregated along ethnic, linguistic, milieu specific, and income-related criteria", leading to an "uneven quality beyond minimum requirements, particularly in non-formal education" (OECD, 2022b, p. 9). **Additional qualitative and observational data** on the characteristics of caregiver-child interactions, e.g., richness of language, common language practices, or the responsiveness of the caregiver (Burchinal et al., 2016; Bustamante et al., 2022) could help to gain an understanding of process quality in ECEC in Luxembourg. Information on structural quality, for example indicated by facility resources (equipment and funding), staff qualification or group sizes[8], would be helpful if they were accessible in a systematic, country-wide database. Both process and structural quality are important factors that likely enable ECEC effects on school performance (Bustamante et al., 2022; Melhuish et al., 2015), as when structural quality improves, it becomes easier to focus on process quality (Bustamante et al., 2022).

One aspect of process quality in ECEC that we have some information about is **language**: Parents reported which language was spoken

[8]Currently, the staff-child-ratio for children under the age of 2 is set to 1 to 6 in Luxembourg. However, little is known on this ratio in reality.

with their child in *crèche*. We have to consider that parents might be an unreliable data source for this question as they cannot answer from first-hand experience. Instead, they might infer the information from official documents by the *crèche* (e.g., flyers, website), from conversations with their child or with the caregivers. Here, further questionnaire items, observational data, or qualitative interview data about the actual language practices in *crèches* (similar to the COMPARE project, see Kirsch, 2020b) would be helpful to determine the actual effect of ECEC languages on school performances. In particular, the frequency and richness of the spoken languages (e.g. sustained shared thinking, see SNJ, 2018) are of interest. Our current analyses on the topic of crèche languages were so far exploratory instead of confirmatory and indicated that language is an important factor here that should be looked into in more detail.

This report has focused on effects of ECEC on learning performance. While other outcome variables such as child **well-being** and socio-emotional variables are undoubtedly important, these were beyond the scope for this report. Further studies should investigate these aspects, similar to the national children's report of Luxembourg which reported that satisfaction with ECEC plays an important role for overall well-being and life satisfaction (Neumann, 2022).

It is important to bear in mind that the data presented in this report cannot tell us about the effects of the **current** ECEC settings in Luxembourg, as the information on ECEC attendance is collected retrospectively. Thus, we will gain a more comprehensive insight into the outcomes of today's developments in the ECEC and the school landscape by exploring data from future ÉpStan cycles, including for example, children attending international public schools or children who aquire literacy in French. Results of this report are therefore to be considered as a window into a past system that has since been changed by several developments and **reforms** (e.g., plurilingual early education program, addition of free CSA hours, choice between languages of instruction).

6.3 OUTLOOK AND IMPLICATIONS

We find large achievement gaps based on family background as early as in first grade. This is particularly consequential as a "child who falls behind may never catch up" (Heckman, 2006, p. 1900). While socioeconomic status, migration background and home language are all factors that are difficult to tackle (though investments and further research into home learning environments might be beneficial, see above), this report highlights the importance of the **early years in child development** and identifies **key adjustable parameters** in the school sector and attendance in *crèche*, *précoce* and Cycle 1. Our results also highlight the detrimental effects of *allongement de cycle* - whose excessive use should be monitored and regulated. Early investments in children have been shown to result in higher economic returns compared to later investments (Heckman, 2006). Thus, investments into the quality and content of ECEC ought to increase the effectiveness of

ECEC services in Luxembourg (Rosholm et al., 2021; Sammons et al., 2004; Ulferts et al., 2019).

Quality of ECEC is a multi-layered concept that, as described above, encompasses structural as well as procedural aspects. It can be steered, for example, by specificities in the framework. While for *précoce* and Cycle 1, the curriculum framework *Plan-Cadre* (MENJE, 2018) and Plan d'Études (MENFP, 2011) have been in continuous development and practice for over 20 years, the framework for the non-formal education sector (e.g., *crèches*) ("Nationaler Rahmenplan zur non-formalen Bildung im Kindes- und Jugendalter") was introduced in 2018 (Hartmann et al., 2018). Especially in these first years, its implementation and effectiveness should be further monitored to ensure a good fit. To be clear, we are not calling for increased "schoolification" in early ECEC (e.g., *crèches*). Schoolification, as described by Kaga and colleagues (2010, p. 9) is "the downward pressure of elementary school approaches (classroom organization, curriculum, teaching methods, child-to-staff ratios and conceptions of childhood) on early childhood pedagogy", has been identified as a risk that may, for example, reduce learning motivation in children by restricting exploration (Cadima et al., 2020). Instead, the frameworks should strive to define quality in non-formal educational settings and focus more on other aspects of **high-quality education and care**. Revised frameworks could include, for example, specified group sizes, qualification requirements of caregivers, facility and equipment availability and more procedural factors. Examples for aspects of procedural quality are sensitivity and responsivity of the caregiver, encouragement of communication, fostering exploration, and attentive personal care routines (Bustamante et al., 2022; Ulferts et al., 2019).

The effectiveness of ECEC might also be increased by ensuring the continuity and integration of the various, successive ECEC services with later schooling. Clear cut beneficial effects are difficult to find in the research literature among more diverse and less unitary ECEC and school systems (Caille, 2001; Driessen, 2004). In such systems, ECEC programs are neither aligned with each other nor with the elementary school system, which is likely why children's educational experiences might not build on each other. **Aligning educational frameworks** and connecting professionals and institutions might go a long way to avoid repetitive or mismatched experiences for children, possibly preventing stress and confusion (due to rule and norm differences) or boredom (see Stipek et al., 2017 for more detailed information). Looking across the borders, two programs in Germany might demonstrate how policy, research, and key stakeholders from early education to secondary school graduation can be integrated in order to further promote a high quality standard (FörMig and BISS).

In Luxembourg, societal changes and economic developments on the one hand strongly influence the language and attendance preferences of non-formal ECEC. It also appears that these settings are especially open to cultural diversities and meet the needs of many families, in particular with

respect to the long opening hours and language offers. On the other hand, the traditional public schools are very slowly adapting to our increasingly multilingual society and student population and appear less flexible when considering the language learning curriculum. While exceptions are currently increasing (i.e., the European and international public schools throughout the country[9], the French literacy acquisition Pilot Project and the growing continuity between language practices in ECEC - Luxembourgish and French, but not yet German), the new and innovative pedagogical developments in ECEC clash with the still rigid monolingual approach of literacy acquisition in German in Cycle 2. While children were previously exposed to Luxembourgish and French, the main instruction and literacy acquisition language, German, is introduced later, in Cycle 2 and remains the instruction language until the end of Cycle 4. It is unfortunate that German is not part of the ECEC language package, because it is indispensable that children master (i.e., comprehend and speak) the language of instruction to develop literacy skills in this language (Röthlisberger et al., 2021). Furthermore, we recommend supporting the literacy acquisition in French (see current Pilot Project by SCRIPT) considering that French is frequently spoken as a home language, as well as supporting the literacy acquisition in another home language in the European and international public school sector. Either way, the essential objective is to **improve continuity between language policies** in ECEC and later schooling, as gains made through qualitatively high ECEC may be lost or diminished when later schooling fails to build upon them.

7. CONCLUSION

We investigated ECEC as one possible strand of preventative measures against the striking educational inequalities in Luxembourg, which have been again highlighted in this report. As attendance of ECEC is generally high in Luxembourg, it shows **promise to be an effective future lever to increase learning performance and success,** especially for those children who do not speak the instruction languages at home, by promoting rich and equal learning opportunities for all children. Compared to family background variables, ECEC seems to currently have a positive yet relatively small effect on learning performance. Therefore, we urge policy makers to pay close attention to this key educational measure and increase its effectiveness by increasing and monitoring quality, as well as by rethinking the alignment of language policies in ECEC and successive schooling.

[9] For first analyses on European Public Schools in Luxembourg, a policy report by LUCET is to be published in June 2023.

GLOSSARY

Allongement de cycle	refers to completing a learning cycle in three instead of two years. In other school systems also labeled grade retention.
Crèche	refers to a daycare center, which offers care and supervision to groups of children by a team of qualified caregivers and emphasizes socio-emotional competences, creativity, and participation.
Cycle 1	refers to the two mandatory years of preschool in Luxembourg. Cycle 1.1 is attended by 4-to-5-year-olds, while Cycle 1.2 is for 5-to-6-year-olds.
Dageselteren	refers to independent child minders that offer family or home based ECEC, usually for a small group of children.
ECEC	includes all regulated forms of early childhood education and care from birth to formal schooling at the age of 6. In Luxembourg, ECEC encompasses *crèche*, *précoce*, *Dageselteren*, Cycle 1, etc.
Précoce	refers to a voluntary preschool year in Luxembourg for 3- to 4-year-olds with emphasis on the promotion of socio-emotional development and the Luxembourgish language.
Confidence interval	refers to a span of values that a value is included in with an 95% probability/confidence
ÉpStan	refers to the national School Monitoring Programme *Épreuves Standardisées* that assess key school competencies in Luxembourg in graders 1, 3, 5, 7 and 9.
Standard error	describes how far a value or coefficient in the population is from the value or coefficient in the sample; shows how the certainty of estimates.
Marginal effects	ease the interpretation of estimation results by converting the model coefficients into probabilities. The average marginal effects show, e.g., how the expected probability to choose certain types of ECEC varies by certain family characteristics.
Standard deviation	refers to the dispersion of scores from their mean.
Standardized regression coefficients (beta)	refers to the change in standard deviations in the dependent variable, here ÉpStan score, when the score of the respective background variable is increased by one standard deviation.
Statistical significance	refers how likely it is to find a specific value by chance. If this value is lower than .05, we speak of a statistically significant result.
Interaction Effect	occurs when the effect of one variable depends on the effect of an interacting variable. That is, under specific values of variable 1, variable 2 shows different effects on our outcome than under other values of variable 1.
Plan-Cadre	refers to the curriculum framework for *précoce*, which, coherently to the Plan d'Études, proposes pedagogical and didactic recommendations to foster motor, socio-emotional, creative, language and cognitive skills in three- to four-year-olds.
Plan d'Études	refers to the curriculum framework for Cycle 1 to 4 in elementary school defining the learning domains and educational standards and proposing content for teachers.
Nationaler Rahmenplan zur non-formalen Bildung im Kindes- und Jugendalter	refers to the framework for non-formal education in various institutions (e.g., Maison Relais, *crèche*), defining pedagogical goals, principles, and characteristics of education in the non-formal sector.

BIBLIOGRAPHY

Anders, J., Barr, A. C., & Smith, A. A. (2019). The effect of early childhood education on adult criminality: Evidence from the 1960s through 1990s. *American Economic Journal: Economic Policy*.

Andersson, B.-E. (1992). Effects of day-care on cognitive and socioemotional competence of thirteen-year-old Swedish schoolchildren. *Child Development*, 63(1), Article 1.

Ansari, A., Pianta, R. C., Whittaker, J. E., Vitiello, V., & Ruzek, E. (2021). Enrollment in public-prekindergarten and school readiness skills at kindergarten entry: Differential associations by home language, income, and program characteristics. *Early Childhood Research Quarterly*, 54, 60–71. https://doi.org/10.1016/j.ecresq.2020.07.011

Backes, S., & Lenz, T. (2021). *Schülerinnen & Schüler im luxemburgischen Schulsystem*. In LUCET & SCRIPT (Eds.), Nationaler Bildungsbericht Luxemburg 2021 (pp. 116–119). Luxembourg Centre for Educational Testing (LUCET) & Service de Coordination de la Recherche et de l'Innovation pédagogiques et technologiques (SCRIPT). https://doi.org/10.48746/BB2021LU-DE-20A

Balladares, J., & Kankaraš, M. (2020). *Attendance in early childhood education and care programmes and academic proficiencies at age 15* (OECD Education Working Papers No. 214; OECD Education Working Papers, Vol. 214). OECD. https://doi.org/10.1787/f16c7ae5-en

Barnes, J., & Melhuish, E. C. (2017). Amount and timing of group-based childcare from birth and cognitive development at 51 months: A UK study. *International Journal of Behavioral Development*, 41(3), 360–370. https://doi.org/10.1177/0165025416635756

Bennett, J. (2012). *ECEC for children from disadvantaged backgrounds: Findings from a European literature review and two case studies*. (European Commission, Ed.). https://op.europa.eu/en/publication-detail/-/publication/cd04bada-ef6c-4026-b2bb-62819dc6fcf9

Bermejo, V., Ester, P., & Morales, I. (2021). How the language of instruction influences mathematical thinking development in the first years of bilingual schoolers. *Frontiers in Psychology*, 12, 533141. https://doi.org/10.3389/fpsyg.2021.533141

Blanden, J., Del Bono, E., McNally, S., & Rabe, B. (2016). Universal pre-school education: The case of public funding with private provision. *The Economic Journal*, 126(592), Article 592. https://doi.org/10.1111/ecoj.12374

Bollig, S., Honig, M.-S., & Nienhaus, S. (2016). *Vielfalt betreuter Kindheiten* (Forschungsprojekt CHILD - Children in the Luxembourgian day care system).

Bousselin, A. (2019). Expanding access to universal childcare: Effects on childcare arrangements and maternal employment. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3538300

Broer, M., Bai, Y., & Fonseca, F. (2019). *Socioeconomic inequality and educational outcomes: Evidence from twenty years of TIMSS* (Vol. 5). Springer International Publishing. https://doi.org/10.1007/978-3-030-11991-1

Burchinal, M., Zaslow, M., & Tarullo, L. (2016). *Quality thresholds, features, and dosage in early care and education: Secondary data analyses of child outcomes*. Monographs of the Society for Research in Child Development, 81(2), 5–126.

Burger, K. (2010). How does early childhood care and education affect cognitive development? An international review of the effects of early interventions for children from different social backgrounds. *Early Childhood Research Quarterly*, *25*(2), Article 2. https://doi.org/10.1016/j.ecresq.2009.11.001

Busse, A., & Gathmann, C. (2020). Free daycare policies, family choices and child development. *Journal of Economic Behavior & Organization*, *179*, 240–260. https://doi.org/10.1016/j.jebo.2020.08.015

Bustamante, A. S., Dearing, E., Zachrisson, H. D., & Vandell, D. L. (2022). Adult outcomes of sustained high-quality early childcare and education: Do they vary by family income? *Child Development*. https://doi.org/10.1111/CDEV.13696

Cadima, J., Nata, G., Barros, S., Coelho, V., & Barata, C. (2020). *Literature review on early childhood education and care for children under the age of 3* (OECD Education Working Papers No. 243; OECD Education Working Papers, Vol. 243). OECD. https://doi.org/10.1787/a9cef727-en

Caille, J.-P. (2001). Scolarisation à 2 ans et réussite de la carrière scolaire au début de l'école élémentaire. *Éducation & formation*, *60*.

Camilli, G., Vargas, S., Ryan, S., & Barnett, W. S. (2010). Meta-analysis of the effects of early education interventions on cognitive and social development. *Teachers College Record: The Voice of Scholarship in Education*, *112*(3), 579–620. https://doi.org/10.1177/016146811011200303

Chmielewski, A. K. (2019). The global increase in the socioeconomic achievement gap, 1964 to 2015. *American Sociological Review*, *84*(3), 517–544. https://doi.org/10.1177/0003122419847165

Cummins, J. (1978). Bilingualism and the development of metalinguistic awareness. *Journal of Cross-Cultural Psychology*, *9*(2), 131–149. https://doi.org/10.1177/002202217892001

Davis-Kean, P. E., Tighe, L. A., & Waters, N. E. (2021). The role of parent educational attainment in parenting and children's development. *Current Directions in Psychological Science*, *30*(2), 186–192. https://doi.org/doi.org/10.1177/0963721421993116

de Jong, P. F., & van der Leij, A. (2002). Effects of phonological abilities and linguistic comprehension on the development of reading. *Scientific Studies of Reading*, 6(1), 51–77. https://doi.org/10.1207/S1532799XSSR0601_03

DeAngelis, C. A., Holmes Erickson, H., & Ritter, G. W. (2020). What's the state of the evidence on Pre-K programmes in the United States? A systematic review. *Educational Review*, *72*(4), Article 4. https://doi.org/10.1080/00131911.2018.1520688

Dearing, E., Zachrisson, H. D., Mykletun, A., & Toppelberg, C. O. (2018). Estimating the consequences of Norway's national scale-up of early childhood education and care (beginning in infancy) for early language skills. *AERA Open*, *4*(1), 233285841875659. https://doi.org/10.1177/2332858418756598

Drange, N., & Havnes, T. (2015). Child care before age two and the development of language and numeracy: Evidence from a lottery. *Discussion Papers. Statistics Norway. Research Department.*, *808*. https://doi.org/10.2139/ssrn.2582539

Driessen, G. W. J. M. (2004). A large scale longitudinal study of the utilization and effects of early childhood education and care in The Netherlands. *Early Child Development and Care*, *174*(7–8), 667–689. https://doi.org/10.1080/0300443042000187158

Dumas, C., & Lefranc, A. (2010). Early schooling and later outcomes: Evidence from pre-school extension in France. In *From parents to children: The intergenerational transmission of advantage* (p. 29). Russel Sage Foundation.

Ebert, S., Lehrl, S., & Weinert, S. (2020). Differential effects of the home language and literacy environment on child language and theory of mind and their relation to socioeconomic background. *Frontiers in Psychology*, *11*, 555654. https://doi.org/10.3389/fpsyg.2020.555654

Ertel, C., Hornung, C., & Schiltz, C. (2021). Sprach- und Leseunterschiede zwischen portugiesischen Migrantenkindern mit und ohne Klassenwiederholung in Luxemburg. In LUCET & SCRIPT (Eds.), *Nationaler Bildungsbericht Luxemburg 2021* (pp. 58–63). Luxembourg Centre for Educational Testing (LUCET) & Service de Coordination de la Recherche et de l'Innovation pédagogiques et technologiques (SCRIPT). https://doi.org/10.48746/bb2021lu-de-15

Eryigit-Mzwamuse, S., & Barnes, J. (2014). Patterns of childcare arrangements and cognitive development. *Journal of Child and Adolescent Behaviour*, *02*(05). https://doi.org/10.4172/2375-4494.1000165

Esser, H. (2009). Der Streit um die Zweisprachigkeit: Was bringt die Bilingualität? In I. Gogolin & U. Neumann (Eds.), *Streitfall Zweisprachigkeit – The bilingualism controversy*. VS Verlag für Sozialwissenschaften.

European Commission. (2022, May 23). *Early childhood education and care initiatives | European Education Area*. https://education.ec.europa.eu/node/1702

Feinstein, L. (2000). Inequality in the early cognitive development of British children in the 1970 cohort. *Economica*, *70*(277), 73–97. https://doi.org/10.1111/1468-0335.t01-1-00272

Felfe, C., & Lalive, R. (2014). Does early child care help or hurt children's development? *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2505346

Fischbach, A., Ugen, S., & Martin, R. (2014). *ÉpStan technical report*. University of Luxembourg, LUCET.

Flisi, S., & Blasko, Zs. (2019). *A note on early childhood education and care participation by socio-economic background.* Publications Office of the European Union. https://doi.org/10.2760/315380

Foster, M. A., Lambert, R., Abbott-Shim, M., McCarty, F., & Franze, S. (2005). A model of home learning environment and social risk factors in relation to children's emergent literacy and social outcomes. *Early Childhood Research Quarterly*, *20*(1), 13–36. https://doi.org/10.1016/j.ecresq.2005.01.006

Gogolin, I. (2013). The 'monolingual habitus' as the common feature in teaching in the language of the majority in different countries. *Per Linguam*, *13*(2). https://doi.org/10.5785/13-2-187

Gogolin, I. (2020). Sprachliche Förderung, sprachliche Bildung und Lernen im Deutschen als Zweitsprache während und nach der Pandemie. In D. Fickermann & B. Edelstein (Eds.), „*Langsam vermisse ich die Schule …*" (pp. 175–188). Waxmann Verlag GmbH. https://doi.org/10.31244/9783830992318.11

Gogolin, I., & Neumann, U. (Eds.). (2009). *Streitfall Zweisprachigkeit – The bilingualism controversy*. VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-91596-8

Goldfeld, S., Moreno-Betancur, M., Guo, S., Mensah, F., O'Connor, E., Gray, S., Chong, S., Woolfenden, S., Williams, K., Kvalsvig, A., Badland, H., Azpitarte, F., & O'Connor, M. (2021). Inequities in children's reading skills: The role of home reading and preschool attendance. *Academic Pediatrics*, *21*(6), 1046–1054. https://doi.org/10.1016/j.acap.2021.04.019

Greisen, M., Georges, C., Hornung, C., Sonnleitner, P., & Schiltz, C. (2021). Learning mathematics with shackles: How lower reading comprehension in the language of mathematics instruction accounts for lower mathematics achievement in speakers of different home languages. *Acta Psychologica*, 103456. https://doi.org/10.1016/j.actpsy.2021.103456

Grimm, P. (2010). Social desirability bias. In J. Sheth & N. Malhotra (Eds.), *Wiley International Encyclopedia of Marketing* (p. wiem02057). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781444316568.wiem02057

Grob, A., Keller, K., & Trösch, L. M. (2014). *Zweitsprache. Mit ausreichenden Deutschkenntnissen in den Kindergarten.* [Wissenschaftlicher Abschlussbericht.]. Universität Basel.

Gyger, M. (2007). Hochdeutsch im Kindergarten. *Linguistik Online*, *32*(3), Article 3. https://doi.org/10.13092/lo.32.536

Hadjar, A., & Buchmann, C. (2016). Education systems and gender inequalities in educational attainment. In A. Hadjar & C. Gross (Eds.), *Education systems and inequalities*. Policy Press.

Hansen, K., & Hawkes, D. (2009). Early childcare and child development. *Journal of Social Policy*, *38*(2), 211–239. https://doi.org/10.1017/S004727940800281X

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children* (pp. xxiii, 268). Paul H Brookes Publishing.

Hartmann, W., Bäck, G., Gorgi, M., Hajszan, M., Hartel, B., Marek, D., Pfohl-Chalaupek, M., Steinmann, R., Bodeving, C., Seele, C., & Biewers, S. (2018). *Nationaler Rahmenplan zur non-formalen Bildung im Kindes- und Jugendalter*. MENJE.

Hattie, J. (2010). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement* (Reprinted). Routledge.

Havnes, T., & Mogstad, M. (2011). No child left behind: Subsidized child care and children's long-run outcomes. *American Economic Journal: Economic Policy*, *3*(2), 97–129. https://doi.org/10.1257/pol.3.2.97

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, *312*(5782), Article 5782. https://doi.org/10.1126/science.1128898

Hemmerechts, K., Agirdag, O., & Kavadias, D. (2017). The relationship between parental literacy involvement, socio-economic status and reading literacy. *Educational Review*, *69*(1), 85–101. https://doi.org/10.1080/00131911.2016.1164667

Hoffmann, D., Hornung, C., Gamo, S., Esch, P., Keller, U., & Fischbach, A. (2018). Schulische Kompetenzen von Erstklässlern und ihre Entwicklung nach zwei Jahren. Erste längsschnittliche Befunde aus dem nationalen Bildungsmonitoring. In LUCET & SCRIPT (Eds.), *Nationaler Bildungsbericht Luxemburg 2018* (pp. 84–96).

Honig, M.-S., Schmitz, A., & Wiltzius, M. (2015). Early education and the unloved market of commercial childcare in Luxembourg. In H. Willekens, K. Scheiwe, & K. Nawrotzki (Eds.), *The development of early childhood education in Europe and North America* (pp. 254–274). Palgrave Macmillan UK. https://doi.org/10.1057/9781137441980_13

Hornung, C., Wollschläger, R., Keller, U., Esch, P., Muller, C., & Fischbach, A. (2021). Neue längsschnittliche Befunde aus dem nationalen Bildungsmonitoring ÉpStan in der 1. Und 3. Klasse: Negativer Trend in der Kompetenzentwicklung und kein Erfolg bei Klassenwiederholungen. In LUCET & SCRIPT (Eds.), *Nationaler Bildungsbericht Luxemburg 2021* (pp. 44–55). LUCET & SCRIPT.

Jordan, N. C., Kaplan, D., Nabors Olah, L., & Locuniak, M. N. (2006). Number sense growth in kindergarten: A longitudinal investigation of children at risk for mathematics difficulties. *Child Development*, *77*(1), 153–175. https://doi.org/10.1111/j.1467-8624.2006.00862.x

Jordan, N. C., Kaplan, D., Ramineni, C., & Locuniak, M. N. (2009). Early math matters: Kindergarten number competence and later mathematics outcomes. *Developmental Psychology*, *45*(3), 850–867. https://doi.org/10.1037/a0014939

Kaga, Y., Bennett, J., & Moss, P. (2010). *Caring and learning together: A cross-national study on the integration of early childhood care and education within education*. UNESCO.

Kirsch, C. (2020b, September 10). *Bildungspartnerschaften und Literacy: Erste Ergebnisse aus dem Projekt COMPARE* [Vortrag]. Zusammenarbeit mit Eltern und Literacy im mehrsprachigen Kontext, online.

Kirsch, C., & Aleksić, G. (2021). Multilingual education in early years in Luxembourg: A paradigm shift? *International Journal of Multilingualism*, *18*(4), 534–550. https://doi.org/10.1080/14790718.2021.1905643

Korous, K. M., Causadias, J. M., Bradley, R. H., Luthar, S. S., & Levy, R. (2022). A systematic overview of meta-analyses on socioeconomic status, Cognitive ability, and achievement: The need to focus on specific pathways. *Psychological Reports*, 43.

Larose, M., Côté, S. M., Ouellet-Morin, I., Maughan, B., & Barker, E. D. (2021). Promoting better functioning among children exposed to high levels of family adversity: The protective role of childcare attendance. *Journal of Child Psychology and Psychiatry*, *62*(6), 762–770. https://doi.org/10.1111/jcpp.13313

Larose, M.-P., Haeck, C., Ouellet-Morin, I., Barker, E. D., & Côté, S. M. (2021). Childcare attendance and academic achievement at age 16 years. *JAMA Pediatrics*, *175*(9), 939. https://doi.org/10.1001/jamapediatrics.2021.1192

Laurin, J. C., Geoffroy, M.-C., Boivin, M., Japel, C., Raynault, M.-F., Tremblay, R. E., & Côté, S. M. (2015). Child care services, socioeconomic inequalities, and academic performance. *Pediatrics*, *136*(6), 1112–1124. https://doi.org/10.1542/peds.2015-0419

Lazzari, A., & Vandenbroeck, M. (2013). *The impact of early childhood education and care on cognitive and non-cognitive development. A review of European studies.* Transatlantic Forum on inclusive early years. Investing in the development of young children from migrant and low-income families.

Le, V.-N., Kirby, S., Barney, H., Setodji, C., & Gershwin, D. (2006). *School readiness, full-day kindergarten, and student achievement: An empirical investigation*. RAND Corporation. https://doi.org/10.7249/MG558

LeFevre, J.-A., Skwarchuk, S.-L., Smith-Chant, B. L., Fast, L., Kamawar, D., & Bisanz, J. (2009). Home numeracy experiences and children's math performance in the early school years. *Canadian Journal of Behavioural Science / Revue Canadienne Des Sciences Du Comportement*, *41*(2), 55–66. https://doi.org/10.1037/a0014532

Lehrl, S., Evangelou, M., & Sammons, P. (2020). The home learning environment and its role in shaping children's educational development. *School Effectiveness and School Improvement*, *31*(1), 1–6. https://doi.org/10.1080/09243453.2020.1693487

Letourneau, N. L., Duffett-Leger, L., Levac, L., Watson, B., & Young-Morris, C. (2011). Socioeconomic status and child development: A meta-analysis. *Journal of Emotional and Behavioral Disorders*, *21*(3), 14.

Li, W., Duncan, G. J., Magnuson, K., Schindler, H. S., Yoshikawa, H., & Leak, J. (2020). Timing in early childhood education: How cognitive and achievement program impacts vary by starting age, program duration, and time since the end of the program. *EdWorkingPaper*, *20–201*. https://doi.org/10.26300/5TVG-NT21

Little, C. W., Larsen, S., Byrne, B., Logan, J. A. R., Olson, R. K., & Coventry, W. L. (2020). Exploring the influence of early childhood education and care on the etiology of achievement. *Behavior Genetics*, *50*(6), Article 6. https://doi.org/10.1007/s10519-020-10013-z

Loeb, S., Bridges, M., Bassok, D., Fuller, B., & Rumberger, R. W. (2007a). How much is too much? The influence of preschool centers on children's social and cognitive development. *Economics of Education Review*, *26*(1), Article 1. https://doi.org/10.1016/j.econedurev.2005.11.005

Loeb, S., Bridges, M., Bassok, D., Fuller, B., & Rumberger, R. W. (2007b). How much is too much? The influence of preschool centers on children's social and cognitive development. *Economics of Education Review*, *26*(1), Article 1. https://doi.org/10.1016/j.econedurev.2005.11.005

LUCET. (2022). *ÉpStan Dashboard: Results from the Luxembourg school monitoring programme 'Épreuves Standardisées'*. http://dashboard.epstan.lu

Luijk, M. P. C. M., Linting, M., Henrichs, J., Herba, C. M., Verhage, M. L., Schenk, J. J., Arends, L. R., Raat, H., Jaddoe, V. W. V., Hofman, A., Verhulst, F. C., Tiemeier, H., & van IJzendoorn, M. H. (2015). Hours in non-parental child care are related to language development in a longitudinal cohort study: Child care and language development. *Child: Care, Health and Development*, *41*(6), 1188–1198. https://doi.org/10.1111/cch.12238

Lundberg, I., Larsman, P., & Strid, A. (2012). Development of phonological awareness during the preschool year: The influence of gender and socio-economic status. *Reading and Writing*, *25*(2), 305–320. https://doi.org/10.1007/s11145-010-9269-4

Martin, R., Ugen, S., & Fischbach, A. (Eds.). (2015). *Épreuves Standardisées. Bildungsmonitoring für Luxemburg. Nationaler Bericht 2011 bis 2013.* University of Luxembourg, Luxembourg Center for Educational Testing (LUCET).

Maurer-Hetto, M.-P., Bamberg, M., & Kerger, L. (1991). Sprachprobleme portugiesischer Kinder. *Forum*, *135*.

Melhuish, E. (2004). *A literature review of the impact of early years provision on young children, with emphasis given to children from disadvantaged backgrounds*. National Audit Office.

Melhuish, E., Ereky-Stevens, K., Petrogiannis, K., Ariescu, A., Penderi, E., Rentzou, K., Tawell, A., Leseman, P., & Broekhuisen, M. (2015). *A review of research on the effects of early childhood education and care (ECEC) on child development* (CARE Project; Curriculum Quality Analysis and Impact Review of European Early Childhood Education and Care (ECEC)) [Technical Report.].

MENFP. (2011). *Plan d'études école fondamentale*. MENFP.

MENFP/SCRIPT. (2000). *PISA 2000. Kompetenzen von Schülern im internationalen Vergleich* (OECD Programme for International Student Assessment) [Nationaler Bericht]. Ministère de l'Éducation Nationale, de la Formation Professionnelle et des Sports.

MENJE. (n.d.). *Horaires et Programmes*. Retrieved 1 August 2022, from https://portal.education.lu/programmes/Privacy

MENJE. (2018). *Plan-cadre. Pour l'éducation précoce au Luxembourg.* MENJE.

MENJE. (2020). *The Luxembourg education system*. www.men.lu

MENJE. (2022). *Projet pilote d'alphabétisation en français à l'école fondamentale luxembourgeoise*. http://men.public.lu/fr/actualites/communiques-conference-presse/2022/05-2022/projet-pilote-alphabetisation-francais-ef.html

MENJE & SCRIPT. (2022). *Education system in Luxembourg. Key Figures*. edustat.lu

MENJE, SNJ, Bühler, C., & Université de Luxembourg. (2021). *Nationaler Rahmenplan zur non-formalen Bildung im Kindes- und Jugendalter* (MENJE & SNJ, Eds.).

Nagy, G., & Neumann, M. (2010). Psychometrische Aspekte des Tests zu den voruniversitären Mathematikleistungen in TOSCA-2002 und TOSCA-2006: Unterrichtsvalidität, Rasch-Homogenität und Messäquivalenz. In U. Trautwein, M. Neumann, G. Nagy, O. Lüdtke, & K. Maaz (Eds.), *Schulleistungen von Abiturienten* (pp. 281–306). VS Verlag für Sozialwissenschaften. https://doi.org/10.1007/978-3-531-92037-5_11

Neumann, S. (2022). Konzeption, Hintergründe und zentrale Ergebnisse des Kinderberichts. In Ministère de l'Éducation nationale, de l'Enfance et de la Jeunesse (MENJE) (Ed.), *Nationaler Bericht 2022 zur Situation der Kinder in Luxemburg: Wohlbefinden von Kindern in Luxemburg* (pp. 13–19). MENJE.

OECD. (2011). *Does participation in pre-primary education translate into better learning outcomes at school?* (PISA in Focus No. 1; PISA in Focus, Vol. 1). https://doi.org/10.1787/5k9h362tpvxp-en

OECD (Ed.). (2020a). *Early learning and child well-being: A study of five-year-olds in England, Estonia, and the United States*. OECD Publishing. https://doi.org/10.1787/3990407f-en

OECD. (2020b). *Quality early childhood education and care for children under age 3: Results from the Starting Strong survey 2018*. OECD. https://doi.org/10.1787/99f8bc95-en

OECD. (2022a). *Enrolment rate in early childhood education* [Data set]. OECD. https://doi.org/10.1787/ce02d0f9-en

OECD. (2022b). *Strengthening early childhood education and care in Luxembourg: A focus on non-formal education*. OECD Publishing. https://doi.org/10.1787/04780b15-en

ONQS. (2022). *L'entrée à l'école: Analyse de la situation scolaire actuelle et état des lieux de la recherche.* (Rapport thématique). Observatoire national de la qualité scolaire.

Paetsch, J., Radmann, S., Felbrich, A., Lehmann, R., & Stanat, P. (2016). Sprachkompetenz als Prädiktor mathematischer Kompetenzentwicklung von Kindern deutscher und nicht-deutscher Familiensprache. *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie*, *48*(1), Article 1. https://doi.org/10.1026/0049-8637/a000142

Pant, H. A., Stanat, P., Schroeders, U., Roppelt, A., Siegle, T., & Pöhlmann, C. (Eds.). (2013). *The IQB national assessment study 2012. Competencies in mathematics and the sciences at the end of secondary level I. Summary*. Waxmann.

Puma, M., Bell, S., Cook, R., Heid, C., Broene, P., Jenkins, F., Mashburn, A., & Downer, J. (2012). *Third grade follow-up to the Head Start impact study: Final report* (OPRE Report No. 2012–45; p. 346). Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services.

Ribeiro, L. A., Zachrisson, H. D., Nærde, A., Wang, M. V., Brandlistuen, R. E., & Passaretta, G. (2022). Socioeconomic disparities in early language development in two Norwegian samples. *Applied Developmental Science*, 1–17. https://doi.org/10.1080/10888691.2022.2051510

Rogde, K., Hagen, Å. M., Melby-Lervåg, M., & Lervåg, A. (2019). The effect of linguistic comprehension instruction on generalized language and reading comprehension skills: A systematic review. *Campbell Systematic Reviews*, *15*(4). https://doi.org/10.1002/cl2.1059

Rose, E., Lehrl, S., Ebert, S., & Weinert, S. (2018). Long-term relations between children's language, the home literacy environment, and socioemotional development from ages 3 to 8. *Early Education and Development*, *29*(3), 342–356. https://doi.org/10.1080/10409289.2017.1409096

Rosholm, M., Paul, A., Bleses, D., Højen, A., S. Dale, P., Jensen, P., M. Justice, L., Svarer, M., & Calmar Andersen, S. (2021). Are impacts of early interventions in the Scandinavian welfare state consistent with a Heckman curve? A meta-analysis. *Journal of Economic Surveys*, *35*(1), Article 1. https://doi.org/10.1111/joes.12400

Rossell, C. H., & Baker, K. (1996). The educational effectiveness of bilingual education. *Research in the Teaching of English*, *30*(1), 7–74.

Röthlisberger, M., Schneider, H., & Juska-Bacher, B. (2021). Lesen von Kindern mit Deutsch als Erst- und Zweitsprache – Wortschatz als limitierender Faktor. *Zeitschrift für Grundschulforschung*, *14*(2), 359–374. https://doi.org/10.1007/s42278-021-00115-w

Ruhm, C., & Waldfogel, J. (2012). Long-term effects of early childhood care and education. *Nordic Economic Policy Review*, *1*, Article 1.

Sammons, P., Elliot, K., Sylva, K., Melhuish, E., Siraj-Blatchford, I., & Taggart, B. (2004). The impact of pre-school on young children's cognitive attainments at entry to reception. *British Educational Research Journal*, *30*(5), 691–712. https://doi.org/10.1080/0141192042000234656

Sammons, P., Sylva, K., Melhuish, E., Siraj-Blatchford, I., Taggart, B., & Hunt, S. (2008). *Influences on children's attainment and progress in key stage 2: Cognitive outcomes in year 6* (Effective Pre-School and Primary Education 3-11 Project (EPPE 3-11)) [Research Report DCSF-RR048].

Sandsør, A. M. J., Zachrisson, H. D., Karoly, L. A., & Dearing, E. (2021). *Achievement gaps by parental income and education* [Preprint]. https://doi.org/10.35542/osf.io/zrctw

Sattler, S. (2022). Curriculum und Mehrsprachigkeit: Planung und Gestaltung sprachlicher Identität in Luxemburg. In *Curriculum und Mehrsprachigkeit*. transcript Verlag. https://doi.org/10.1515/9783839460016

Service National de la Jeunesse (Ed.). (2018). *Frühe mehrsprachige Bildung. L'education plurilingue dans la petite enfance. Sammlung der Beiträge der Konferenz zur frühen mehrsprachigen Bildung in der Luxemburger Kindertagesbetreuung*.

Service National de la Jeunesse. (2023). *Petite enfance. La diversité linguistique des jeunes enfants et les pratique langagières au sein des familles au Luxembourg.*

Sierens, S., Van Avermaet, P., Van Houtte, M., & Agirdag, O. (2020). Does pre-schooling contribute to equity in education? Participation in universal pre-school and fourth-grade academic achievement. *European Educational Research Journal*, *19*(6), Article 6. https://doi.org/10.1177/1474904120925981

Sirin, S. (2005). *The relationship between socioeconomic status and school outcomes: Meta analytic review of research, 1990-2000*.

Slavin, R. E., & Cheung, A. (2005). A synthesis of research on language of reading instruction for English language learners. In Janina Söhn (Ed.), *The effectiveness of bilingual school programs for immigrant children: Vol. Discussion Papers / Wissenschaftszentrum Berlin für Sozialforschung, Forschungsschwerpunkt Zivilgesellschaft, Konflikte und Demokratie, Arbeitsstelle Interkulturelle Konflikte und gesellschaftliche Integration, 2005-601*. Wissenschaftszentrum Berlin für Sozialforschung gGmbH.

Söhn, J. (2005). *The effectiveness of bilingual school programs for immigrant children. Discussion Papers / Wissenschaftszentrum Berlin für Sozialforschung, Forschungsschwerpunkt Zivilgesellschaft, Konflikte und Demokratie, Arbeitsstelle Interkulturelle Konflikte und gesellschaftliche Integration, 2005-601*. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-110296

Sonnleitner, P., Krämer, C., Gamo, S., Reichert, M., Keller, U., & Fischbach, A. (2021). Neue längsschnittliche Befunde aus dem nationalen Bildungsmonitoring ÉpStan in der 3. und 9. Klasse: Schlechtere Ergebnisse und wirkungslose Klassenwiederholungen. In LUCET & SCRIPT (Eds.), *Nationaler Bildungsbericht Luxemburg 2021* (pp. 109–115). Luxembourg Centre for Educational Testing (LUCET) & Service de Coordination de la Recherche et de l'Innovation pédagogiques et technologiques (SCRIPT). https://doi.org/10.48746/BB2021LU-DE-24A

Sonnleitner, P., Krämer, C., Gamo, S., Reichert, M., Muller, C., Keller, U., & Ugen, S. (2018). Schülerkompetenzen im Längsschnitt—Die Entwicklung von Deutsch-Leseverstehen und Mathematik in Luxemburg zwischen der 3. Und 9. Klasse. In LUCET & SCRIPT (Eds.), *Nationaler Bildungsbericht Luxemburg 2018* (pp. 39–58).

Spiess, C. K., Büchel, F., & Wagner, G. G. (2003). Children's school placement in Germany: Does Kindergarten attendance matter? *Early Childhood Research Quarterly*, *18*(2), 255–270. https://doi.org/10.1016/S0885-2006(03)00023-1

Stanat, P., & Christensen, G. (2006). *Where immigrant students succeed—A comparative review of performance and engagement in PISA 2003*. https://www.oecd.org/education/school/programmeforinternationalstudentassessmentpisa/whereimmigrantstudentssucceed-acomparativereviewofperformanceandengagementinpisa2003.htm

Starkey, P., Klein, A., & Wakeley, A. (2004). Enhancing young children's mathematical knowledge through a pre-kindergarten mathematics intervention. *Early Childhood Research Quarterly*, *19*(1), 99–120. https://doi.org/10.1016/j.ecresq.2004.01.002

Stipek, D., Clements, D., Coburn, C., Franke, M., & Farran, D. (2017). PK-3: What does it mean for instruction? *Social Policy Report*, *30*(2), Article 2.

Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2004). *The effective provision of pre-school education (EPPE) project: Final report. A longitudinal study funded by the DfES 1997-2004.* (Effective Pre-School Education). SureStart.

Tamis-LeMonda, C. S., Luo, R., McFadden, K. E., Bandel, E. T., & Vallotton, C. (2019). Early home learning environment predicts children's 5th grade academic skills. *Applied Developmental Science*, *23*(2), 153–169. https://doi.org/10.1080/10888691.2017.1345634

Thieme, A.-M. M. M., Hanekamp, K., Andringa, S., Verhagen, J., & Kuiken, F. (2022). The effects of foreign language programmes in early childhood education and care: A systematic review. *Language, Culture and Curriculum*, *35*(3), 334–351. https://doi.org/10.1080/07908318.2021.1984498

Tracy, R. (2009). Mehrsprachigkeit in der frühen Kindheit: Bedingungen, Risiken und Chancen. In J. Heide, S. Hanne, O.-C. Brandt, T. Fritzsche, & M. Wahl (Eds.), *Spektrum Patholinguistik 2. Schwerpunktthema: Ein Kopf—Zwei Sprachen. Mehrsprachigkeit in Forschung und Therapie.* (pp. 1–8). Universitätsverlag Potsdam.

Ulferts, H., Wolf, K. M., & Anders, Y. (2019). Impact of process quality in early childhood education and care on academic outcomes: Longitudinal meta-analysis. *Child Development*, *90*(5), 1474–1489. https://doi.org/10.1111%2Fcdev.13296

UNESCO. (2005). *Towards knowledge societies* [UNESCO World Report]. UNESCO Publishing.

Ünver, Ö., Bircan, T., & Nicaise, I. (2021). A multilevel approach to ECEC policies and intensity of formal childcare participation of young children in Europe. *Children and Youth Services Review*, *122*, 105798. https://doi.org/10.1016/j.childyouth.2020.105798

van Huizen, T., & Plantenga, J. (2018). Do children benefit from universal early childhood education and care? A meta-analysis of evidence from natural experiments. *Economics of Education Review*, *66*, 206–222.

Van Staden, S., Bosker, R., & Bergbauer, A. (2016). Differences in achievement between home language and language of learning in South Africa: Evidence from prePIRLS 2011. *South African Journal of Childhood Education*, *6*(1), 10. https://doi.org/10.4102/sajce.v6i1.441

van Zwieten, A., Teixeira-Pinto, A., Lah, S., Nassar, N., Craig, J. C., & Wong, G. (2021). Socioeconomic status during childhood and academic achievement in secondary school. *Academic Pediatrics*, *21*(5), 838–848. https://doi.org/10.1016/j.acap.2020.10.013

Vandenbroeck, M., & Lazzari, A. (2014). Accessibility of early childhood education and care: A state of affairs. *European Early Childhood Education Research Journal*, *22*(3), 327–335. https://doi.org/10.1080/1350293X.2014.912895

Weth, C. (2018). Schrifterwerb in Luxemburg. In Luxembourg Centre for Educational Testing (LUCET), University of Luxembourg & Service de Coordination de la Recherche et de l'Innovation pédagogiques et technologiques (SCRIPT) (Eds.), *Nationaler Bildungsbericht Luxemburg 2018* (pp. 142–151).

Xue, Y., Miller, E. B., Auger, A., Pan, Y., Burchinal, M., Tien, H.-C., Peisner-Feinberg, E., Zaslow, M., & Tarullo, L. (2016). IV. Testing for dosage-outcome associations in early care and education. *Monographs of the Society for Research in Child Development*, *81*(2), 64–74. https://doi.org/10.1111/mono.12239

APPENDIX

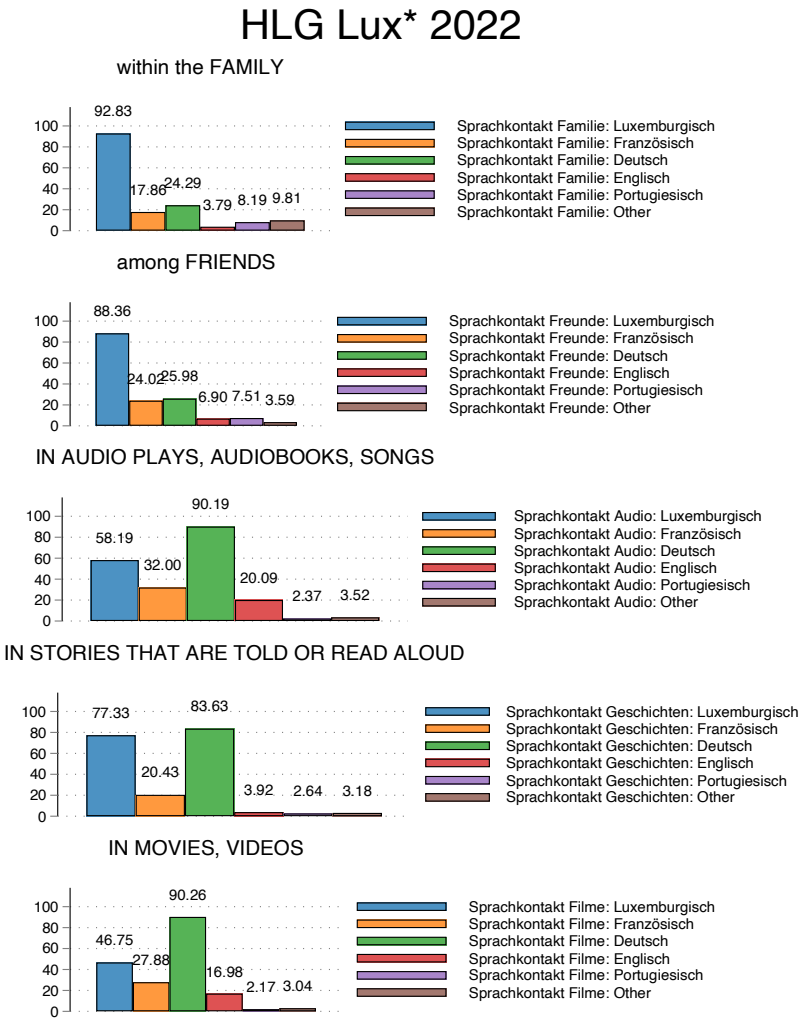


Figure 30. Contact with languages in different contexts within the Luxembourgish* home language group (sample of Luxembourg's first graders in 2022)

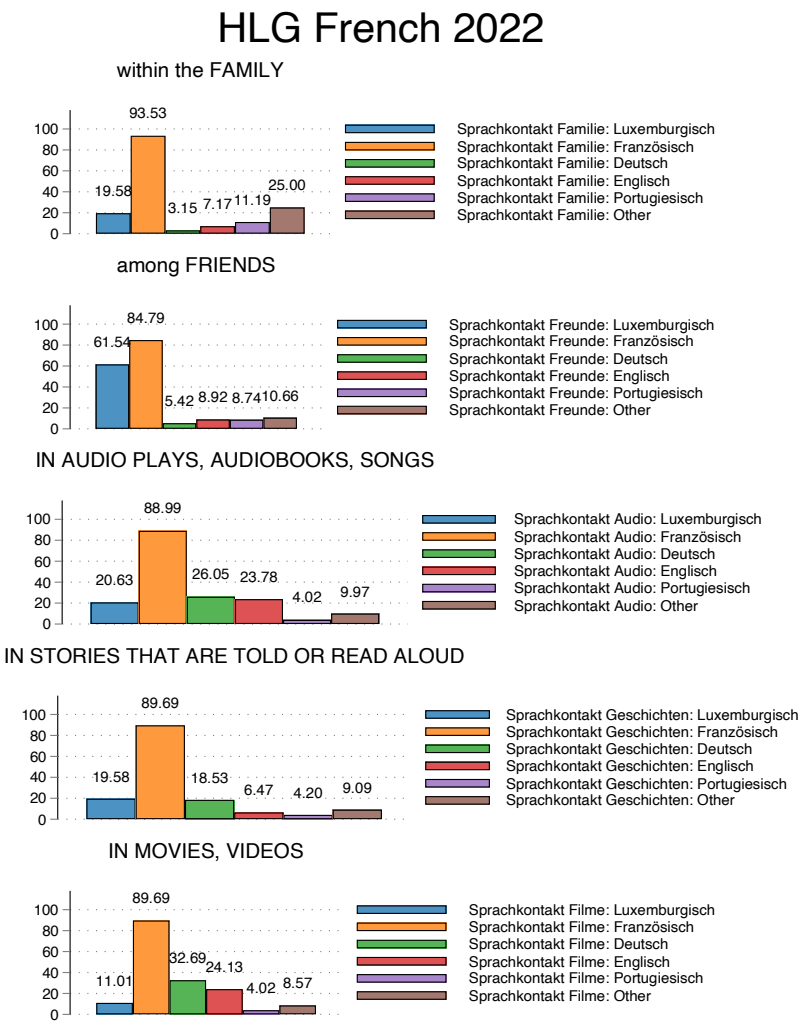


Figure 31. Contact with languages in different contexts within the French home language group (sample of Luxembourg's first graders in 2022)

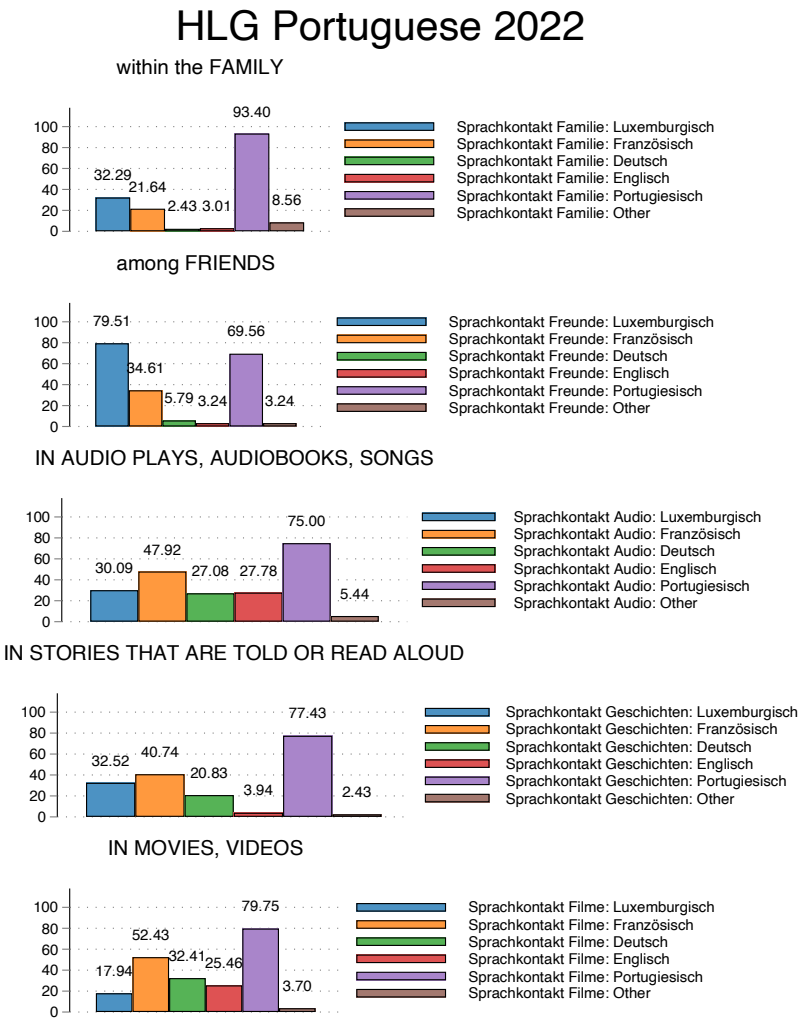


Figure 32. Contact with languages in different contexts within the Portuguese home language group (sample of Luxembourg's first graders in 2022)

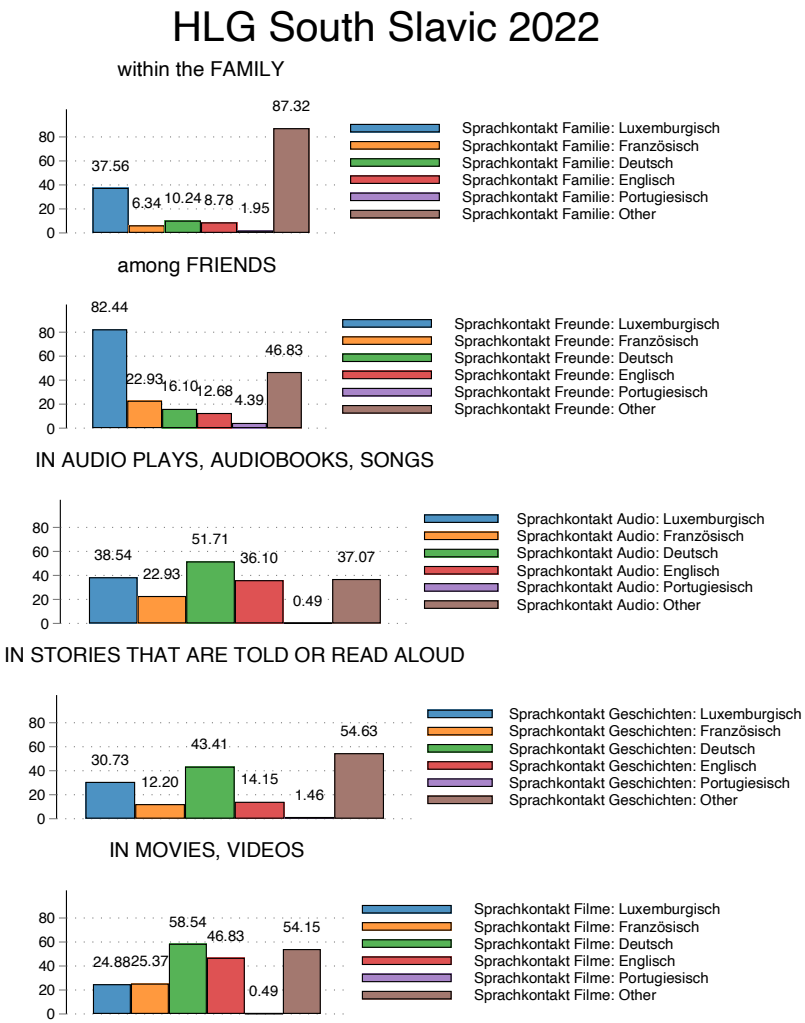


Figure 33. Contact with languages in different contexts within the South Slavic home language group (sample of Luxembourg's first graders in 2022)

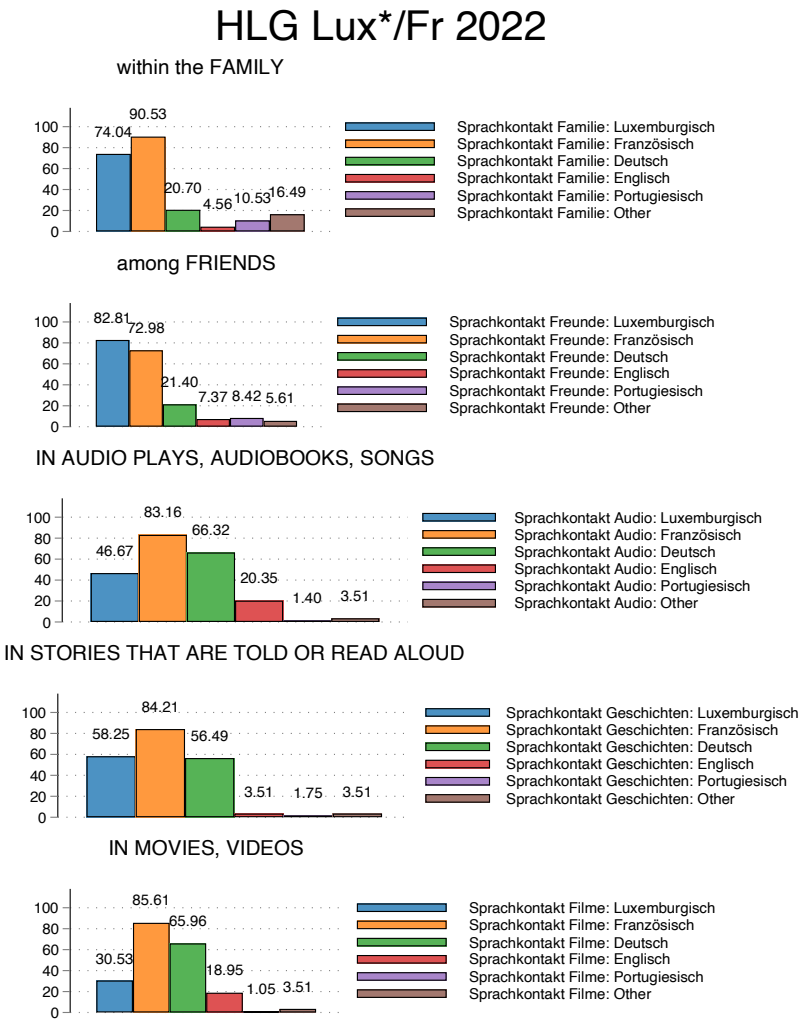


Figure 34. Contact with languages in different contexts within the Luxembourgish*/French home language group (sample of Luxembourg's first graders in 2022)

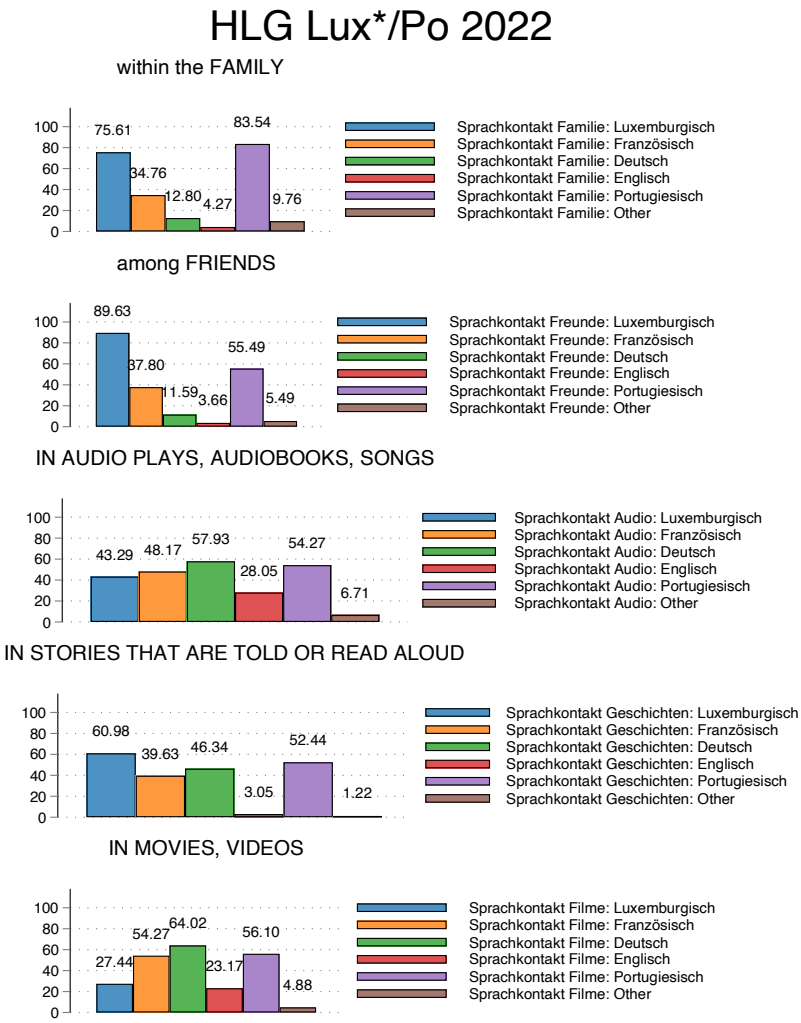


Figure 35. Contact with languages in different contexts within the Luxembourgish*/Portuguese home language group (sample of Luxembourg's first graders in 2022)

Table 1. Attendance of different types of ECEC by family background in Luxembourg (marginal effects)

	only *crèche*	only *précoce*	*crèche + précoce*
Socioeconomic status	-0.000	-0.002***	0.002***
	(0.000)	(0.000)	(0.000)
First generation	0.188***	-0.094***	-0.124***
	(0.009)	(0.008)	(0.010)
Second generation	0.004	-0.037***	0.034***
	(0.007)	(0.007)	(0.008)
Native	(reference group)	(reference group)	(reference group)
French	0.052***	-0.175***	0.112***
	(0.010)	(0.009)	(0.012)
Portuguese	0.027**	-0.075***	0.052***
	(0.009)	(0.009)	(0.010)
South Slavic	-0.007	0.148***	-0.146***
	(0.014)	(0.017)	(0.017)
Lux*/French	0.068***	-0.133***	0.062***
	(0.012)	(0.010)	(0.013)
Lux*/Portuguese	0.033*	-0.096***	0.070***
	(0.013)	(0.012)	(0.015)
Other language	0.049***	-0.099***	0.049***
	(0.008)	(0.008)	(0.009)
Luxembourgish*	(reference group)	(reference group)	(reference group)
Controls (gender, year)	included	included	included
N	29670	29670	29670

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

• • •

Table 2. Time in *crèche* by family background in Luxembourg (marginal effects)

	Duration	Intensity
Socioeconomic status	0.003*	-0.012***
	(0.001)	(0.002)
First generation	-0.306***	0.304***
	(0.037)	(0.045)
Second generation	0.021	0.317***
	(0.029)	(0.034)
Native	(reference group)	(reference group)
French	0.259+	-0.595**
	(0.152)	(0.184)
Portuguese	0.637***	-0.486***
	(0.105)	(0.128)
South Slavic	0.018	-0.942***
	(0.231)	(0.279)
Lux*/French	0.304	0.126
	(0.195)	(0.237)
Lux*/Portuguese	0.223	-0.215
	(0.177)	(0.214)
Other language	0.231*	-0.350**
	(0.104)	(0.126)
Luxembourgish*	(reference group)	(reference group)
Intensity (in hours per week)	0.288***	(omitted)
	(0.009)	
précoce	-0.242***	-0.168**
	(0.045)	(0.054)
French x SES	-0.003	0.025***
	(0.003)	(0.003)
Portuguese x SES	-0.007***	0.020***
	(0.002)	(0.003)
South Slavic x SES	-0.006	0.024***
	(0.005)	(0.006)
Lux*/French x SES	-0.003	0.008*
	(0.003)	(0.004)
Lux*/Portuguese x SES	0.001	0.010*
	(0.004)	(0.004)
Other language x SES	-0.004*	0.017***
	(0.002)	(0.002)
Duration (in years)	(omitted)	0.422***
		(0.013)
Controls (gender, year)	(included)	(included)
Constant	2.643***	1.810***
	(0.095)	(0.119)
N	7,190	7,190
R-squared	0.177	0.256

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

• • •

Table 3. *Crèche* language by family background in Luxembourg (marginal effects)

	Crèche Lux*	*Crèche* French	*Crèche* Portuguese	*Crèche* English	*Crèche* Lux/ French	*Crèche* Lux/Portu-guese
Socioeconomic status	0.000**	0.001***	-0.000**	0.000***	0.001***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
First generation	-0.124***	0.034***	0.061***	0.017***	-0.068***	0.016***
	(0.009)	(0.006)	(0.004)	(0.002)	(0.007)	(0.003)
Second generation	-0.042***	0.037***	0.001	0.002*	0.008	0.005**
	(0.008)	(0.005)	(0.001)	(0.001)	(0.006)	(0.002)
Native	(reference group)	(reference group)	(reference group)	(reference group)	(reference group)	(reference group)
Luxembourgish*	0.149***	-0.089***	-0.002	-0.014***	-0.065***	-0.001
	(0.009)	(0.005)	(0.001)	(0.002)	(0.007)	(0.001)
French	-0.116***	0.117***	-0.005***	-0.014***	0.158***	-0.004***
	(0.009)	(0.009)	(0.001)	(0.002)	(0.010)	(0.001)
Portuguese	0.011	-0.055***	0.040***	-0.018***	-0.090***	0.038***
	(0.008)	(0.005)	(0.003)	(0.002)	(0.007)	(0.003)
South Slavic	0.006	-0.053***	-0.004***	-0.013***	-0.100***	-0.003
	(0.015)	(0.009)	(0.001)	(0.003)	(0.012)	(0.002)
Lux*/French	-0.026*	0.038***	-0.003*	-0.012***	0.105***	-0.003
	(0.012)	(0.010)	(0.001)	(0.002)	(0.012)	(0.002)
Lux*/Portuguese	0.040**	-0.057***	0.038***	-0.017***	-0.063***	0.046***
	(0.014)	(0.009)	(0.007)	(0.002)	(0.012)	(0.006)
Other home language	(reference group)	(reference group)	(reference group)	(reference group)	(reference group)	(reference group)
Pre-Reform Dummy	0.016*	0.003	0.001	-0.001	-0.039***	0.000
	(0.008)	(0.005)	(0.002)	(0.002)	(0.007)	(0.002)
Post-Reform Dummy	-0.004	-0.012*	0.004+	0.000	0.037***	0.000
	(0.008)	(0.005)	(0.002)	(0.002)	(0.007)	(0.002)
Controls (gender)	(included)	(included)	(included)	(included)	(included)	(included)
N	29,664	29,664	29,664	29,664	29,664	29,664

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

• • •

Table 4. Association of family background and ECEC with learning performance in Luxembourg (marginal effects)

	Lux. *listening*	***Early literacy***	***Mathematics***
No ECEC attendance	-19.037*	-2.683	-3.164
	(8.287)	(9.984)	(8.029)
Only *précoce*	5.442**	6.506**	.095*
	(1.940)	(2.337)	(1.880)
Crèche and *précoce*	12.952***	10.108***	7.614***
	(1.602)	(1.931)	(1.553)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	16.401***	9.328***	16.454***
	(1.658)	(1.997)	(1.606)
Socioeconomic status	1.324***	1.792***	1.367***
	(0.045)	(0.054)	(0.044)
First generation	-26.787***	2.179	3.725+
	(2.306)	(2.779)	(2.235)
Second generation	-22.619***	-3.790+	0.974
	(1.835)	(2.211)	(1.778)
Native	(reference group)	(reference group)	(reference group)
French	-63.557***	-27.466***	-19.275***
	(2.661)	(3.206)	(2.578)
Portuguese	-72.343***	-38.574***	-27.424***
	(2.383)	(2.871)	(2.308)
South Slavic	-75.267***	-28.759***	-28.494***
	(4.199)	(5.059)	(4.068)
Lux*/French	-39.752***	-14.443***	-12.421***
	(2.892)	(3.484)	(2.802)
Lux*/Portuguese	-67.529***	-38.669***	-35.323***
	(3.412)	(4.111)	(3.306)
Other	-54.504***	-15.322***	-14.243***
	(2.091)	(2.519)	(2.026)
Luxembourgish*	(reference group)	(reference group)	(reference group)
Age	18.049***	22.209***	22.935***
	(1.378)	(1.660)	(1.335)
Gender (female)	12.038***	15.918***	-8.742***
	(1.309)	(1.577)	(1.268)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-56.399***	-70.605***	-60.664***
	(3.027)	(3.647)	(2.933)
Constant	353.950***	272.544***	310.358***
	(9.836)	(11.850)	(9.530)
N	15,389	15,389	15,389
R squared	0.311	0.171	0.153

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

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Table 5. Association of family background and ECEC with learning performance in Luxembourg including *crèche* languages (marginal effects)

	Luxembourgish listening	Early literacy	Mathematics
No ECEC attendance	-36.666***	-12.980	-9.452
	(8.329)	(10.052)	(8.085)
Only *précoce*	-10.474***	-3.968+	-2.715
	(1.833)	(2.212)	(1.779)
Crèche French	-14.052***	-9.440**	-2.625
	(2.397)	(2.893)	(2.327)
Crèche Lux*/French	-10.022***	-4.724*	-2.482
	(1.910)	(2.305)	(1.854)
Crèche Lux*/Portuguese	-11.783*	-11.809+	-7.163
	(5.324)	(6.426)	(5.168)
Crèche English	-30.810***	-7.814	-9.624
	(6.043)	(7.294)	(5.866)
Crèche Portuguese	-5.866	5.090	9.135
	(7.447)	(8.987)	(7.228)
Crèche Other	-20.176***	-9.143**	-4.992*
	(2.450)	(2.957)	(2.378)
Crèche Luxembourgish*	(reference group)	(reference group)	(reference group)
Cycle 1	17.546***	10.606***	7.470***
	(1.645)	(1.985)	(1.596)
Socioeconomic status	1.339***	1.802***	1.371***
	(0.045)	(0.055)	(0.044)
First generation	-24.595***	2.070	3.372
	(2.348)	(2.833)	(2.279)
Second generation	-21.514***	-3.313	1.003
	(1.836)	(2.216)	(1.782)
Native	(reference group)	(reference group)	(reference group)
French	-60.557***	-24.855***	-18.109***
	(2.755)	(3.325)	(2.674)
Portuguese	-68.731***	-36.254***	-25.694***
	(2.445)	(2.950)	(2.373)
South Slavic	-75.582***	-28.191***	-28.370***
	(4.203)	(5.073)	(4.080)
Lux*/French	-37.886***	-12.888***	-11.941***
	(2.918)	(3.522)	(2.833)
Lux*/Portuguese	-64.942***	-37.072***	-34.687***
	(3.427)	(4.136)	(3.326)
Other home language	-52.028***	-13.870***	-13.822***
	(2.098)	(2.532)	(2.036)
Luxembourgish*	(reference group)	(reference group)	(reference group)
Age	18.731***	22.634***	23.255***
	(1.376)	(1.661)	(1.335)
Gender (female)	12.073***	15.977***	-8.707***
	(1.308)	(1.578)	(1.269)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-56.496***	-70.925***	-60.936***
	(3.024)	(3.649)	(2.935)

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Constant	325.052***	263.298***	303.209***
	(12.722)	(15.354)	(12.349)
Observations	15,387	15,387	15,387
R-squared	0.312	0.170	0.152

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 6. Association of family background and ECEC with learning performance in Luxembourg including interaction terms (marginal effects)

	Luxembourgish listening	Early literacy	Mathematics
No ECEC attendance	-39.116*	-9.517	-3.960
	(15.207)	(19.162)	(14.552)
Only *précoce*	-8.104	-7.571	4.075
	(5.241)	(6.604)	(5.015)
Crèche and *précoce*	9.084***	3.916	6.066**
	(2.455)	(3.094)	(2.350)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	16.013***	11.829***	4.999*
	(2.504)	(3.155)	(2.396)
Socioeconomic status	1.317***	1.881***	1.280***
	(0.070)	(0.088)	(0.067)
First generation	-28.623***	6.694	5.573
	(3.660)	(4.612)	(3.502)
Second generation	-26.036***	-5.075	-1.352
	(2.857)	(3.600)	(2.734)
Native	(reference group)	(reference group)	(reference group)
Intensity (in hours)	-4.381*	-6.070*	-2.431
	(2.056)	(2.591)	(1.967)
French	-89.612***	-52.618***	-41.961***
	(9.767)	(12.307)	(9.346)
Portuguese	-96.653***	-52.390***	-32.156***
	(6.788)	(8.553)	(6.495)
South Slavic	-102.511***	-46.721***	-35.545***
	(9.472)	(11.935)	(9.064)
Lux*/French	-38.730***	-23.755+	0.937
	(10.655)	(13.426)	(10.196)
Lux*/Portuguese	-64.337***	-31.433*	-22.787*
	(10.603)	(13.360)	(10.146)
Other home language	-77.350***	-40.982***	-27.129***
	(5.795)	(7.302)	(5.545)
Luxembourgish*	(reference group)	(reference group)	(reference group)
Lux* x Intensity	(reference group)	(reference group)	(reference group)
French x Intensity	3.056	8.989*	5.968+
	(3.379)	(4.257)	(3.233)
Portuguese x Intensity	7.247*	8.592*	7.114**
	(2.816)	(3.548)	(2.694)
South Slavic x Intensity	6.026	1.009	9.421+
	(5.646)	(7.114)	(5.403)
Lux*/French x Intensity	-2.661	1.260	-6.017
	(4.356)	(5.489)	(4.169)
Lux*/Portuguese x Intensity	-4.452	-8.205	-3.988
	(5.022)	(6.328)	(4.806)
Other language x Intensity	3.341	10.382**	5.610*
	(2.659)	(3.351)	(2.545)
Age	17.594***	23.400***	21.480***
	(2.123)	(2.675)	(2.032)

Gender (female)	12.913***	13.815***	-10.611***
	(2.029)	(2.556)	(1.941)
Gender (male)	(Reference group)	(Reference group)	(Reference group)
Allongement de cycle	-64.789***	-81.642***	-63.544***
	(4.772)	(6.012)	(4.566)
Duration (in years)	-0.889	0.822	3.067
	(2.235)	(2.817)	(2.139)
Lux* x Duration	.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
French x Duration	5.027	-0.442	2.533
	(4.060)	(5.116)	(3.885)
Portuguese x Duration	-1.124	-5.599	-6.053*
	(3.205)	(4.039)	(3.067)
South Slavic x Duration	0.899	7.285	-10.301
	(7.087)	(8.930)	(6.781)
Lux*/French x Duration	0.139	2.316	1.882
	(5.207)	(6.561)	(4.983)
Lux*/Portuguese x Duration-	0.836	5.318	-2.021
	(5.626)	(7.089)	(5.384)
Other x Duration	4.210	-1.534	-1.983
	(3.050)	(3.843)	(2.918)
Constant	374.011***	286.746***	330.877***
	(15.679)	(19.756)	(15.003)
Controls (year dummies)	(included)	(included)	(included)
Observations	6,419	6,419	6,419
R-squared	0.348	0.182	0.155

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 7. Association of family background and ECEC with learning performance in Luxembourg split by socioeconomic status (marginal effects)

	High socioeconomic status (upper 25 %)		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	-28.912	-11.753	-13.460
	(19.592)	(24.712)	(19.767)
Only *précoce*	9.894*	11.448*	12.350**
	(4.461)	(5.627)	(4.501)
Crèche and *précoce*	11.407**	12.105**	12.557***
	(3.543)	(4.468)	(3.574)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	21.396***	8.370+	4.323
	(3.642)	(4.593)	(3.674)
First generation	-28.651***	-1.985	4.803
	(4.855)	(6.124)	(4.898)
Second generation	-25.822***	-4.313	1.804
	(4.286)	(5.407)	(4.325)
Native	(reference group)	(reference group)	(reference group)
French	-69.930***	-38.373***	-27.387***
	(5.524)	(6.968)	(5.574)
Portuguese	-98.495***	-58.244***	-48.743***
	(7.718)	(9.735)	(7.787)
South Slavic	-73.957***	-28.261	-23.563+
	(13.818)	(17.429)	(13.942)
Lux*/French	-34.747***	-14.574*	-14.146**
	(5.215)	(6.578)	(5.262)
Lux*/Portuguese	-74.274***	-30.649*	-32.259**
	(9.963)	(12.567)	(10.052)
Other language	-53.633***	-22.774***	-19.593***
	(4.440)	(5.600)	(4.480)
Luxembourgish*	(reference group)	(reference group)	(reference group)
Age	20.878***	25.785***	28.137***
	(3.081)	(3.886)	(3.109)
Gender (female)	11.206***	15.436***	-10.015***
	(2.861)	(3.609)	(2.887)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-96.609***	-115.584***	-109.194***
	(10.664)	(13.451)	(10.760)
Constant	422.230***	377.780***	382.926***
	(20.632)	(26.023)	(20.816)
Observations	3,235	3,235	3,235
R-squared	0.264	0.084	0.085

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

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	Low socioeconomic status (lower 25 %)		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	-29.323+	-30.107	-4.998
	(16.988)	(20.162)	(16.576)
Only *précoce*	0.264	6.291	5.770
	(3.838)	(4.554)	(3.744)
Crèche and *précoce*	7.961*	8.204*	5.694+
	(3.387)	(4.019)	(3.305)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	14.538***	7.722*	6.886*
	(3.289)	(3.904)	(3.210)
First generation	-30.733***	-12.255*	-3.475
	(5.146)	(6.108)	(5.022)
Second generation	-28.077***	-10.186*	-2.881
	(4.068)	(4.828)	(3.969)
Native	(reference group)	(reference group)	(reference group)
French	-59.901***	-24.920**	-17.724**
	(6.995)	(8.301)	(6.825)
Portuguese	-56.975***	-28.199***	-16.534***
	(4.906)	(5.822)	(4.787)
South Slavic	-58.865***	-16.377+	-21.616**
	(7.474)	(8.870)	(7.292)
Lux*/French	-51.074***	-17.101+	-17.172*
	(8.197)	(9.728)	(7.998)
Lux*/Portuguese	-61.114***	-37.771***	-27.600***
	(6.999)	(8.306)	(6.829)
Other language	-58.389***	-21.060***	-15.815**
	(4.944)	(5.868)	(4.824)
Luxembourgish*	(reference group)	(reference group)	(reference group)
Age	13.320***	19.868***	18.166***
	(2.800)	(3.323)	(2.732)
Gender (female)	14.524***	16.259***	-5.477*
	(2.745)	(3.258)	(2.678)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-49.001***	-63.460***	-53.310***
	(4.723)	(5.605)	(4.608)
Constant	418.255***	342.604***	368.271***
	(20.626)	(24.479)	(20.125)
Observations	3409	3409	3409
R-squared	0.213	0.085	0.066

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 8. Association of family background and ECEC with learning performance in Luxembourg split by migration status (marginal effects)

	First generation		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	-11.359	-8.864	-8.757
	(10.634)	(12.916)	(10.329)
Only *précoce*	0.485	-6.560	-6.621
	(5.832)	(7.084)	(5.665)
Crèche and *précoce*	10.752*	3.733	-1.528
	(4.185)	(5.083)	(4.064)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	33.224***	15.900***	8.168*
	(3.439)	(4.177)	(3.340)
Socioeconomic status	1.289***	1.858***	1.371***
	(0.118)	(0.144)	(0.115)
Immigration status	(omitted)	(omitted)	(omitted)
French	-69.147***	-14.148	-4.716
	(7.707)	(9.361)	(7.486)
Portuguese	-83.639***	-36.146***	-30.522***
	(7.519)	(9.132)	(7.303)
South Slavic	-85.345***	-47.498**	-38.158**
	(12.318)	(14.962)	(11.965)
Lux*/French	-56.429***	-32.781*	-21.087*
	(10.945)	(13.293)	(10.631)
Lux*/Portuguese	-89.601***	-55.713**	-36.128**
	(14.205)	(17.253)	(13.797)
Other home language	-71.022***	-12.528	-7.184
	(6.784)	(8.240)	(6.589)
Luxembourgish*	(reference group)	(reference group)	(reference group)
Age	18.108***	31.043***	25.749***
	(3.635)	(4.415)	(3.531)
Gender (female)	8.257*	9.492*	-12.812***
	(3.595)	(4.366)	(3.491)
Gender (female)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-38.026***	-50.517***	-36.220***
	(6.986)	(8.485)	(6.785)
Constant	319.664***	210.024***	296.786***
	(26.435)	(32.107)	(25.675)
Observations	2,152	2,152	2,152
R-squared	0.221	0.172	0.159

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

	Second generation		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	-69.651**	11.115	-4.944
	(21.734)	(26.116)	(21.320)
Only *précoce*	-13.219***	-1.995	-1.754
	(3.257)	(3.914)	(3.195)
Crèche and *précoce*	10.219***	7.154*	7.459**
	(2.582)	(3.103)	(2.533)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	10.592***	8.228*	3.254
	(2.751)	(3.305)	(2.698)
Socioeconomic status	1.173***	1.599***	1.290***
	(0.073)	(0.088)	(0.072)
Immigration status	(omitted)	(omitted)	(omitted)
French	-35.363***	-5.744	-5.428
	(5.657)	(6.797)	(5.549)
Portuguese	-48.488***	-20.399**	-11.319*
	(5.353)	(6.432)	(5.251)
South Slavic	-45.261***	-3.992	-10.018
	(6.524)	(7.839)	(6.399)
Lux/Ger/French	-22.899**	-5.040	-2.965
	(7.105)	(8.538)	(6.970)
Lux/Ger/Portuguese	-48.406***	-26.423**	-23.147**
	(7.283)	(8.752)	(7.144)
Other home languages	-30.758***	6.766	0.940
	(5.264)	(6.325)	(5.163)
Luxembourgish*	(reference group)	(reference group)	(reference group)
Age	16.145***	17.674***	21.196***
	(2.251)	(2.704)	(2.208)
Gender (female)	14.523***	13.913***	-9.169***
	(2.131)	(2.561)	(2.090)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-43.078***	-60.238***	-54.012***
	(4.508)	(5.417)	(4.422)
Constant	348.485***	298.982***	320.479***
	(16.539)	(19.874)	(16.224)
Observations	5,744	5,744	5,744
R-squared	0.151	0.139	0.127

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

	Native		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	0.983	1.086	-2.810
	(18.328)	(22.375)	(17.827)
Only *précoce*	16.534***	15.046***	10.923***
	(2.657)	(3.244)	(2.584)
Crèche and *précoce*	13.585***	14.850***	11.212***
	(2.333)	(2.848)	(2.269)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	9.889***	7.410*	10.408***
	(2.649)	(3.233)	(2.576)
Socioeconomic status	1.456***	1.906***	1.408***
	(0.065)	(0.080)	(0.064)
Immigration status	(omitted)	(omitted)	(omitted)
French	-83.202***	-41.925***	-25.805***
	(4.624)	(5.645)	(4.497)
Portuguese	-82.696***	-41.549***	-28.455***
	(3.916)	(4.781)	(3.809)
South Slavic	-109.485***	-43.490**	-33.198**
	(13.082)	(15.970)	(12.724)
Lux*/French	-36.046***	-6.847+	-8.131*
	(3.379)	(4.124)	(3.286)
Lux*/Portuguese	-63.188***	-32.541***	-33.901***
	(4.179)	(5.102)	(4.065)
Other home language	-47.591***	-19.299***	-18.221***
	(2.763)	(3.373)	(2.687)
Luxembourgish*	(reference group)	(reference group)	(reference group)
Age	20.773***	23.492***	23.847***
	(1.960)	(2.392)	(1.906)
Gender (female)	10.906***	19.106***	-7.588***
	(1.835)	(2.241)	(1.785)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-84.129***	-94.852***	-83.074***
	(5.008)	(6.114)	(4.871)
Constant	336.335***	252.929***	291.029***
	(14.034)	(17.133)	(13.650)
Observations	7,491	7,491	7,491
R-squared	0.260	0.167	0.157

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

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Table 9. Association of family background and ECEC with learning performance in Luxembourg split by home language group (marginal effects)

	Luxembourgish* home language group		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	-28.682	-21.030	-6.719
	(18.716)	(22.737)	(18.412)
Only *précoce*	13.206***	15.322***	9.842**
	(3.208)	(3.898)	(3.156)
Crèche and *précoce*	11.267***	14.390***	10.974***
	(2.948)	(3.581)	(2.900)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	7.438*	12.001**	10.885***
	(3.275)	(3.979)	(3.222)
Socioeconomic status	1.498***	2.009***	1.516***
	(0.079)	(0.096)	(0.077)
First generation	-13.165*	3.394	0.589
	(6.116)	(7.431)	(6.017)
Second generation	-44.357***	-20.354***	-11.238*
	(5.025)	(6.105)	(4.943)
Native	(reference group)	(reference group)	(reference group)
Home language group	(omitted)	(omitted)	(omitted)
Age	21.149***	21.301***	23.763***
	(2.377)	(2.887)	(2.338)
Gender (female)	10.977***	23.577***	-5.117*
	(2.245)	(2.727)	(2.208)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-109.061***	-114.741***	-105.014***
	(6.481)	(7.874)	(6.376)
Constant	335.159***	251.566***	286.314***
	(16.957)	(20.601)	(16.682)
Observations	5,081	5,081	5,081
R-squared	0.170	0.161	0.146

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

	French home language group		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	-7.939	20.094	-2.042
	(15.364)	(19.493)	(15.834)
Only *précoce*	0.553	11.307	3.384
	(7.475)	(9.485)	(7.704)
Crèche and *précoce*	16.526***	14.733*	12.802**
	(4.652)	(5.902)	(4.794)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	30.950***	14.668*	7.205
	(4.564)	(5.790)	(4.703)
Socioeconomic status	1.191***	1.422***	1.249***
	(0.150)	(0.190)	(0.154)
First generation	3.973	31.082***	22.941***
	(6.287)	(7.977)	(6.479)
Second generation	2.971	13.887*	7.322
	(5.124)	(6.501)	(5.280)
Native	(reference group)	(reference group)	(reference group)
Home language group	(omitted)	(omitted)	(omitted)
Age	28.916***	29.187***	36.099***
	(4.294)	(5.449)	(4.426)
Gender (female)	14.692***	12.327*	-14.640***
	(4.013)	(5.091)	(4.135)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-48.598***	-85.697***	-74.387***
	(9.852)	(12.500)	(10.154)
Constant	184.277***	192.345***	205.302***
	(30.539)	(38.748)	(31.474)
Observations	1,507	1,507	1,507
R-squared	0.147	0.110	0.135

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

	Portuguese home language group		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	-25.119	-32.303	-18.784
	(23.362)	(27.577)	(22.770)
Only *précoce*	-3.665	0.818	1.686
	(4.160)	(4.910)	(4.054)
Crèche and *précoce*	10.068**	2.722	2.828
	(3.426)	(4.044)	(3.339)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	13.914***	8.217+	6.194+
	(3.615)	(4.267)	(3.523)
Socioeconomic status	0.439***	0.967***	0.740***
	(0.102)	(0.121)	(0.100)
First generation	-19.242***	0.482	-4.169
	(5.026)	(5.932)	(4.898)
Second generation	-14.537***	-3.449	0.828
	(4.037)	(4.765)	(3.934)
Native	(reference group)	(reference group)	(reference group)
Home language group	(omitted)	(omitted)	(omitted)
Age	14.866***	15.544***	18.660***
	(3.000)	(3.541)	(2.924)
Gender (female)	10.136***	5.060	-13.337***
	(2.871)	(3.389)	(2.798)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-33.150***	-45.146***	-39.890***
	(5.298)	(6.253)	(5.163)
Constant	345.875***	324.381***	337.428***
	(21.298)	(25.140)	(20.758)
Observations	2,864	2,864	2,864
R-squared	0.062	0.050	0.057

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

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	South Slavic home language group		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	-83.617*	-38.346	-47.615
	(33.517)	(41.876)	(31.695)
Only *précoce*	-18.959+	0.907	-2.852
	(9.697)	(12.116)	(9.170)
Crèche and *précoce*	-10.690	-4.577	-6.260
	(10.261)	(12.820)	(9.703)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	-3.176	14.344	-1.837
	(9.018)	(11.267)	(8.527)
Socioeconomic status	0.602*	1.114***	1.020***
	(0.257)	(0.321)	(0.243)
First generation	7.304	-3.738	-5.008
	(16.718)	(20.888)	(15.810)
Second generation	9.895	12.748	6.912
	(13.834)	(17.285)	(13.082)
Native	(reference group)	(reference group)	(reference group)
Home language group	(omitted)	(omitted)	(omitted)
Age	8.273	33.115***	29.150***
	(7.562)	(9.447)	(7.150)
Gender (female)	15.651*	27.056**	6.545
	(7.323)	(9.150)	(6.925)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-30.342*	-56.908**	-51.596***
	(14.963)	(18.695)	(14.150)
Constant	407.262***	186.218**	267.621***
	(56.794)	(70.959)	(53.707)
Observations	470	470	470
R-squared	0.083	0.090	0.101

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

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	Lux*/French home language group		
	Luxembourgish listening	**Early literacy**	**Mathematics**
No ECEC attendance	21.429	15.586	7.797
	(31.459)	(37.547)	(28.938)
Only *précoce*	11.739	15.267	10.919
	(8.633)	(10.304)	(7.941)
Crèche and *précoce*	11.744+	20.961**	12.676*
	(6.052)	(7.223)	(5.567)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	20.508**	-1.902	3.578
	(6.635)	(7.919)	(6.103)
Socioeconomic status	1.965***	2.090***	1.616***
	(0.186)	(0.222)	(0.171)
First generation	-35.619***	-26.672*	-14.142
	(9.480)	(11.314)	(8.720)
Second generation	-31.560***	-23.594**	-9.608+
	(6.124)	(7.309)	(5.633)
Native	(reference group)	(reference group)	(reference group)
Home language group	(omitted)	(omitted)	(omitted)
Age	19.012***	21.185**	20.771***
	(5.684)	(6.784)	(5.228)
Gender (female)	4.387	14.656*	-13.067**
	(5.253)	(6.270)	(4.832)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-72.359***	-79.466***	-74.340***
	(14.312)	(17.081)	(13.165)
Constant	271.252***	266.379***	305.419***
	(40.275)	(48.068)	(37.047)
Observations	966	966	966
R-squared	0.201	0.153	0.159

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

	Luxembourgish/Portuguese home language group		
	Luxembourgish listening	**Early literacy**	**Mathematics**
Only *précoce*	3.663	8.155	-0.942
	(8.811)	(10.865)	(8.025)
Crèche and *précoce*	11.714	21.962*	10.599
	(7.386)	(9.108)	(6.727)
Only *crèche*	(reference group)	(reference group)	(reference group)
Cycle 1	17.326*	11.248	10.560
	(8.055)	(9.932)	(7.336)
Socioeconomic status	1.080***	1.946***	1.042***
	(0.216)	(0.267)	(0.197)
First generation	-43.487***	-22.400	-5.421
	(12.945)	(15.963)	(11.790)
Second generation	-30.315***	-12.274	-4.040
	(6.794)	(8.378)	(6.188)
Native	(reference group)	(reference group)	(reference group)
Home language group	(omitted)	(omitted)	(omitted)
Age	20.200**	34.276***	20.987***
	(6.464)	(7.971)	(5.887)
Gender (female)	12.716*	10.845	-2.672
	(6.209)	(7.656)	(5.655)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle	-78.372***	-83.158***	-64.650***
	(14.069)	(17.348)	(12.813)
Constant	295.298***	151.322**	291.550***
	(46.346)	(57.147)	(42.209)
Observations	667	667	667
R-squared	0.186	0.177	0.116

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 10. Association of family background and ECEC with learning performance in Luxembourg (standardized coefficients)

	Luxembourgish listening	Early literacy	Mathematics
No ECEC attendance (standardized)	-0.016*	-0.002	-0.003
	(0.007)	(0.007)	(0.008)
Only *précoce* (standardized)	0.023**	0.025**	0.020*
	(0.008)	(0.009)	(0.009)
Crèche and *précoce* (standardized)	0.066***	0.047***	0.045***
	(0.008)	(0.009)	(0.009)
Only *crèche (standardized*	(reference group)	(reference group)	(reference group)
Cycle 1 (standardized)	0.069***	0.036***	0.031***
	(0.007)	(0.008)	(0.008)
Socioeconomic status (standardized)	0.218***	0.269***	0.258***
	(0.007)	(0.008)	(0.008)
First generation (standardized)	-0.095***	0.007	0.015+
	(0.008)	(0.009)	(0.009)
Second generation (standardized)	-0.112***	-0.017+	0.006
	(0.009)	(0.010)	(0.010)
Native (standardized)	(reference group)	(reference group)	(reference group)
French (standardized)	-0.196***	-0.077***	-0.068***
	(0.008)	(0.009)	(0.009)
Portuguese (standardized)	-0.290***	-0.141***	-0.126***
	(0.010)	(0.010)	(0.011)
South Slavic (standardized)	-0.133***	-0.046***	-0.058***
	(0.007)	(0.008)	(0.008)
Lux*/French (standardized)	-0.099***	-0.033***	-0.035***
	(0.007)	(0.008)	(0.008)
Lux*/Portuguese (standardized)	-0.141***	-0.073***	-0.084***
	(0.007)	(0.008)	(0.008)
Other home language (standardized)	-0.239***	-0.061***	-0.072***
	(0.009)	(0.010)	(0.010)
Luxembourgish* (standardized)	(reference group)	(reference group)	(reference group)
Age (standardized)	0.093***	0.105***	0.136***
	(0.007)	(0.008)	(0.008)
Gender (female) (standardized)	0.062***	0.074***	-0.051***
	(0.007)	(0.007)	(0.007)
Gender (male)	(reference group)	(reference group)	(reference group)
Allongement de cycle (standardized)	-0.134***	-0.153***	-0.165***
	(0.007)	(0.008)	(0.008)
Constant	0.042*	-0.063***	0.000

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	(0.017)	(0.019)	(0.019)
N	15,389	15,389	15,389
R squared	0.311	0.171	0.153

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 11. ANOVA on Luxembourgish-German listening difference by home language group for low socioeconomic status subgroup

Summary of Luxembourgish-German listening difference

	Mean	Std. dev.	Freq.
Luxembourgish*	-32.201	70.818	274
French	32.910	73.577	84
Portuguese	31.182	64.808	451
Total	9.894	74.153	809

Analysis of variance

Source	SS	df	MS	F	Prob > F
Between groups	734410.094	2	367205.047	79.81	0.00000
Within groups	3708477.88	806	4601.08918		
Total	4442887.97	808	5498.62373		

Bartlett's equal variances test: chi2(2) = 4.0076 prob>chi2 = 0.135

Comparison of Luxembourgish-German listening difference by home language group (Bonferroni)

Row mean – Col mean	Luxembourgish*	French
French	65.111	
	0.000	
Portuguese	63.383	-1.728
	0.000	1.000

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Table 12. ANOVA on Luxembourgish-German listening difference by home language group for high socioeconomic status subgroup

Summary of Luxembourgish-German listening difference

	Mean	Std. dev.	Freq.
Luxembourgish*	-11.793	77.402	329
French	38.459	57.328	141
Portuguese	33.733	54.385	50
Total	6.211	74.250	520

Analysis of variance

Source	SS	df	MS	F	Prob > F
Between groups	291145.508	2	145572.754	29.28	0.00000
Within groups	2570122.39	517	4971.22318		
Total	2861267.89	519	5513.04026		

Bartlett's equal variances test: chi2(2) = 22.0668 prob>chi2 = 0.000

Comparison of Luxembourgish-German listening difference by home language group (Bonferroni)

Row mean – Col mean	Luxembourgish*	French
French	50.252	
	0.000	
Portuguese	45.526	-4.726
	0.000	1.000

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