Investing in our future: quality investment in education and training

Final report of the Commission expert group

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Expert group on quality investment in education and training

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Foreword

Public investment in education and training is investment in our future. Within the European Union, we are committed to ensure that everyone receives the best education possible. Promoting quality investment in education and training is therefore key: key for students' good learning outcomes, key for teachers, and key for successful reforms in education and training.

However, how exactly do we recognise quality investment? And how can it inform choices to be made? What can we learn from experiences? And how can observed quality investment be applied in education systems with different traditions and characteristics?

To formulate answers to such questions I established the Expert Group on quality investment in education and training in May 2021 with the mandate to identify education and training policies that have the strongest potential to boost education outcomes and inclusiveness, while improving efficiency of public spending.

I am happy to see that the report focuses its analysis on areas that represent the bulk of education and training expenditure and that may indeed have a major impact on education outcomes: teachers and trainers, digital education, infrastructure and learning environment, and equity and inclusion. These areas are of strategic importance to Europe's green and digital transformation and to building resilient economies and societies where no one is left behind.

The main findings of this report will feed into the work of the European Commission, supporting national authorities in making the best possible use of the available resources to strengthen the quality of investment in education and, thereby, strengthen Europe's innovation potential and competitiveness. Therefore, I hope this report will become a source of inspiration for policymakers in the Member States as well as at the European level and contribute to achieving the European Education Area.

I wholeheartedly thank the Expert Group and its Chair, Professor Gabrielle Fack, for the great work done, and for their recommendations – they are helping to create a real education policy evaluation culture in the EU to support quality investment in education and training.

Mariya Gabriel

Commissioner for Innovation, Research, Culture, Education and Youth

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Glossary

TERM	DEFINITION
Ability grouping	Placing students into different classrooms or small groups based on their initial achievement skill levels, readiness, or abilities. Such placements are not permanent school administrative arrangements that lead to restrictions on students' graduation or career paths.
Alternative routes to teaching	Routes that offer people who have not completed coursework in education the opportunity to meet teacher standards and become educators licensed to teach in public schools. They are typically introduced to fill critical teacher shortages.
Basic skills	Basic skills are to be understood according to the OECD's Programme for International Student Assessment (PISA), which measures 15-year-old pupils' ability to use their reading, mathematics and science knowledge and skills to meet real-life challenges.
Blended learning	Blended learning is a pedagogical approach mixing face-to-face and online learning, with some element of learner control over time, place, path, and pace.
Capital expenditure on education	The expenditure for education goods or assets that yield benefits for a period of more than one year. It includes expenditure for construction, renovation and major repairs of buildings and the purchase of heavy equipment or vehicles.
Casualisation of work (also *precarisation*)	The structural trend of moving from full-time, permanent positions to temporary and contract positions, associated with lower levels of social security, increased uncertainty in relation to the future and professional identity.
Class size	Number of pupils in a group studying together.
Cost-benefit analysis	An analysis that aims at comparing the costs with the monetary value of (almost) all benefits

	stemming from an intervention.
Cost-effectiveness analysis	An analysis that relates the costs to the key outcome(s) of an intervention.
Digital capacity or readiness	Digital capacity or readiness is the ability to integrate, optimise and transform digital technologies in different processes and activities. It can be measured by a variety of indicators on different levels.
Digital competences	Digital competence is recognised as one of the key competences for lifelong learning. Being digitally competent involves the confident, critical, and responsible use of, and engagement with, digital technologies for learning, work, and participation in society. The European Digital Competence Framework has identified the key components of digital competence in five areas: information and data literacy; communication and collaboration; digital content creation; safety; and problem solving.
Digital education	Digital education comprises two different but complementary perspectives: the pedagogical use of digital technologies to support and enhance teaching, learning and assessment and the development of digital competences by learners and education and training staff.
Digital literacy	The ability to articulate information needs from digital sources; to locate and retrieve digital data, information and content; to judge the relevance of the source and its content; and to store, manage, and organise digital data, information and content.
(Advanced) digital skills	Advanced digital skills are specialised skills, i.e., skills in designing, developing, managing and deploying technologies, such as high-performance computing, artificial intelligence and cybersecurity at ISCED level 4 and above.
(Basic) digital skills	Basic digital skills allow a basic ability to use digital devices and online applications (for instance to access, filter and manage information, create and share content, communicate and collaborate), and are widely

	considered a critical component of a new set of literacy skills in the digital era, with reading, writing, and numeracy skills.
Digital transition/transformation	Digital transition (digitisation) refers specifically to the conversion of information or data from analogue to digital format. Digital transformation (digitalisation), by contrast, refers to the adoption or increase in use of digital technology by an organisation, an industry, or a country and therefore describes more generally the way digitisation is affecting economy and society.
Disadvantaged students	Those students whose family, social or economic circumstances, personal characteristics or cultural background hinder their ability to learn at school.
Early leaving from education and training	People aged 18-24 who have (at most) lower secondary education and are no longer in education or training.
Effectiveness	Ability to provide high-quality educational outcomes by making the most of the available human and physical resources.
Efficiency	Ability to provide high quality educational outcomes at the lowest possible cost.
Equality	Providing the same opportunities (i.e., equal treatment) to all pupils to start off with positive educational outcomes.
Equity	Providing additional support or attention to students who are more in need.
Inclusion	Inclusive education policies aim to allow all learners to achieve their full potential by providing good quality education to all in mainstream settings with special attention to learners at risk of exclusion and underachievement by actively seeking out to support them and responding flexibly to the circumstances and needs of all learners, including through individualised approaches, targeted support and cooperation with families and local communities.

Learning deficit	Lower educational attainments compared to what students would achieve in 'normal' circumstances.
Learning outcomes	Learning outcomes are statements of what a learner knows, understands and can do on completion of a learning process in formal, non-formal or informal education.
Lifelong learning	Lifelong learning includes all activities undertaken throughout life, with the aim of improving knowledge, skills and competences for personal, civic, social and/or professional reasons. It covers education and training across all ages and in all areas of life - be it formal, non-formal or informal.
Low achievers	Students who score below the baseline level of proficiency in mathematics, reading and/or science as measured by national or international tests (such as PISA).
Mentoring	Support, guidance, or development programmes in which a child or a youth is paired with a non-family adult serving as a positive reference for fostering academic results, school engagement, social competences or any other personal goal or objective.
Multigrade class	A class composed of pupils from different grades studying in one classroom while each of them works toward an individual curriculum corresponding to one's grade.
Newly arrived migrant students	First generation migrant children and young people who, as they enter the formal education system of the host country, may qualify for additional support measures to assist their integration into schools.
One-to-one tuition	An additional and intensive support led by a teacher or teacher assistant oriented to reinforce a learning area working individually with students.
Online learning	Online learning is a methodology involving the use of information and communication technologies (ICTs) to support both teaching and learning. The term may refer to the use of various technologies and tools to support learning in different contexts, including face-to-face settings and distance learning, separately or in combination, in which case it is usually

	called blended learning.
Pedagogical digital competence	The ability to consistently apply the attitudes, knowledge, and skills required to plan and conduct, and to evaluate and revise on an ongoing basis, ICT-supported teaching, based on theory, current research, and proven experience with a view to supporting students' learning in the best possible way.
Peer-effect	The process through which peers' backgrounds might influence their classmates' individual choices and outcomes.
Peer-tutoring	Interventions in which students from different levels of proficiency or age work together for sharing support strategies.
Performance-based incentives	Temporary bonuses based on various indicators of performance, such as students' outcomes, teachers' participation in training courses, publications, etc. The criteria are often elaborated by education authorities who also make decisions on allocations. Incentives may target individuals or groups of teachers.
Physical learning environment	The physical spaces (including formal and informal spaces) in which learners, teachers, content, equipment, and technologies interact.
Remote education	Method of delivery, which involves teaching and learning activities where educators and learners are not physically present in one location at the same time. In this case, learning happens away from the physical site of an educational provider with educators and learners using different means to connect and engage with a programme, course, or educational activity.
School segregation	Separation of students among different schools based on their ethnic or social origin, academic performance, or any other attribute of social or educational vulnerability.
Student-teacher ratio	The number of pupils/students per teacher.
Teacher's effectiveness	Teacher's ability to improve student learning outcomes. The way teacher effectiveness is defined impacts how it is conceived and measured (see also 'teacher's value-added').
Teacher's value-added	Ability to improve student learning outcomes as measured by student gains on standardised tests (Ballou, Sanders, & Wright, 2004) or ratings of teachers' performance through classroom observations (Hafen, Hamre & Allen

	et al., 2015).
Teachers' working conditions	The pecuniary and non-pecuniary elements of the workplace that affect teaching, typically, referring to: (i) leadership; (ii) collegiality, professional learning, and collaboration; (iii) accountability systems; (iv) remuneration and career advancement opportunities; (v) contractual arrangements and job security; and (vi) working hours and workload.
Tracking	Placing students into different classrooms – often different schools (mostly in secondary and high school) based on their choice of academic and vocational tracks, or on their ability or career aspirations in a way that shapes students' destinations and career paths.

Acknowledgements

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This report is dedicated to the memory of **Professor Francesco Pastore (1966-2022)**, who was an internationally renowned academic, a true supporter of the EU project and a very active member of this group.

1. Executive Summary

Education and training are the foundation for personal development and well-being, and their benefits go well beyond the individuals, affecting the whole of society. The private average global rate of return to one extra year of schooling is about 9% a year and social returns to schooling are equally high, measured at above 10% at the secondary and higher education levels. Education and training strongly promote equality, tackling poverty and unemployment and stimulating intergenerational mobility. Disadvantaged pupils, in particular, strongly benefit from quality education and training as they reduce socio-economic differences with those from more affluent families. Education and training also support political and democratic systems, and promote societal cohesion.

Education and training support economic development by improving productivity, stimulating innovation and strengthening employability. They play a large role in building a country's human capital. By equipping people with the right skills, knowledge and competences, education and training can improve productivity and promote environmental sustainability, which are key for the EU to retain its competitiveness in the global market. Moreover, education and training strengthen innovation capacity as people learn to generate and adopt new ideas that spur technological progress. Finally, they boost people's employability, which is the best safeguard against personal hardship and poverty, and positively influences individuals' lives.

Investing in high quality education and training for all is a key priority for the European Union, even more in the current particularly challenging situation. The COVID-19 pandemic has triggered a huge disruption to our education and training systems and it has exacerbated educational inequalities. Moreover, Russia's invasion of Ukraine has created the largest refugee population in the EU since World War II, creating an imperative to support the educational and socio-emotional needs of children and young adults who are directly affected.

This challenging situation brings about significant opportunities for investing more and better in our education and training systems. In the EU, Member States have benefitted from a more flexible application of the EU fiscal rules in 2020-2022. This gives EU countries room for using investment to promote long-term economic growth, including by investing in education and training. At the same time, the EU has been channelling more funds into education and training than ever before through various programmes. In particular, NextGenerationEU, through its Recovery and Resilience Facility (RRF), has become a game-changer by spurring reforms and boosting investment in education and training across the EU. As of 1st September 2022, 25 National Recovery and Resilience Plans had been adopted and RRF funds allocated in these plans totalled EUR 495 billion. All EU Member States have included education and skills-related measures in their National Recovery and Resilience Plans. All levels and sectors are covered and the estimated spending on education and training amounts to around EUR 71 billion, i.e. about 14% of the total estimated costs of those 25 plans.

Nevertheless, there is no guarantee that increasing public spending automatically yields better results. The relationship between expenditure and educational outcomes or equity largely depends on the context or the policy choices. Although it is evident that below a minimum level of spending, no education and training system can achieve high quality educational outcomes and equity, it is also true that at a comparable level of spending, some EU Member States achieve better results than others. This evidence points to the critical importance of increasing the efficiency and effectiveness of education spending by designing the right policies, programmes or reforms, and putting in place proper implementation strategies.

Therefore, ensuring an adequate level of investment and making the best use of all available public resources to enhance educational outcomes and foster equity is now of critical importance. Promoting quality investment in education and training means making investment *effective*, *equitable* and *efficient*. Effective investment provides good educational outcomes by making the most of the available human and physical resources, while equitable investment reduces shortfalls in educational outcomes linked to a lack of opportunity or socio-economic disadvantage. Finally, an investment that is efficient provides the desired educational outcomes at the lowest possible cost. When all these three conditions are met, we can reasonably consider that a quality investment in education and training has been made.

In the *Communication on Achieving the European Education Area by 2025*, the Commission has proposed to intensify the work on quality investment in education and training. The Council has also endorsed this proposal in its Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond. This points to the high political attention given to this topic. All key actors are aware that it is time to act now because the earlier the investment is made, the larger the future benefits.

As a first concrete step, an Expert Group on Quality Investment in Education and Training was created at EU level in May 2021. Its overall mission was to help the Commission and the EU Member States identify those education and training policies that have the potential to boost education outcomes, promote inclusion and equity, ensure pupils' well-being and improve the efficiency of public spending. This was not an easy task because while policy evaluations can show that a particular programme has been successful in improving outcomes in some contexts, the results are not always transferable to a different context. Therefore, it is always extremely difficult to distinguish what defines a quality investment in education and training in general.

The group has focused its analysis on those areas that represent the bulk of education and training public expenditure, and that may have a large impact on education outcomes and equity. Those areas are: i) teachers and trainers; ii) digital education; iii) management of education infrastructure and related physical and human resources; and iv) equity and inclusion. While providing an exhaustive and extensive literature review of each topic was beyond the scope of this report, the group has relied on experts' academic knowledge of each topic to provide a clear picture on the state of knowledge on different areas of investment for quality education and training. The aim was to identify the types of educational investments that have already been extensively studied in the academic literature and for which clear policy conclusions can be drawn, but also to point out important areas where existing evidence is still lacking.

Teachers and trainers

Teachers and trainers play a key role in students' achievements and life chances and their salaries represent the largest budgetary element at all levels of education. According to most recent data, in 2020 the compensation of employees represented 65% of total public expenditure on education at EU level. Research shows a positive link between teacher quality and student performance. Consecutive years of effective teaching can also offset learning gaps for disadvantaged pupils.

Recruiting effective teachers is a key policy concern for education authorities. It is all the more pressing given that most EU Member States are faced with general teacher shortages, sometimes exacerbated by an unbalanced distribution across subjects and geographies, an ageing teaching force, as well as high attrition and low

enrolment in initial teacher education. There are particular challenges in recruiting effective teachers in high-demand subjects and hard-to staff schools.

The decision to become a teacher is influenced by financial rewards as well as expectations on what the work entails in terms of career opportunities or social status. Competitive salaries that are on par with the remuneration paid to adults with similar education levels working in comparable occupations, enhance the ability of school systems to attract and retain teachers. At the same time, teachers' working conditions (such as leadership opportunities) have been reported as 'highly predictive' of teachers' stated intentions to remain in or leave their schools.

A key aspect that affects teachers' working conditions is class size. Several studies on the link between class size and student outcomes in the EU reveal a beneficial impact of smaller classes on education outcomes, if teachers are able to adapt their pedagogical approaches. At the same time, reducing class size tends to come at a relatively high cost, calling for careful cost-benefit considerations.

Teachers' pedagogical digital competences and their attitudes towards technology are particularly important today. Teachers who lag behind in the development of such competences and attitudes do not effectively integrate digital technologies into their teaching. Hence, there is a need to support teachers in developing their pedagogical digital competences. This need is even greater in light of the COVID-19 crisis and the resulting school closures, which elevated online learning from a potential tool to the only option for education.

Finally, it is time to reflect on how parents could support their children's education and teachers and trainers in this demanding task. While many parents see schools as having primary responsibility for formal education and training, shifting the responsibility for teaching and learning entirely to schools is neither feasible nor desirable if we take into account practical and organisational limitations of schools and teachers**.** It may be therefore important to promote parental involvement in children's education. Nevertheless, one of the key challenges is ensuring that all parents have opportunities to support their children's learning, both in home and school settings, and so avoid widening inequalities.

A broad review of literature on the above mentioned topics has helped the experts draw the following **main policy conclusions**:

- Teacher quality is key to boosting education outcomes. Therefore, *ensuring adaquate financial rewards as well as creating good working conditions for teachers is crucial* to having an enthusiastic and dynamic teacher workforce ready for the challenges ahead.
- *A more balanced policy approach addressing both teacher recruitment and retention* allows for the mitigation of the impact of demographic changes on the teaching population.
- *Alternative routes to full teacher qualifications* can be effective ways to attract and retain teachers if underpinned by appropriate support in the form of induction, mentoring, professional development and career opportunities.
- *Recruitment financial incentives work if they are well-designed and targeted precisely*, and if they include requirements to stay in a specific school or area for a certain period of time.
- *Reducing teachers' work-related stress and promoting their well-being* may reduce high turnover and sickness absence.
- *Reducing class size may be effective in schools/areas with high percentages of disadvantaged pupils*. However, *it remains an expensive intervention*.

- *Raising teachers' pedagogical digital competences* may improve student outcomes and promote digital education.
- *Promoting parental involvement may help teachers increase children's academic performance*, but policies should ensure that all parents have opportunities to support their children's learning to avoid widening inequalities.

Digital education

The education and training sectors have been dramatically affected by the digital transformation and emerging technologies. The increased use of digital technologies may help teachers and trainers to effectively provide quality education, including the possibility to open up to a more diverse cohort of learners, increase flexibility, personalisation and inclusion, and offer more interactive and engaging forms of cooperation and communication. At the same time, digital technologies bring challenges as they may also exacerbate inequalities, due to a differential access to these technologies. Nevertheless, the question is not whether to invest in digital education, but what the minimum – or necessary – requirements and standards to aim for are. The 25 national Recovery and Resilience Plans (RRPs) approved as of September 1st, 2022 support digital education and skills with around EUR 28 billion.

The use of digital technologies in school serves two purposes: developing digital skills, and fostering the acquisition of key competencies. In the digital world, acquiring digital skills has become just as important as mastering basic skills. All of them are parts of the key competences each pupils should become proficient in. It is evident that people who can hardly read and write and/or do not understand simple sentences will be excluded from the digital world, apart from simple and passive consumption of content.

Digital education requires appropriate teacher pre- and in-service training, which demands in turn that teacher training institutions are well-equipped for this purpose. Teacher education programmes are a natural place to start preparing teachers to integrate technology in the classroom but approaches to enhance the pedagogical digital competences of in-service teachers, such as mentoring or coaching, online training or formal continuing professional development, are equally important.

Robust evidence on the impact of the use of digital tools within schools is still rather limited in the EU, and there is even less evidence on how digital tools can be used beyond classroom hours. Research has shown that policies such as intense tutoring may help increase the educational outcomes of low-performing pupils, but they require significant resources. However, there is potential to leverage digital technologies to help better connect families, students and schools and to develop compensatory programmes that could be more intensive at a lower cost or reach more students.

Higher education institutions have been promoting the strategic use of digital education in the last few decades. Innovations in digital education were first implemented in higher education under the assumption that relatively older students can manage the use of technology in a more mature way than pupils in primary and secondary schools. As a consequence, experimentation and innovations in online learning were implemented on a wider scale since the early 90s. In spite of this, digitalisation remains challenging, and evolving - it keeps on transforming the way students learn, and institutions plan and deliver educational programmes.

Finally, the intersections between adult learning and digital technologies introduce a plethora of different practices. Digital technologies may be used for tailored/modular provision of learning, which is particularly important for lifelong

learning due to the more heterogeneous starting points of adult learners. Moreover, they have the potential to create the flexibility that especially adult learners, with their many competing responsibilities, need. This can be achieved through blended learning, modular Massive Open Online Courses (MOOCs) or individual learning accounts (ILAs)[1]. Nevertheless, the potential of those practices has not been fully exploited yet and robust evaluations on their effectiveness are still rare.

The results of available research on the effectiveness of digital education in primary, secondary, and higher education as well as adult learning let the experts to draw the following **main policy conclusions**:

- The use of *digital technologies for teaching and learning can offer huge opportunities* to boost educational outcomes, if properly planned and designed. At the same time, *mitigating the risks of digital exclusion or inappropriate use of technology is vital.*
- The *impact of digital education on student outcomes mainly depends on which technologies are selected for use, how they are implemented in the classroom and integrated into the teaching process*. This points to the importance of raising teachers' pedagogical digital competences.
- *Low-tech behavioural interventions that contribute to parental involvement seem promising* given their very limited costs and positive effects on test scores.
- The potential of using *digital tools beyond classroom hours has not been fully realised and more robust evidence of the effectiveness of this is needed*.
- It is important to *further develop a different paradigm for instructional design and delivery of content for adults*, as they have more sophisticated needs and expectations than young learners.
- *The European Commission should promote new experiments in digital education* to broaden the existing knowledge as developments in this area have been rapid and several aspects are relatively new or lack a solid research base.

Management, infrastructure and learning environments

Buildings, classrooms and equipment are crucial elements of learning environments in schools and universities. Education facilities are expected to provide a safe, secure, and accessible physical environment that fosters teaching and learning activities. They are an influential element in the complex education process as they affect the interactions among learners and educators. Good architectural and educational design may be the catalyst for good teaching practices and innovative pedagogies. They can also contribute to the New European Bauhaus initiative[2].

Well-built and well-maintained infrastructure can have positive effects on student well-being and learning outcomes. Policy makers are increasingly interested in understanding the link between the physical learning environment and its impact on student performance and learning outcomes. Concrete evidence about the

[1] See also Council Recommendation on individual learning accounts, recommending Member States to set up a digital portal that links a personal account with training entitlements to eligible training offers and other support services such as career guidance, validation, paid training leave: EUR-Lex - 32022H0627(03) - EN - EUR-Lex (europa.eu)

[2] https://new-european-bauhaus.europa.eu/index_en

impact of learning environments on education outcomes can lead to better informed policy and investment decisions.

Moreover, physical learning environments represent a significant part of educational investments. According to a CEB report[3], 6% of education expenditures or about EUR 48 billion, were allocated to education infrastructure in Europe in 2017 (based on Eurostat data). Educational buildings represent 17% of non-residential buildings in the EU and they are among the oldest. Around 75% of educational buildings in the EU were constructed before 1980[4].

A large part of the current stock would therefore need to be renovated to be more energy efficient and ease the implementation of innovative and blended teaching practices. Despite the high interest and need for understanding the impact of the physical learning environment and its design on learning outcomes to ensure effectiveness and efficiency of education spending, robust empirical evidence is still very limited.

Decision-making processes underpinning the construction and renovation of educational infrastructure are key to ensuring that investments in facilities are effective and efficient. In this report, the group tried to identify policies and approaches used for the management of the education infrastructure network**,** and the allocation of construction, operation and maintenance budgets.

The experts came to the following **main policy conclusions**:

- *Research activities studying the impact of learning environments on education outcomes should receive financial support* because school design needs to evolve to respond to changes in teaching and learning.
- *Developing common tools or frameworks, and defining indicators* for the assessment of the current condition and design of new learning spaces, and their impact on education outcomes is key.
- *An assessment of the current state of building stock* would allow for the establishment of priorities for the renovation and maintenance of educational facilities.
- *Clear criteria and priorities for the allocation of construction, operation and maintenance budgets should be designed at national level* to support the quality and longevity of education infrastructure.
- *Multiple use of educational facilities after school operating hours* might not necessarily generate savings but it brings important non-monetary benefits. The school becomes the centre of their neighbourhood, the area is revitalised and the community is brought together, resulting in improved well-being.
- *Key funding instruments* such as performance based funding in higher education *needs to be based on smart performance measurement systems,* which could also include indicators on the use of infrastructure and learning environments.

[3] Duthilleul, Y., Woolner, P., and Whelan, A. (2021). *Constructing Education: An Opportunity Not to Be Missed*. Thematic Reviews Series Council of Europe Development Bank, Paris.

[4] https://www.europarl.europa.eu/RegData/etudes/STUD/2016/587326/IPOL_STU(2016)587326_EN.pdf

Equity and inclusion

Education and training play an important role in making European societies fairer and more inclusive. However, socio-economic background continues to be a strong determinant of pupils' educational outcomes. The COVID-19 crisis has reinforced the case for improving equity in education as the shift to online learning and the loss of teaching time have brought increased challenges for disadvantaged pupils and are likely to compound existing inequalities.

More equity in education tends to be associated with higher educational outcomes for all. Research shows that education systems that aim at reducing inequality in students' learning conditions are also the ones that get better academic results and improve students' wellbeing. Equity involves a dimension of fairness, a complex concept with no single definition as there are different theories of social justice in political philosophy. Beyond the many debates, all authors agree that fairness is at least making sure that personal and social circumstances – for example gender, socio-economic background or ethnic origin – are not obstacles to achieving life opportunities. In education, this means ensuring that pupils who are more in need receive adeguate additional support or resources.

Large socio-economic inequalities in cognitive and socio-emotional development emerge early in life. Therefore, early interventions, such as investment in early childhood education and care (ECEC), have been advocated to tackle such inequalities. High-quality ECEC is an essential foundation for successful lifelong learning, personal development and later employability, especially for disadvantaged pupils. It can enhance social mobility by helping children from disadvantaged backgrouds acquire the key competences they need for today's economy and society.

School segregation is a critical dimension of education inequality. It implies the homogenisation of school composition, limiting diversity among classmates and increasing the interaction of students with peers of similar background. Research has found that education systems with higher levels of school segregation reduce the opportunities of pupils from lower socio-economic backgrounds. Desegregation policies aim at ending the practice of separating pupils among different schools based on their ethnic or social origins, academic performance or any other attribute of social or educational vulnerability.

Tracking and ability grouping tend to create segregation and may be counterproductive if not well-designed. A more homogeneous learning environment allows teachers to provide instruction better matched to students' needs and students can benefit from interactions with their academically similar peers. Nevertheless, it also creates forms of segregation and limits the opportunity for disadvantaged pupils to learn from better performing pupils. The effects of tracking depend on its organisation, particularly the age at which students are first assigned to a track, the number of tracks or the degree of differentiation.

Priority education policies aim to provide some disadvantaged sub-population with additional resources in order to achieve equal opportunity. The importance of these programmes and their contribution to the reduction of school failure is clear, so even if they require considerable investment, it is worth supporing them.

Student-centred compensatory education aims at improving the results, attendance, experience, and wellbeing of low performing pupils in primary and secondary education. The main compensatory education policies at the student level can include interventions with varying focus and with diverse policy designs. In this report, experts have focused on one-to-one tuition; peer tutoring; mentorships; summer learning programmes; and grade repetition.

Finally, equity issues are becoming more and more evident in higher education. The expansion of tertiary education raises new challenges for funding models, notably on how to contain public costs in the short run while ensuring broad access to education, as the economic benefits of education typically only appear in the medium run. These challenges call for updating higher education governance models and finding effective ways of cost-sharing between the private (e.g., in the form of tuition fees) and the public sector.

After an in-depth analysis of the literature, the experts have drawn the following **main policy conclusions**:

- *ECEC has positive effects especially for the development of disadvantaged pupils*, both for socio-emotional and cognitive skills. Therefore, investing in ECEC is essential and it is particularly cost-effective.
- Nevertheless, *the quality of ECEC is crucial and it should be combined with policies that help to increase take-up among disadvantaged pupils*, who do not always have access to ECEC.
- *Reducing school segregation brings benefits both in terms of equity and quality of education*. Therefore, it is important that desegregation policies are implemented in EU Member States.
- There is *no "optimal level of tracking"*, rather there is a need to find the right balance between differentiation and tracking. Nevertheless, *early tracking seems to have negative effects on equity and inclusion*.
- *Financial resources need to be differentiated according to learner needs.* Schools with higher proportions of disadvantaged pupils would benefit from receiving targeted additional resources. However, the nature and scale of interventions are key to determine the impact of priority education policies on student outcomes and equity.
- *One-to-one tuition and peer tutoring programmes are highly recommended* if they are implemented in an individualised way or through small groups, and interventions should be cohesive, coherent, and sustained.
- *Mentorships and summer programmes are appropriate student-based compensatory policies* but special attention should be paid to their policy design and implementation.
- *Needs-based grants in higher education have a positive effect on completion rates* of disadvantaged students but *they increase enrolment rates only when they provide adequateresources*.

Apart from the four focus areas just mentioned, the experts have also tried to shed light on the consequences of recent disruptions in education and reflect on the role of policy evaluation to promote quality investment. The report than also covers the long-term consequences of the COVID-19 pandemic and the integration of newly arrived migrant students, and gives a broad overview of different methodologies used for education policy evaluation.

COVID-19 implications for learning outcomes

The COVID-19 pandemic resulted in significant challenges for EU education and training systems. Due to the unprecedented school closures, many EU Member States observed a decrease in educational outcomes of their pupils and some recent

studies suggest that such learning deficits do not disappear quickly. It is clear that education disruptions have affected learning progress. The learning deficits, especially in the medium-to-long run, are composed of two elements: i) absolute loss, where pupils forget what they had learned, and ii) slower learning progress, where pupils learn less in a year compared to previous cohorts. Unfortunately, the COVID-19 pandemic has also increased learning disparities.

Education systems currently face two main challenges. First, they should try to 'build back' the COVID-19 learning deficits. As earlier evidence from long term teacher strikes suggests, learning deficits might accumulate over time, resulting in lower participation in higher education, reductions in higher education success and lower income. Significant policy attention should try to avoid this accumulating effect over time. Second, education systems should be reinforced such that they are ready for upcoming pandemics or disruptions.

Significant policy attention should be given to improving digital infrastructure in schools, boosting digital skills and supporting teachers' professional development. Investment in digital infrastructure should cover both hardware and software. Strong digital competences of the population can prevent digital exclusion and foster a knowledge-intensive economy. Furthermore, a significant investment should be made to support teachers' professional development as teachers' digital skills play an important role when it comes to implementing digital education.

Finally, promoting targeted compensatory measures, such as tutoring, accelerated schools, or summer schools and ensuring adequate training opportunities for young people in general and early school leavers in particular remain key. Given the long-term costs of lower human capital formation, compensatory measures are clearly cost-effective. Moreover, given that successful progression to and completion of vocational education and training is important for a successful start to working life, policy actions that supported young people finding a job or accessing and remaining in training should be adopted.

Integration of newly arrived migrant students (NAMS)

Russia's invasion of Ukraine has created an imperative to support the educational and socio-emotional needs of children and young adults impacted, and to integrate them into our education and training systems. This challenging situation adds to social and political developments in the last decade that had already led to changes in patterns of migration within the EU, with an increased number of newly arrived migrant students (NAMS).

PISA results repeatedly confirm the importance for NAMS of learning the language of instruction, for academic success, and likely a host of social and emotional outcomes. Across OECD countries, immigrant students who speak the language of instruction at home are roughly a half-year of learning behind their non-immigrant peers in maths, while immigrant students who do not speak the language of instruction at home are about a year behind. These students are at an even greater disadvantage when it comes to reading.

Therefore, investments in systematic language support programmes are essential. Evidence shows that complete or partial lack of the language of instruction can lead to NAMS being placed into special classes or in special needs schools. Researchers have criticised the 'segregating' nature of this approach, finding that these measures not only do not reach their goal of access to the regular classroom with sufficient linguistic skills, but also impede social interaction between migrant and native students.

In general, a blend of immersion and separation seems to be the best approach. More widely, there needs to be a focus on migrant students within broader inclusive education discourse and efforts**.** It is fundamental that schools provide sufficient and timely support for children to learn and master the language of instruction, ideally within an inclusive framework. Overall, there is evidence that the length of time that children without the language of instruction should spend in preparation classes should be limited and should include a transition to immersion with support. It should be longer for older children, so that they make the transition once they have a basic competency.

Moreover, the need for consistent and responsive professional development supports for teachers meeting the needs of NAMS is also key in ensuring effective educational provision. Teachers should receive effective training to be able to teach the host language as a second language. Research suggests that the most effective professional development will most likely cover language support. This support requires that teachers have strong linguistic knowledge, so that they can effectively teach grammatical structures. They must also be aware of the language structures that present the main hurdles in second-language acquisition and how these can be overcome.

Parental involvement can bring a host of benefits for students in terms of academic achievement, school attendance, social skills and behaviour, wellbeing and educational aspirations. Support to parents of migrant students becomes even more important where parents lack proficiency in the host language, because they are less likely to get actively involved in family-school connections. However, the evidence across countries suggests insufficient policy driven programmes to address the needs of parents of NAMS, either to help them support their children's learning or their children's inclusion (and their own) into the school community.

School leaders and teachers can frame diversity as a learning opportunity. Schools serving NAMS should use heterogeneous groupings wherein they can use the diversity of students as an educational resource. School leaders could also leverage school communities to promote collective responsibility for NAMS. However, schools often have insufficient instructional and organisational capacity. Given the growing diversity in EU schools, initial and continuing professional development and school leadership preparation programmes alike would benefit from engaging with a more dynamic view of culture, creating a space to explore opportunities for both students and schools to adapt their respective cultural practices.

Nevertheless, a one-size-fits-all approach is unlikely to be effective. Therefore, in developing their own, context responsive approach, EU Member States need to test and properly evaluate different approaches and programmes.

Methodologies for education policy evaluation

The review of the evidence conducted for this report revealed that robust evidence from EU Member States is missing. Although the analysis has allowed the identification of many promising education policies, these policies would definitely deserve further experimentation in the EU context. For some areas, such as digital education, and even more so for physical learning environments, more evidence would substantially contribute to improving the efficiency and effectiveness of spending. There are even less evaluations that provide cost-benefit analysis. This is partly due to the lack of data related to the costs of specific investments.

Experimentation and evaluation in education are key steps in the design and successful implementation of policy interventions to ensure that they can be adapted to each specific context. Education policy evaluations aim at rigorously

testing the effectiveness (and efficiency) of policies, programmes and practices. They represent an important source of critical knowledge and information for improving learning outcomes, promoting equal access to education and fostering its competitiveness. High-quality evaluations support evidence-based decision-making among authorities and practitioners.

Developing the expertise for the evaluation and dissemination of key findings at EU level could help fill the current knowledge gap and support the design of effective education policies in the EU Member States. The development of a framework for evaluation would be useful to estimate ex-ante, and evaluate ex-post, the impact of a policy, together with cost-benefit analysis. Research in social science has progressed considerably and methods have been developed that can be used to perform rigorous evaluations, combined with qualitative analysis, to provide a comprehensive assessment of the effect of a policy. The implementation of such methods necessitates the careful design of data infrastructure with the creation of indicators on costs and outcomes. Cost-benefit analysis and evaluation can indeed only be performed when the expected impacts of a policy are clearly identified and measured, and when costs are properly recorded.

The promotion of rigorous impact evaluation and cost-benefit analysis of educational policies in EU Member States could bring several benefits. First, while the experience of successful policies implemented in other contexts is very useful to design future policies, the actual effectiveness of a given policy may depend on the specific context where it is implemented. It is therefore necessary to conduct robust impact evaluation when a policy is implemented in a new setting, in order to adapt it to the specificities of each country and level of education. Second, investing in quality education and training for future generations necessitates innovating with policies that have never been implemented before. Policy designs that allow for experimentation and evaluation can help conceive educational policies for the future. Third, gathering more evidence of policy impacts from different settings allows a better understanding of the mechanisms that explain why some policies might work in some contexts and be less effective in others. It is therefore very useful to gather knowledge from multiple evaluations in different countries and contexts in an easily accessible and comparable way, and see how they have been implemented on the ground as this stage is key for ensuring the effectiveness of a specific policy.

The experts believe that a culture of education policy evaluation should build on four pillars:

1. **Experimentation.** In order to evaluate the efficiency and effectiveness of education policies, it is important to develop more pilot experiences with rigorous evaluations to obtain causal evidence.
2. **Use of appropriate evaluation methods**. Causal evaluation involves the use of appropriate quantitative methods (randomised control trials, quasi experiments, etc.). Quantitative evaluation can be combined with qualitative analysis to provide a comprehensive analysis of the process of policy implementation.
3. **Development of data collection.** Evaluation requires thinking about the outcomes to be measured (cognitive/non-cognitive outcomes, equity measures, labour market outcomes, etc.). The organisation of a data infrastructure that allows the collection of data on such outcome measures and consent to follow the achievements of cohorts of students over time would allow the possibility of studying the medium and long-term beneficial effects of educational policies.
4. **Assessment of costs and benefits.** Education policies are investments with current costs and long-term benefits. It is therefore necessary to perform cost-benefit analysis of education policies to assess the efficiency of such

interventions and choose among different policies to promote sustainable public finances. This also requires the collection of detailed data on costs.

There are gains to be expected from gathering expertise and evidence on policy evaluation at EU level. Therefore, **the experts recommend that the European Commission should continue the analytical work started by this group and give it a medium-to-long term perspective to promote a real evaluation culture in education and training in the EU.**

This would require providing support to EU Member States that want to run education policy evaluations through:

- **Promoting the development of expertise on evaluation methods among policy makers** (both causal quantitative analyses and qualitative studies of the process of policy implementation).
- **Disseminating knowledge** about rigorously evaluated policies to develop and share best practice.
- **Making available EU funding for policy experiments** for the evaluation of the development of innovative education policies through EU programmes such as Horizon Europe.

Please note that the policy conclusions presented in this final report do not represent the official position of the European Commission. This document reflects the views only of the authors, and the European Commission is not liable for any consequence stemming from the reuse of this publication.

2. Introduction

Education and training are the foundation for personal development and well-being, and their benefits go well beyond the individual, influencing the whole of society.[5] The private average global rate of return to one extra year of schooling is about 9% a year and social returns to schooling are equally high, measured at above 10% at the secondary and higher education levels.[6] Education and training strongly promote equality, tackling poverty and stimulating intergenerational mobility. Disadvantaged students, in particular, strongly benefit from quality education and training as they reduce socio-economic differences with those from more affluent families. Education supports active citizenship, increased social cohesion, political participation, and environmental awareness. It contributes towards social justice and more democratic systems.

Education and training have also a strong impact on economic development by improving productivity, stimulating innovation and strengthening employability. They play a large role in building a country's human capital. By equipping people with the right skills, knowledge and competences, education and training can improve productivity and promote environmental sustainability, which are key for the EU to retain its competitiveness in the global market.[7] Moreover, education and training strengthen innovation capacity as people learn to generate and adopt new ideas that spur technological progress.[8] Finally, they boost people's employability, which is the best safeguard against personal hardship and poverty, and positively influences individuals' lives.[9]

The COVID-19 pandemic has triggered a huge disruption to our societies and economies, including our education and training systems. School closures, abrupt transitions to remote education, significant deterioration in teachers' and pupils' well-being are just a few examples of the main challenges faced by education and training systems around the world. Nevertheless, this situation has also brought about significant opportunities for investment in the education and training sector.

In the EU, Member States have benefitted from a more flexible application of the EU fiscal rules in 2020-2022. The European Commission has activated the so-called 'general escape clause', which allows - in a period of severe economic downturn for the EU as a whole - Member States to deviate temporarily from their medium-term budgetary objectives (European Commission 2020; European Commission 2022b)[10]. This has given EU countries more room to use public expenditure to respond to the difficult situation and to invest in the education sector.

At the same time, the EU has been channelling more funds into education and training than ever before through various programmes. In particular, the new

[5] European Commission, Investment in Human Capital – Assessing the Efficiency of Public Spending on Education – Note for the Eurogroup on 6 November 2017, 2017

[6] Psacharopoulos, G., Patrinos H.A., Returns to investment in education - A Decennial Review of the Global Literature, World Bank Group, Education Global Practice, April 2018

[7] European Commission, The Economic Case for Education, Background paper prepared by the Commission services to inform the policy debate of the Council on 12 December 2014, p. 2, 2014

[8] Woessmann, L., The Economic Case for Education, European Expert Network on Economics of Educaiton (EENEE), Analytical Report No. 20, 2017.

[9] European Commission, The Economic Case for Education, Background paper prepared by the Commission services to inform the policy debate of the Council on 12 December 2014, 2014

[10] The general escape clause will be extended through 2023, because of increased economic uncertainty "in the context of war in Europe, unprecedented energy price hikes and continued supply chain disturbances" (European Commission 2022f, p.12).

NextGenerationEU, through its Recovery and Resilience Facility (RRF), has become a game-changer by spurring reforms and boosting investment in education and training across the EU. As of 1st September 2022, 25 National Recovery and Resilience Plans had been adopted and RRF funds allocated to these plans totalled EUR 495 billion. The estimated spending on education (from early childhood education and care to adult learning) amounted to around EUR 71 billion, i.e. about 14% of the total estimated costs of those plans.

Therefore, making the best use of those additional public resources to enhance educational outcomes and promote equity is now of critical importance. Promoting quality investment in education and training means making investment effective, equitable and efficient. One can think of quality as the interplay of these three components (European Commission 2017). 'Effectiveness' refers to the ability to provide good educational outcomes, by making the most of the available human and physical resources. Studies of educational effectiveness usually analyse whether specific resources have positive effects on different outcomes, and if so, how large these effects are. 'Equity' means that the quality of outcomes does not depend strongly on socio-economic or other disadvantages. 'Efficiency' adds a financial dimension to the analysis of effectiveness and refers to the ability to provide the desired educational outcomes at the lowest possible cost. The immediate concern is to what extent a school education system can be effective, equitable and efficient at the same time.

Investing in education and training pays off, with long-lasting effects in the medium-to-long term. We have to act now because, the earlier the investment is made, the larger the future benefits. Addressing existing and emerging challenges will require major public investment in several sectors, which will extend beyond the scope and time horizon of the RRF. At the same time, EU Member States will have to ensure medium-to-long-term sustainability of their public finances. This is likely to translate into increasing 'competition' for public funding among the various policy sectors and to calls for improving the overall quality of public expenditure. Therefore, showing the benefits of investing in education and training becomes key.

Education and training systems in the EU still face several challenges in terms of delivering high-quality education and training, and equity. The COVID-19 pandemic has revealed large inequalities in access to and quality of education, and these issues require promptr attention. Although investing in education and training remains a priority for all EU Member States, these challenges cannot be solved by simply investing more money: they require effective and efficient investment. There is no guarantee that increasing public spending yields automatically better results because the relationship between expenditure and educational outcomes or equity largely depends on the context, and policy choices. Although it is evident that below a minimum level of spending, no education and training system can achieve high quality educational outcomes, it is also true that at a comparable level of spending, some EU Member States achieve better results than others. This evidence points to the critical importance of increasing the efficiency and effectiveness of education spending by designing the right policies, programmes or reforms, and putting in place comprehensive implementation strategies.

The Commission Communication on Achieving the European Education Area by 2025 clearly states that the Commission will help intensify work on investment as part of the European Education Area[11] and the Council endorsed

[11] *"The Commission will help intensify work on investment as part of the European Education Area. This will include fostering debate at high-level political fora, such as joint exchanges between EU finance ministers and EU education ministers, as well as with other institutions, such as the European Investment Bank and the European Parliament. At technical level, an expert group on quality investment in education and training will support this process, helping to maintain focus on national and regional investment. The Commission will also provide specific support to local,*

this proposal in its Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond.[12]

To deliver on this promise, a Commission Expert Group on Quality Investment in Education and Training was launched in May 2021.[13] The group was made up of 15 independent experts from all over the EU. Its overall mission was to carry out an evidence-based evaluation of education and training policies to identify those that support education outcomes and inclusiveness, while improving the efficiency of public spending.

The group has focused its analysis on those areas that represent the bulk of education and training expenditure, and that may have a large impact on education outcomes. Those areas are: teachers and trainers; digital education, both in terms of infrastructure and competence development; management of education infrastructure and related physical and human resources; and equity and inclusion (Table 1).

Table 1: Report's focus areas

Focus area 1	Focus area 2	Focus area 3	Focus area 4
Teachers and trainers	**Digital education**	**Management, infrastructure and learning environment**	**Equity and inclusion**
It covers issues related to teachers' and trainers' effectiveness and value added, including wages, working conditions, professional development, and class size. It also reflects on stimulating parental involvement in the learning process.	It covers issues related to online learning both in schools and outside school hours, in higher education, and adult learning.	It covers issues related to the quality of the physical learning environment and the management of school resources and infrastructure. It also analyses one of the most widely used funding allocation mechanisms, performance-based funding in higher education.	It covers issues strictly linked to equity and inclusion, such as early childhood education and care, desegregation policies, tracking and ability grouping, priority education policies, compensatory policies, and access and persistence in higher education

Within each main focus area, the choice of topics has been made based on the expertise of the group's members with the objective to identify areas for which academic literature may help assess the effectiveness and efficiency of a specific policy. While providing an exhaustive and extensive literature review of each topic is beyond the scope of this report, we have relied on experts' academic knowldege of each topic in order to provide a clear picture on the evidence on

regional and national authorities to facilitate mutual learning, analysis and sharing of good practices on investment in education infrastructure.", COM(2020) 625 final

[12] The Council has agreed that *"While respecting the principle of subsidiarity, intensified work on investment has a potential to aid the recovery from the current crisis and contribute to the green and digital transitions of the education and training sector"*, and invited the Commission to *"work with the Member States and provide specific support to local, regional and national authorities to facilitate mutual learning, analysis and sharing of good practices on investment in education infrastructure"*, OJ 2021/C 66/01.

[13] Register of Commission expert groups and other similar entities (europa.eu)

different areas of investment for quality education and training. More precisely, our aim was to identify: first, those policies that have already been evaluated, for which there is solid empirical evidence and that allow meaningful policy conclusions; and ii) second, policies where evidence is lacking and additional research is needed. For each topic, experts have focused on existing academic evidence, published in peer-reviewed journals, with the aim of extracting the most important results from the literature. Whenever available, we relied on the latest literature reviews and meta-analyses on the topic, complemented by recent studies. We aimed to specifically review evidence on EU Member States, although, for some topics, much of the evidence stems from the US and UK contexts. For each topic, we tried to provide carefully chosen examples of promising policies that have been properly evaluated. Our focus, whenever possible, was on studies relying on experimental (randomised experiments) or quasi-experimental identification of the effects, which provide the best possible methods to estimate a causal impact, linking policy intervention to clear outcomes. We also discussed available qualitative evidence on each topic. We mainly reviewed studies that analyse the direct impact of educational investments on children's short- and medium-term outcomes (such as cognitive achievements and non-cognitive outcomes), but we also looked for studies on long-term outcomes. While our focus is mainly on the direct impact of educational policies on children and young people, it is important to keep in mind that eduational investments can have larger overall effects on families and society as a whole. It is important to note that, the quantity and quality of existing studies varies widely across topics. While some policies, such as class size reductions, have been extensively studied with careful experimental designs in many countries, other areas of investment have received much less analysis. For example, much less is known about how to best manage and renovate school buildings. One of the aims of the report was to identify areas where more evidence is needed and where additional research would be very useful. Moreover, given the very limited number of studies that perform a full cost-benefit or cost-effectiveness analysis, we included in the review studies that analyse the benefits of educational investments even if costs are not directly measured.

Moreover, the group has tried to shed light on the consequences of recent disruptions in education and reflect on the role of policy evaluation to promote quality investment. The report also addresses the long-term consequences of the COVID-19 pandemic and the integration of newly arrived migrant students, and gives a broad overview of different methodologies used for education policy evaluation.

The group published an interim report in January 2022[14]. The preliminary conclusions were discussed with EU Member State representatives, social partners, civil society organisations and international organisations in a dedicated online event. Feedback received by those actors have been taken into consideration as much as possible in the preparation of this document.

This final report draws some policy conclusions on the most promising education and training policies in terms of education outcomes and equity. **It also stresses the need to continue this analytical work at EU level and promote a better policy evaluation culture in Member States to support quality investment in education and training**.

[14] https://op.europa.eu/en/publication-detail/-/publication/1e9927db-78da-11ec-9136-01aa75ed71a1

3. Focus areas

3.1. Teachers and trainers

Key policy conclusions:

- Teacher quality is key to boosting education outcomes. Therefore, *ensuring adaquate financial rewards as well as creating good working conditions for teachers is crucial* to having an enthusiastic and dynamic teacher workforce ready for the challenges ahead.
- *A more balanced policy approach addressing both teacher recruitment and retention* allows for the mitigation of the impact of demographic changes on the teaching population.
- *Alternative routes to full teacher qualifications* can be effective ways to attract and retain teachers if underpinned by appropriate support in the form of induction, mentoring, professional development and career opportunities.
- *Recruitment financial incentives work if they are well-designed and targeted precisely*, and if they include requirements to stay in a specific school or area for a certain period of time.
- *Reducing teachers' work-related stress and promoting their well-being* may reduce high turnover and sickness absence.
- *Reducing class size may be effective in schools/areas with high percentages of disadvantaged pupils*. However, *it remains an expensive intervention*.
- *Raising teachers' pedagogical digital competences* may improve student outcomes and promote digital education.
- *Promoting parental involvement may help teachers increase children's academic performance*, but policies should ensure that all parents have opportunities to support their children's learning to avoid wideninginequalities.

EU policy framework for teachers and trainers

The 2019 Council Resolution on further developing the European Education Area to support future-oriented education and training systems[15] invites the Commission to *"Develop new means to train and support competent, motivated and highly qualified teachers, trainers, educators and school leaders, and promote their continuous professional development and high-quality, research-based teacher education."*

The Council Conclusions on European Teacher and Trainers for the Future of May 2020[16] reiterate the role of teachers as cornerstones of the European Education Area and call for further support for teachers' career and competence development as well as well-being at all stages of their careers. The Conclusions stress the benefits of cross-border mobility of teachers and the need of embedding learning mobility as part

[15] https://data.consilium.europa.eu/doc/document/ST-13298-2019-INIT/en/pdf

[16] https://www.consilium.europa.eu/media/44115/st08269-en20.pdf

of teachers' initial and continuous education. Moreover, the Conclusions invite the Commission to support closer cooperation between teacher education providers within the continuum of teachers' professional development.

The 2020 Commission's Communication on Achieving the European Education Area by 2025[17] recognises the key role of teachers and trainers and sets the vision of having highly competent and motivated educators who can benefit from a range of support and professional development opportunities throughout their varied careers. It proposes a number of actions to address the challenges the teaching professions face today, including the plan to launch Erasmus+ Teacher Academies.

The Commission's Digital Education Action Plan (2021-2027)[18] stresses the need to ensure that all teachers and trainers have the confidence and competences to use technology effectively and creatively to engage and motivate their learners as well as to ensure that all learners develop their digital competences for learning, living and working in an ever more digitalised world.

The Council Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond (2021- 2030)[19] also recognises the key role of teachers as one of the key priorities. It refers for example to the potential of Erasmus+ Teacher Academies in facilitating networking, knowledge sharing and mobility among institutions providing teachers and trainers with learning opportunities at all phases of teachers' and trainers' careers.

The European Commission supports teachers and teaching professions as follows:

- The **Erasmus+ Teacher Academies** (E+TA), consisting in networks of teacher education institutions, aim to provide a joint learning offer for teachers, on digitalisation, inclusion, environmental sustainability, or improving gender equality. With these new courses and mobility as a regular feature, E+TA projects are intended to improve the attractiveness of the teaching profession. The target set in the EEA Communication is to have 25 Erasmus+ Teacher Academies by 2025.
- The Commission is further developing with EU Member States guidance for the **development of national career frameworks** in order to diversify school education careers and improve recruitment, retention and professional development of teachers, trainers and school leaders.
- The Commission will develop a **policy framework for promoting teacher cross-boarder mobility** to embed it as an integral part of initial and continuous teacher education.
- In order to highlight and value high quality teaching and learning, the Commission has established a **European Innovative Teaching Award**, which highlights innovative Erasmus+ projects and complements existing European and national awards.
- To contribute to the development of digital competences, the Commission has developed a **SELFIE for teachers.**[20] This tool accompanies the **SELFIE for schools** and it will help teachers to assess their digital competences and identify further learning needs.

[17] Achieving the European Education Area by 2025 - Communication | Education and Training (europa.eu)

[18] Digital Education Action Plan (2021-2027) | Education and Training (europa.eu)

[19] https://www.consilium.europa.eu/media/48584/st06289-re01-en21.pdf

[20] SELFIE stays for "Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies"

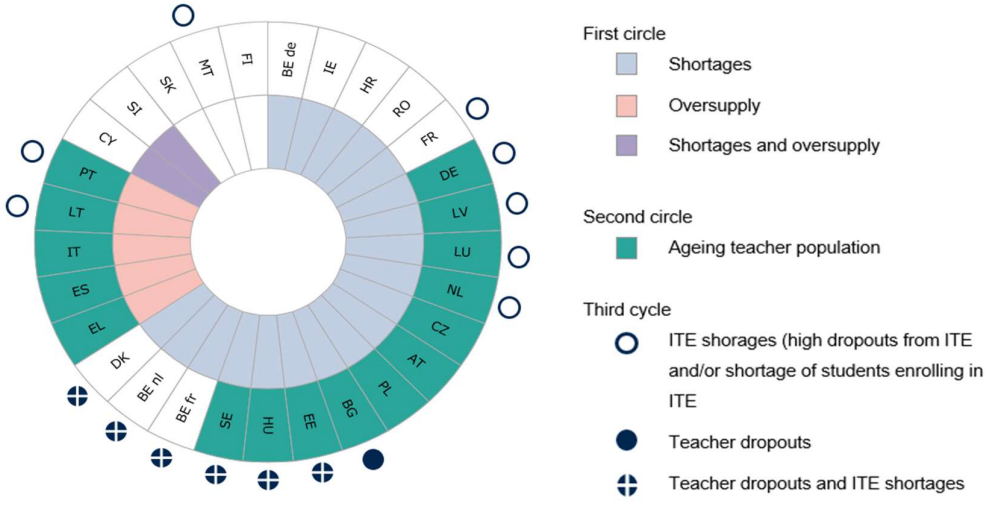
- Finally, the support to teachers and their professional development is a core part of the proposal for a **Council Recommendation on blended learning in primary and secondary education** that was adopted in December 2021.

Setting the scene

Recruiting, training and retaining effective teachers is important because of the role they play in student achievement and life chances. Moreover, teachers' salaries represent the largest budgetary element at all levels of education. Research shows a positive link between teacher quality and student performance (Hanushek, Schwerdt, Wiederhold et al., 2015; Chetty, Friedman & Rockoff, 2014). Consecutive years of effective teaching can offset learning gaps for disadvantaged students (Hanushek & Rivkin, 2010). Still, in practice, it is often the least experienced and least skilled teachers who are teaching the students with greater need, which contributes to academic achievement gaps based on students' socio-economic background (Boyd, Lankford & Loeb, 2003; OECD, 2019). For those students, class size also matters, as it can lead to better performance through closer interactions, both among students and between students and teachers. Moreover, teachers and trainers need to be equipped with the right skills, knowledge and competences to cope with a fast-changing learning environment, including digital tools, and be able to address properly students' need.

Recruiting effective teachers is a key policy concern for education authorities. It is all the more pressing given that most EU countries are faced with general teacher shortages, sometimes exacerbated by an unbalanced distribution across subjects and geographies, an ageing teaching force, as well as high attrition and low enrolment in initial teacher education (Figure 1) (European Commission, 2021a). There are particular challenges in recruiting effective teachers in high-demand subjects and hard-to staff schools.

Figure 1: Main challenges in teacher demand and supply in lower secondary education, 2019/2020



Source: European Commission/EACEA/Eurydice, 2021

The concept of "teacher effectiveness" has been thoroughly reviewed in research literature. In the simplest terms, teachers who are effective enable their students to learn. With the growth of standardised testing, teacher effectiveness has been operationalised as teacher's "value-added", meaning their ability to improve student learning as measured by student gains on standardised tests (Ballou, Sanders, & Wright, 2004) or ratings of teachers' performance through classroom observations

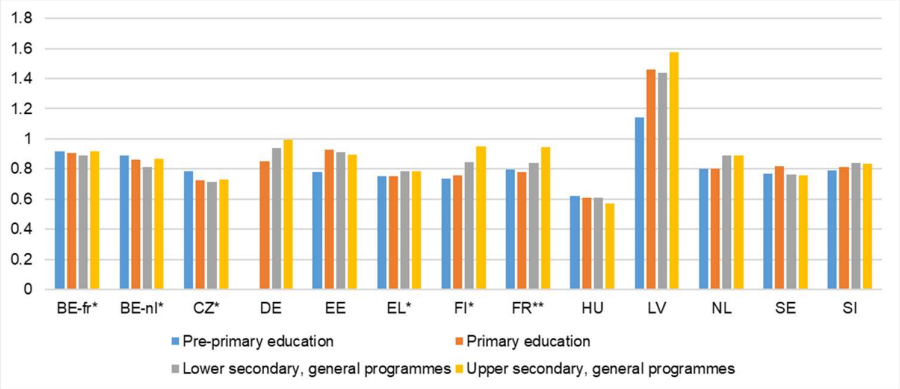
(Hafen, Hamre & Allen et al., 2015). However, a debate remains whether teachers' impacts on students' test scores is an appropriate measure of their effectiveness and to what extent – and how they can be used for accountability purposes.

Individual-level factors that influence the decision to become a teacher are related to identifying and selecting the options that provide the most favourable career opportunities. The decision to become a teacher is influenced by financial rewards and expectations on what the work entails in terms of working conditions, career opportunities, autonomy, social status and utility, as well as intrinsic motivations and self-efficacy.

Competitive salaries that are at par with the remuneration paid to adults with similar education levels working in comparable occupations enhance the ability of school systems to attract and retain teachers (OECD, 2019). Currently the level of actual teacher salaries varies widely in EU countries (EC, 2021b)[21].

There is no one-size-fits-all solution to the design of effective salary scales (OECD, 2019). Policy makers need to consider *'the specific challenges of their system and the characteristics of their local labour markets'*, such as the level of private sector wages or unemployment rates when deciding on which point higher starting salaries can be an effective means to attract high-performing candidates into teaching (OECD, 2020).

Figure 2: Teachers' actual salaries relative to earnings for full year similarly educated workers, 2019



Source: OECD, 2021. Notes: Data not available for remaining EU Member-States; * = Year of reference is 2018 for salaries of teachers; ** = Year of reference is 2017 for salaries of teachers.

[21] The actual salaries refer to the average annual gross salary, including allowances and other additional payments that teachers receive on top of the statutory salary.

Figure 3: Percentage difference between the statutory starting salaries of lower secondary teachers and their salaries after 10- and 15 years' service, and at the top of the pay range, 2019/2020

Source: European Commission/EACEA/Eurydice, 2021

Teacher working conditions comprise the (non)pecuniary elements of the workplace that affect teaching (Merrill, 2021; OECD, 2019, 2020c). They mainly refer to: (i) leadership; (ii) collegiality, professional learning and collaboration; (iii) accountability systems; (iv) career advancement opportunities; (v) contractual arrangements and job security; and (vi) working hours and workload.

Research confirms that *"what appear to matter most to teachers about the context in which they work, are not the traditional working conditions policy makers often think of, such as modern facilities and well-equipped classrooms, but aspects that are difficult to observe and measure, such as the quality of relationships, collaboration among staff, the responsiveness of school administrators and the academic and behavioural expectations"* (Kraft and Papay, 2017: 20).

Teachers' working conditions have been reported as 'highly predictive' of teachers' stated intentions to remain in or leave their schools (Ladd, 2011; Barnett Berry et al., 2019). The evidence suggests that attrition from teaching is (i) not necessarily a 'healthy' turnover; (ii) more strongly moderated by characteristics of teachers' work conditions than previously noted; and (iii) a problem that can be addressed through policies (Borman and Dowling, 2008; Barnett et al., 2021). High turnover contributes to organisational instability and potentially reinforces a cycle of poor working conditions (Kraft and Papay, 2017; Education International Research, 2021). These findings apply to all levels of general education and are particularly strong for the 'hard to staff' schools where students are more disadvantaged.

One of the key aspects that affects teachers' working conditions is class size, which relates directly to the educational expenditure and presumably education outcomes. Class size refers to the number of students in a group studying together in contrast to "student-teacher ratio" that refers to the number of students per teacher.

According to recent data from the OECD[22], in 2019 the average class size in EU countries was 19.5 students in primary education (ISCED 1) and 20.9 students in lower secondary education (ISCED 2). Over the last decade (2010-2019) the class size has increased by 0.6 students in primary and decreased by 0.4 students in lower secondary education on average (OECD, 2021b). Different minimum or maximum class size rules are imposed at national level (EC, 2021c).

Leuven and Oosterbeek (2018) have shown that around half of the studies on the link between class size and student outcomes in the EU reveal a beneficial impact of smaller classes on education outcomes, mainly on mathematics and reading scores. At the same time, evidence shows that smaller classes need to be underpinned by training: this implies equipping teachers with appropriate competences and training to implement effective pedagogical approaches that are adapted to a smaller class size or new learning needs.

In this respect, an important development in education has been the increasing use of digital technologies. It is widely believed that digital technologies can facilitate high-quality teaching and enhance student learning (Wekerle & Kollar, 2021). Common beliefs are that digital (educational) technologies can enhance learning efficiency, facilitate a greater focus on students' professional future which will likely include the use of Information and Communication Technology (ICT), and foster personality development in a digital society (Seufert et al., 2021).

Yet, several meta-analyses revealed that the use of digital technology leads to positive but not overwhelming effects on learning outcomes and that the magnitude of the effects appears to depend on contextual factors. Among those factors, teachers' pedagogical digital competences and their attitudes towards technology are important (Schmid et al., 2014; Tamin et al., 2011). In particular, various studies have shown that teachers who lag behind in the development of such competences and attitudes do not effectively integrate digital technologies into their teaching (Chen, 2010; Petko, 2012; Tondeur et al., 2019). Hence, there is a need to support teachers in developing their pedagogical digital competences. This need is even greater in light of the COVID-19 crisis and the resulting school closures, which elevated online learning from a bonus tool to the only option for education (OECD, 2020a), resulting in larger attainment deficits in education systems with low online pre-pandemic learning (Maldonado & De Witte, 2021; Gambi & De Witte, 2021) and significant post-pandemic investments in ICT-infrastructure (De Witte & Smet, 2021). For a more detailed analysis of the long-term implication of the pandemic, see also section 4.1.

The concept of digital competence has been reviewed thoroughly in the literature, resulting in many operationalisations of the concept. J. From (2017) proposed using the concept of Pedagogical Digital Competence (PDC) which was defined as "*the ability to consistently apply the attitudes, knowledge, and skills required to plan and conduct, and to evaluate and revise on an ongoing basis, ICT-supported teaching, based on theory, current research, and proven experience with a view to supporting students' learning in the best possible way*" (p. 48).

Learning obviously does not start, nor stop at school. Many EU Member States have experienced declines in their international assessment rankings, signalling deterioration in the quality of their education systems, at least relative to other countries. Driven by this trend, as well as growing marketisation of education, there is renewed focus on how parents can best support their children's education and play an active role in their learning. While many parents see schools as having primary responsibility for formal education and training, considering practical and organisational limitations of schools and teachers, shifting the responsibility of

[22] Please note that only 22 EU Member States are also OECD members. Data on the average class size for the non-OECD members from the EU27 has not been reported.

teaching and learning entirely to schools is neither feasible nor desirable (De Witte and Maldonado, 2022). The evidence suggests that the learning of knowledge, skills and behaviours should not necessarily be strictly divided between school and home. However, one of the key challenges for policy is ensuring *all* parents have opportunities to support their children's learning, in home and school settings.

Our literature review highlights the interconnected challenges within education systems concerning teacher recruitment, retention, working conditions, career development and parental involvement. Recruitment, retention and regeneration from initial teacher training through continuing professional development are all important.

This report focuses on the following topics. Unless otherwise indicated, our focus of analysis is on general education:

Topic 3.1.1	**Recruiting effective teachers**
Topic 3.1.2	**Improving working conditions and wage policies**
Topic 3.1.3	**Adapting class size**
Topic 3.1.4	**Raising teachers' pedagogical digital competences**
Topic 3.1.5	**Stimulating parental involvement**

3.1.1. Recruiting effective teachers

What the evidence shows

There is rich research on individual-level factors that influence the decision to become a teacher, mainly based on surveys of existing teachers. International comparative studies provide evidence on the impact of competitive salaries in attracting people to teaching careers. Longitudinal studies show that trends in teacher recruitment are associated with labour market developments and the relative attractiveness of other occupations. Evidence suggests that teacher observable characteristics account for a negligible variation in teacher effectiveness, in contrast to selectivity to teacher education and early classroom experience.

Individual-level factors that influence the decision to become a teacher are related to identifying and selecting the options that provide the most favourable career opportunities. The decision is influenced by financial rewards and expectations on what the work entails (working conditions, career opportunities, autonomy, social status and utility), but also intrinsic motivations and self-efficacy. Based on PISA data, Han, Borgonovi and Guerriero (2017; 2020) find that salaries, job responsibility and respect are positively associated with teaching career expectations. They also show that men are more likely to work as teachers in countries with higher teacher salaries and more male teachers. A survey of teachers in the EU ranks salaries and social status, better working conditions and smaller class sizes as key factors for making teaching more attractive (EC, 2013, p. 72). Using longitudinal survey data, Savage et al. (2021) show that early decision-making in relation to becoming a teacher in Germany is motivated by social interests and parental influence.

Trends in teacher recruitment are associated with wider labour market developments and the relative attractiveness of different occupations (Dolton, 2006). More people enter the teaching profession during recessions: in particular, graduates are more likely to opt for teaching when teachers' relative pay is high and graduate employment low (Dolton, Tremayne & Chung, 2003). The wage effect on the supply of teachers is strongest for recent graduates and when teacher wages are relatively low (Chevalier, Dolton and McIntosh, 2007). Evidence also suggests that teachers entering the

profession during recessions are more effective in raising student test scores (Nagler et al., 2015).

Consistent evidence suggests that years of education and degree qualifications account for a negligible variation in teacher effectiveness (see, e.g., Hanushek & Woessmann, 2011). In contrast, selective processes to access initial teacher education or profession lead to higher quality teachers on average (Darling-Hammond et al., 2005). In primary education, countries with more selective teacher recruitment or structured training periods enhance student achievement in standardised tests in reading (Brage et al., 2019). Early classroom experience has a positive impact on teacher effectiveness in general education (Kane et al., 2006). Furthermore, mandatory practical training before (or immediately after) entering the profession generates higher student achievement in primary education (Brage et al., 2019). In higher education, evidence in this domain is lacking, however a cause of concern is that doctoral training - the main route to academic teaching roles - often lacks pedagogical skills development (Eurydice, 2017).

What is missing

Causal evidence on the effectiveness of remuneration in attracting more talented teachers and improving student achievement is limited and should be further investigated. Higher salaries could expand the pool of potential teachers and reduce teacher turnover, but do not guarantee better quality teachers (Hanushek & Rivkin, 2004, Hanushek et al., 2015). Hoxby and Leigh (2004) show that pay compression contributed to the decline in the average aptitude of individuals entering the teaching profession, but the focus is on their SAT-results, rather than student achievement.

Evidence on the effectiveness of financial incentives in recruiting teachers in schools serving more disadvantaged populations is inconsistent. Some suggest that higher salaries – from 30 to 50% more – are needed to recruit teachers to work in such schools (Boyd, Lankford & Loeb, 2003). Others suggest that salary compensation has only a short-term effect (Bueno & Sass, 2016). There is limited robust evidence regarding the influence of non-financial incentives, such as induction and mentoring, or teacher education in high-need schools.

Causal research from the US on the effects of alternative entry routes shows no significant difference between the effectiveness of teachers who enter the profession through alternative routes and traditionally certified teachers, but suggests that the effectiveness of alternative routes depends on their design features and context-specific matters (Alfonso, Santiago & Bassi, 2010; Boyd et al., 2012). In the EU, causal research and rigorous cost-benefit analyses of teacher training routes are largely missing. To capture the related impact on teacher effectiveness such analysis would require access to information on applications made to each route, detailed information on the prior attainment and quality of each candidate, and the ability to measure retention and the effectiveness of the successful candidates in improving student achievement. These research questions should be factored into teacher policies. In line with evidence-based education, new policies should be tested through pilots before they are rolled out and generalised.

The effectiveness of different systems of recruiting and selecting individuals to initial teacher education programmes and the teaching profession and how these systems influence the time-to-entry into profession and the associated costs would deserve further analysis[23]. The existing diverse approaches to teacher certification across EU

[23] Eurydice (EC, 2018) shows that EU countries control the quality of teacher entrants in different ways and stages: in nearly half of EU education systems graduating from initial teacher education delivers full teaching qualifications, while in others, graduates must meet additional criteria such as a competitive examination, probation periods or confirmation of professional competency.

education systems, such as competition, probationary periods, or waiting lists, may cause delay in entry to the profession and exert varying costs to the public purse. There is a lack of research whether credentialing programmes provide useful training, and whether entry requirements prevent effective individuals from entering the profession.

It is equally difficult to identify evidence on how different types of employment contracts, from permanent/statutory contracts to temporary contracts, influence the attractiveness of the teaching profession and what impact they have on teacher effectiveness. Carefully designed contractual arrangements could make teaching more attractive, but this is difficult to study through experimental interventions and quasi-experimental approaches as career decisions are based on expectations for the future.

Finally, there is limited experience in the EU in implementing teacher value-added measures to capture teachers' impact on student achievement. Evidence from countries where value-added measures of student achievement are used suggests that they should be limited to low-stakes evaluations as part of an integrated analysis at school level and combined with other measures, such as classroom observations and improvements in working conditions, while high-stakes incentives should be avoided. For most countries, it could be more efficient to certify initial education and continuing professional development programmes and oblige all teachers to go through structured career development steps underpinned with salary incentives conditional to these steps.

Cost-effectiveness aspects

Cost-effectiveness analyses of teacher recruitment policies are rare and context specific. Most evidence is from the US. In the following, we present four studies of policies that have been implemented in Norway and the US with a causal or comparative design and robust measurement of recruitment and/or retention outcomes (See et al., 2020). Whilst the Norwegian study examined the effect of wage premium of recruitment only the three US studies also address teacher effectiveness using value-added measures and cost-effectiveness analysis. Besides, they also have a strong focus on inclusion through attracting teachers to hard-to-staff schools and/or high-in-demand subjects.

First, Glazerman et al. (2013) evaluated the US Federal Government's Talent Transfer Initiative (TTI), which provided *bonuses to the best teachers with highest student achievement gains to move to and stay in low-performing schools* in seven US states. USD 20,000 was paid in instalments over a two-year period, while teachers already teaching in such schools received half this sum. TTI was found to be effective: 88% of vacancies were filled, student learning improved and TTI teachers had higher retention rates than their counterparts (93% vs. 70%), but the difference faded after the payments stopped. TTI saved the government USD 13,000 per grade per school compared with the cost of class-size reductions.

Second, Feng Li & Sass (2017) investigated the effects of the long-term, state-wide Florida Critical Teacher Shortage Programme (FCTSP) designed to *increase the supply of teachers in hard-to-staff subjects*. The FCTSP recipients were of higher quality than non-recipients. The loan forgiveness component was effective, reducing mean attrition rates for middle and high school maths and science teachers by 10.4% and 8.9%, respectively. Modest payments (USD 500-1,000 per year) helped reduce attrition. In special education, only payments of approximately USD 2,500 were effective. The cost-effectiveness was high given that a one-time retention bonus of USD 1,200 reduced teacher attrition by 25%, more than loan repayments of comparable magnitude.

Third, Hough & Loeb (2013) examined the effects of *financial incentives to teachers in shortage subjects in disadvantaged schools*. Under the Quality Teacher and Education Act (QTE) of 2008, 1,611 teachers in the San Francisco district received a pay rise (USD 500-6,300), a once-off bonus of USD 2,000 and a retention bonus. The pay rise improved the district's attractiveness in the local labour market and increased the quality of new-hires as measured by student achievement in English. There was no difference in the retention rates of QTE teachers and counterparts.[24]

Fourth, Falch et al. (2010; 2013) studied the centrally determined *wage premium for teachers* in Norway in the 1990s and early 2000s, identifying the wage effect *on schools with severe recruitment problems* in a specific region. The wage premium of about 10% increased recruitment by 30%, with responsiveness varying by age and gender. The study did not address cost-effectiveness or student achievement.

Table 2: Cost-effective ways to enhance teacher recruitment - financial incentives

Approach	Authors	Evidence base	Effectiveness	Costs
Federal government bonuses to the best teachers to move and stay in low-performing schools (US)	Glazerman et al., 2013	High	High	Low
State-level loan forgiveness, tuition reimbursement and retention bonuses for teachers in high-need subjects (US)	Feng Li & Sass, 2017	High	High	Low
District-level salary increases, bonuses and retention bonuses to teachers in shortage subjects in disadvantaged schools (US)	Hough & Loeb, 2013	High	High	Low
Increasing salaries: National wage premium for schools with teacher shortages (NO)	Falch, et al., 2010; Falch, 2013	Medium	Medium	Medium

3.1.2. Improving working conditions and wage policies

What the evidence shows

Leadership approach is the most important working condition shaping teachers' decisions to remain or to stay in their profession and is often more important than their salary (Ladd, 2011; Barnett Berry et al., 2019; Ingersoll et al., 2017). The 'shared/ distributive leadership' model is better able to sustain teachers in the profession. This relationship is even stronger in the 'hard-to-staff schools' (Darling-

[24] The reason could be the low level of incentives or the fact that the policy took place during the recession with low labour mobility.

Hammond et al., 2019). In particular, a collective sense of responsibility (shared/ distributed leadership) was considered essential when deciding whether to leave a school or not. Research further shows benefits of cooperative teaching, which has a higher occurrence in Sweden, Denmark and Norway (European Schoolnet, 2022).

Teachers with full-time contracts, higher levels of formal education preparedness and societally oriented motivations when entering the profession display higher levels of exchange and coordination for teaching and professional collaboration (European Schoolnet, 2022: 26). As suggested in section 3.3, there is a tendency towards increased school autonomy and a transfer of power to school principals or local governing bodies who are better positioned to take informed decisions. This process creates enabling circumstances for shared leadership.

Overall, compensating for the disadvantage of some schools by allocating additional teaching staff is insufficient to close the gap in student performance based on socio-economic status, as the quality of teachers also needs to be considered (OECD, 2018 cf. OECD, 2019). Besides, modest increases to teacher salaries do not appear to be sufficient on their own to have a significant impact on inclusiveness (Education and Training Monitor, 2019: 40). However, there is evidence that a stronger focus on retention than on recruitment is cost-effective (Ingersoll and Smith, 2004; Doherty, 2020). By large, the pecuniary and non-pecuniary incentives to attract teachers to disadvantaged schools are less common and evidence on their effectiveness, less conclusive (see also section 3.4).

Inadequate working conditions decrease the attractiveness of the teaching profession, undermine the professional status and make it difficult and costly to recruit new teachers (Ingersoll, 2001; Doherty, 2020). Moreover, increased recruitment is not likely to solve the turnover problem as many teachers are leaving schools because of poor leadership (ILO, 2021), their professional status, increased job expectations and the working environment being defined in social terms (Ingersoll, 2017; Sutcher, Darling-Hammond and Carver-Thomas, 2016; ILO, 2021). Recruitment and training are costly, and they reduce the budget otherwise available for improving teacher working conditions and thus, the retention of qualified teachers (Borman and Dowling, 2008). This explains the recent policy concern with increasing retention as a means of addressing the teacher supply crisis, especially for maths and sciences (Ingersoll, 2017; Sibieta, 2018; Sutcher et al., 2016; Worth and De Lazzari, 2017). Although some education systems have a tradition of differentiating salaries based on the teaching subject, in order to reflect the opportunity costs of pursuing a teaching career, there is no evidence on the cost-effectiveness of these policies (OECD, 2019).

Arguments around salaries are often accompanied by considerations related to non-monetary benefits, such as greater job stability, social benefits and overall higher work–family balance (ILO, 2021). However, the two types of benefits, monetary and non-monetary, should not be seen as mutually exclusive. As the process of reforming salaries in education can pose implementation challenges and a degree of uncertainty about the size and distribution of benefits, engagement with stakeholders is key (OECD, 2020c; Liebowitz et al., 2018). This can also highlight the value of salaries as investments for high-quality education, more than a pure cost factor in public budgets. As stated in the Council Conclusions on European Teachers and Trainers for the Future (2020)[25], "*Evidence suggests that salaries have an impact on recruitment and retention of teachers and trainers, as well as on learning outcomes. Salaries of teachers are often lower than the average salaries of other tertiary-educated workers"* (Education and Training Monitor 2019: 39-40).

[25] https://www.consilium.europa.eu/media/44115/st08269-en20.pdf

On a different note, at higher education level, women faculty members still encounter workplace harassment and gender-based discrimination in promotion and in the distribution of work. Preventing and addressing mobbing and sexual harassment at a structural level is cost-effective. Across all occupations, there is strong evidence that workplace mobbing has a stronger association with sickness absence than any other work-environmental factor and it is a risk factor for sickness absence (Niedhammer et al. 2012; Verkuil, Atasay, and Molendijk 2015; Björklund et al., 2020). The financial implications of mobbing among staff members, although significant, have been only tentatively analysed for higher education. The COVID-19 pandemic increased workload for teachers was associated with potentially stressful working environments, managed partly "through resilience and extreme effort" (UNESCO and IEA, 2022: 207).

The employment conditions are increasingly precarious, especially for the young teachers. In the EU, one teacher out of five works on a temporary contract. However, among teachers below 35, one out of three is employed on a fixed term contract, and in some countries, more than two-thirds of young teachers have short-term contracts (European Commission, 2021). Those working on temporary contracts of less than one year tend to report lower levels of self-efficacy (an effect also attributed to their younger age) and higher levels of occupational stress (OECD, 2019). More research on the implications and long term (measurable and non-measurable) costs of casualisation of work in schools and in the academia is warranted, in ways that go beyond the immediate monetary organisational calculations.

What is missing

The working conditions that matter most are mainly *social* in nature and are strongly related to leadership and collegiality. However, these are difficult to operationalise and replicate in research designs that are robust in informing policy making.

The high prevalence of work-related stress imposes a financial burden on the public budget in terms of turnover and sickness absence. Nevertheless, the most frequently evaluated interventions for the wellbeing of teachers are directed at the individual level, and so do not tackle the causes of stress at the workplace level. The quality of evidence on *organisational* interventions leading to improvements in teacher wellbeing and retention is low (Naghieh et al., 2015). Further evaluation of the effects of organisational interventions on teacher wellbeing, based on complex-interventions frameworks, using cluster-randomised designs on large samples would be beneficial.

Finally, there is no definitive evidence on the effectiveness of pay-per-performance schemes in general education, with some studies showing they fail to improve student outcomes and others reporting some positive effects (Ferra 2017). So far little research on the impact of different types of incentives on performance has been carried out in EU Member States (European Commission, 2018).

Cost-effectiveness aspects

Overall, cost-effectiveness analyses are rare and context specific. They cannot be easily generalised or used as a base to inform policy choices. Therefore, further evaluations in that sense are needed.

Table 3: Cost-effective ways to improve working conditions

Approach	Evidence base	Effectiveness	Costs
Increasing the quality of administration by 'distributed' leadership approaches	High	High	Medium
Differentiating salaries based on the teaching subject	Medium	Low	Low
Bottom-up accountability systems in general education	Medium	High	Low
Allocating additional teaching staff in deprived schools	Medium	Low	Medium
Addressing bullying in higher education	Medium	High	Uncertain

3.1.3. Adapting class size

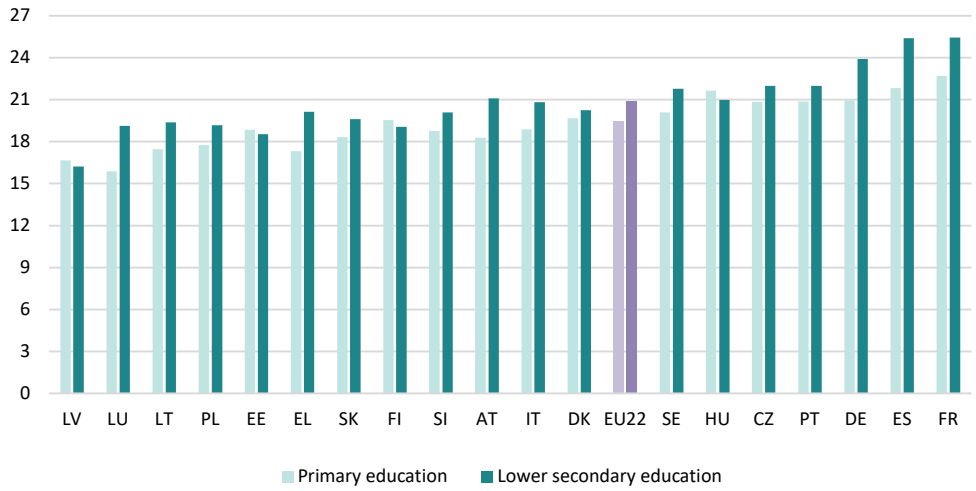
What the evidence shows

Although class size remains one of the most debated topics in education, the evidence from the EU context is limited. The bulk of relevant studies focus on the US and the impact of the STAR (Student/Teacher Achievement Ratio) experiment in which students were randomly assigned into small classes from 13 to 17 students per teacher, regular classes from 22 to 25 students per teacher, and regular-with-aide classes with 22 to 25 students with a full-time teacher's aide.

The STAR experiment and its evaluation is controversial in the academic literature. According to some studies a smaller class size has a beneficial short-term impact by significantly increasing performance on standardised tests in comparison with regular classes after one year of policy intervention (Krueger, 1999), along with a long-term effect on college completion, earnings, wages, etc. (Schanzenbach, 2014). But, it is also pointed out that the small classes have been found to be superior to large ones because both types of classes were mostly taught by teachers with similar qualification, earning similar salaries on average (Mishel and Rothstein, 2002, p. 3).

Looking at the EU, according to the most recent data for the OECD, in 2019 the average class size was 19.5 students in primary education (ISCED 1) and 20.9 students in lower secondary education (ISCED 2) as figure 4 shows.

Figure 4: Average class size, 2019[26]



Source: OECD, 2021. Notes: data for Luxembourg refers to year 2017; data is not available for Belgium, Ireland and the Netherlands; the EU average refers to the 22 EU Member States which are OECD members.

In Europe, the empirical evidence produces mixed results, as indicated by Leuven and Oosterbeek (2018) in their literature review. Half of the 30 studies under review show that smaller classes have a beneficial impact on education outcomes, mainly measured in terms of mathematics and reading scores. This includes studies in Denmark, France (for disadvantaged areas), Sweden, and Poland (6th graders). In contrast, the effects of class size on academic performance are negligible or not significant according to studies on compulsory education in Italy, the UK, and Norway.

In the following review we summarise the latest findings of relevant recent academic studies (since 2015 onwards) in peer reviewed journals indexed in recognised scientific databases which explore mainly EU Member States. The majority of the studies are country specific and use a quasi-experimental design, which limits the validity of the results but improves their comparability.

In these studies, the average size of compulsory education classes varies from 9 to 26 students. The evidence for compulsory education is mainly based on the impact of class size on student performance measured by the results of standardised assessments such as PISA, TIMSS, PIRLS, and national exams. The effects on the drop-out rate and repetition rate have also been explored. Another strand of the literature focuses on the link between class size and teachers and teaching approaches.

Effects of class size on students' education outcomes

Smaller classes improve academic performance for students from lower socio-economic backgrounds as well as those with special education needs (SEN) at different educational levels (Ecalle et al., 2019; Capucha et al., 2017; Kara et al. 2021; see, also Zyngler, 2014). Reduced primary-school classes of no more than 12 students in schools in zones with specific educational needs in France show higher performance in reading and spelling in comparison with the normal-sized classes of 20-25 students (Ecalle et al., 2019, Andreu et al., 2021). A reduced class size of 10.5 students on average in Grade 1 is found to increase literacy scores (Bressoux et al.,

[26] The average class size in all private and public institutions.

2019). However, one year in a small class does not lead to longer-term benefits. Bressoux (2017) points out that the positive effect of reduced classes is stronger for low achievers, disadvantaged students and those in priority educational areas (see also section 3.4).[27] Fredriksson et al. (2014) examine upper primary school classes in Sweden with an average size ranging between 15 and 30 students. In larger classes disadvantaged students find it difficult to follow the teacher especially in the case of whole class teaching, owing to greater levels of home responsibilities, a greater likelihood of moving school, and less parental support relative to the children of high-income parents.

Student's education outcomes in multi-grade classes appear to depend on the class composition. Fifth graders exhibit poorer test scores in numeracy compared to their peers in single grade classrooms in Italy. According to the authors, this is probably due to their interaction with students from lower grades (Checchi and Paola, 2018). Lower grade students in Norwegian junior high schools gain from sharing the classroom with more mature peers from higher grades (Leuven and Ronning, 2014).

For regular compulsory education, the evidence on the impact of class size on student achievement is mixed, and generally no data is provided on class size for the schools under study. Overall, where a positive effect of reduced class size is found, it is generally small in size (Hattie, 2017; Jepsen, 2015). Li and Konstantopoulos (2016) indicate that a one-student reduction in 4th grade classes in Romania and Slovakia would increase student mathematics performance by about 4.5 points as measured by the TIMSS scale. Moreover, class size reductions have been associated with slightly increased mathematics achievement among 4th graders in Cyprus as well as in reading in Romania whereas for the other countries smaller classes make no difference (Konstantopoulos and Shen, 2016; Shen and Konstantopoulos, 2017). Smaller classes increase student retention but are also associated with lower performance in national high-stakes standardised assessments in Portugal, as a result of the Portuguese national educational policy "Programa Mais Sucesso Escolar" (PMSE) (Barata et al., 2015).

For Germany, Argaw and Puhani (2018)[28] apply the recommendation to 4th graders to attend more academic middle school (Gymnasium) since it depends on the achievements in the main subjects. They cannot find a significant impact of class size on school tracking outcome; however, male students appear to benefit more from smaller classes. Furthermore, Alivernini at al. (2020)[29] point out that smaller classrooms benefit students' psychological well-being at school.

In Denmark, studies suggest that larger classes modestly reduce test scores at primary school level but not at the lower secondary level (Nandrup, 2016). The average class size is 21-22 students while the range is 14 to 28 students. Based on a review of 127 studies for 41 countries, Filges et al. (2018) conclude that in the non-STAR studies reduced class sizes have on average a small positive effect on achievement in reading but not in mathematics, at compulsory education levels.

Some studies suggest that it is possible to identify a class of optimal size in terms of student performance (Mazrekaj et al., 2021). The classroom which maximises the

[27] "The French *"Réseaux ambition réussite"* (RAR) programme, for example, targeted low-achieving and socially disadvantaged lower secondary schools between 2006 and 2011"

[28] Argaw, B., P. Puhani (2018) Does class size matter for school tracking outcomes after elementary school? Quasi-experimental evidence using administrative panel data from Germany. Economics of Education Review, vol. 65, p. 48-57.

[29] Alivernini, F., E. Cavicchiolo, S. Manganelli, A. Chirico, F. Lucidi (2020) Students' psychological well-being and its multilevel relationship with immigrant background, gender, socioeconomic status, achievement, and class size. School Effectiveness and School Improvement, vol. 31, p. 172-191.

performance of Greek high school students, taking into account the associated costs, is found to have 22-23 students (Kedagni et al., 2021).

For higher education smaller classes increase student performance for STEM in contrast to non-STEM subjects (Kara et al., 2021), and for mandatory but not elective courses (Karas, 2021). However, as different academic programmes and subject fields have been examined, it becomes difficult to identify common trends and draw conclusions.

Effects of class size on teachers and teaching

Small classes allow for increased instructional time (owing to fewer disruptions and less classroom management time), more intensive teacher-student and student-student interactions, higher personal and academic support as well as better emotional connections and identification of students with the class and the school community (Finn, 2019). However, smaller classes might not improve student performance if the teaching methods have not been tailored to the size of the class (Konstantopoulos and Shen, 2016) or students are taught by inexperienced teachers (Bressoux et al., 2019; Dieterle, 2015).

Larger classes might lead to poorer class management, instruction and teaching strategies among pre-service teachers and those with less than three years of experience (Maulana et al., 2017; Van der Pers and Helms-Lorenz, 2019), bigger or greater numbers of groups, as well as pressure on space and resources. Blatchford and Russel (2019) point out that larger groups resulting from bigger classes comprising at least 31 students in the UK might lead to reduced individual attention by the teacher, less differentiation of work and less work and of lower quality. Where there is wide variation in students' characteristics and behaviour, teachers might experience difficulties in making their teaching decisions.

There is a positive though small effect of classes of 21-25 students – compared to smaller classrooms of 15-19 students – on teachers' burnout measured by exhaustion and lack of accomplishment especially for primary subject teachers (Saloviita and Pakarinen, 2021). The number of students with special education needs and intensive support needs in the class, the school size, and the availability of teaching assistants are among the factors contributing to teacher burnout. Pedagogical approaches appropriate for larger classes in higher education include peer learning combined with technology usage (Bozzi et. al., 2021), collaborative learning using wikis (de Ariba, 2017), and experiential learning using performative pedagogy (Donovan and Hood, 2021). Other approaches identified in the research include student-centred instead of teacher-centred approaches and dividing students into smaller groups. Individual guidance and high student learning engagement could be achieved in primary classes with more than 20 students.

What is missing

Our systematic review of the relevant studies identified the following important areas where more robust evidence is needed for the EU Member States.

First, while some studies suggest an optimal class size in compulsory education, there is still not enough evidence in this regard.

Second, there is a need to evaluate the costs and benefits associated with class size reductions/increases. Existing studies focus predominantly on the link between class size changes and academic outcomes. However, it is important to consider that adapting class size might involve higher pressure on education spending than other policy options, such as improving teacher quality (Normore and Ilon, 2006). Moreover,

current online education settings should be also considered in future analysis to evaluate the cost-effectiveness of reducing/increasing class size.

Third, the review shows that more evidence is needed on the impact of class size on student achievement and their motivation and on teaching approaches across EU Member States in Central and Eastern Europe.

Cost-effectiveness aspects

Our literature search resulted in only two studies of quality presenting estimates of the monetary costs related to class size changes.

First, Kedagni et al. (2021) evaluated the monetary impact of decreasing and increasing class sizes in Greece, taking account of the costs of hiring and firing. They estimated that a rise in teacher wages of 50% would increase the optimal class size by two students whereas grade point average (GPA) would fall by 0.3 points. Class size caps[30] might be costly even if they are set well above the average level of the class size since schools are expected to add a class before the cap is reached in the case of volatile enrolment and large adjustment costs.

Second, Mucharreira et al. (2019) estimated additional gross and net costs associated with the increasing number of classes and hence teaching hours in Portuguese public primary and secondary education in 2017/18. The total net costs reflecting both the additional expenditure and the associated additional benefits from direct and indirect tax contributions to the State budget are 30% lower than the gross costs.

On the basis of the available evidence, we estimate the cost effectiveness of the following four approaches to class size (table 4).

Table 4: Cost-effective ways to adapt class size

Approach	Authors	Evidence base	Effectiveness	Costs
Reduced classes for disadvantaged students and SEN students (primary, secondary education)	Ecalle et al. (2019); Andreu et al. (2021) Bressoux et al. (2019) Fredriksson et al. (2014)	High	High	High
Training teachers in effective pedagogical approaches according to the class size (primary, secondary, higher education)	Konstantopoulos and Shen (2016) Dieterle (2015) Maulana et al. (2017)	Medium	High	Medium
Multigrade classes (primary, secondary education)	Checchi and Paola (2018) Leuven and Ronning (2014)	Low	Medium	Medium
Optimal class size for regular classes in compulsory education (20-23 students) (primary, secondary education)	Mazrekaj et al.(2021), Kedagni et al.(2021)	Low	High	Medium

[30] "Cap" is the maximum number of students who can be enrolled in a classroom.

3.1.4. Raising teachers' pedagogical digital competences

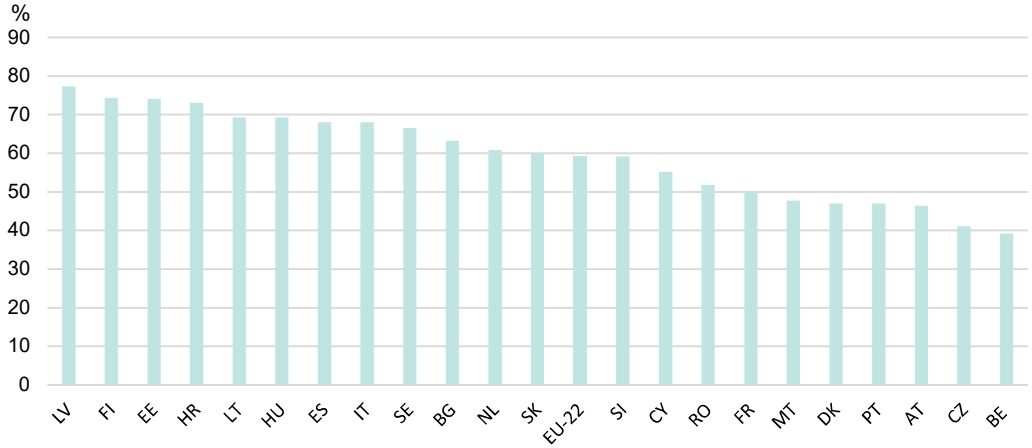
What the evidence shows

Raising teachers' pedagogical digital competences is expected to be associated with improved student outcomes. In particular, OECD data from 2018 revealed that students in schools where teachers have the necessary technical and pedagogical skills to integrate digital technology in instruction perform better in a test than students whose teachers do not possess such skills. This finding might also be driven by selection effects with better teachers in the better schools, which might explain that the difference is not statistically significant when socioeconomic status is taken into account (OECD, 2020b). Using an experiment in Flemish Community of Belgium's secondary education, Compen, De Witte and Schelfhout (2021) show that teacher engagement in a webinar series generated student learning outcomes 0.39 standard deviations higher than those of students whose teachers did not receive this intervention, thus, confirming the effectiveness of an online teacher professional development initiative that focussed also on digital competences. This effect was found immediately after programme implementation, and it persisted for at least six weeks. As an underlying mechanism, the authors suggest that engagement in the webinar series enhances teachers' self-efficacy.

In addition, raising teachers' pedagogical digital competence may help teachers feel more prepared to teach remotely in particular situations, such as the recent COVID-19 crisis. This way, attainment gaps in education systems may be reduced or even avoided as a (sudden) change to remote education will not penalise students whose teachers would otherwise not use or feel comfortable to use digital technology in the classroom (OECD, 2020a). Meester (2021) showed that adaptive practicing software mitigated, or even reversed, the negative effects of school closures on mathematics learning. This contrasts to significant learning deficits that have been observed in education systems where teachers have less digital competences (Gambi & De Witte, 2021). If digital tools effectively succeed in mitigating the attainment deficits during school closures, raising the digital competences of teachers, and consequently fostering the use of digital tools, would result in significant welfare gains at both the individual and societal levels (Maldonado & De Witte, 2021).

Despite the benefits of raising teachers' pedagogical digital competences, there is significant variation in professional development on the topic of ICT and skills for teaching. Using TALIS (2018) data, we show the variation between EU Member States in Figure 5.

Figure 5: ICT skills for teaching' as a topic in professional development of lower secondary teachers who attended at least one type of CPD activity, 2018 (%)



Source: OECD, TALIS 2018.

Moreover, while many approaches have been developed that focus on improving the pedagogical digital competences of teachers, sound empirical evidence on the effectiveness of these approaches is scarce. Several literature reviews have pointed to the lack of high-quality studies and the need for more (controlled) evaluations (Kay, 2006; Lawless & Pellegrino, 2007; Yurtseven et al., 2020). In particular, the majority of the extant evaluations have been based on qualitative research, examining the effectiveness of one approach rather than comparing different approaches against each other. Evidence supporting one approach over the other is thus missing.

Below, we discuss different possible approaches. A distinction is made between approaches identified for pre-service teachers and in-service teachers.

Approaches identified for pre-service teachers

Teacher education programmes are a natural place to start preparing teachers to integrate technology in the classroom (Kay, 2006). This has resulted in the development and evaluation of various approaches in teacher education programmes. Four main approaches were found in the literature, i.e., a one-shot workshop (e.g., Reisoğlu & Çebi, 2020), a stand-alone technology course (e.g., Angeli & Valanides, 2009; Lee & Lee, 2014), a technology-infused approach (e.g., Admiraal et al., 2017; Banas & York, 2014; Buss et al., 2015; Tondeur et al., 2017), and an integrated approach (e.g., Shinas et al. 2015; Mouza et al., 2014). One-shot workshops are primarily used to help pre-service teachers in key areas, whereas stand-alone technology courses teach pre-service teachers a wide range of computer skills. Although the former approach saves time, the set of digital competences teachers learn might be limited. A technology-infused approach implies one step further than a stand-alone technology course. In particular, rather than learning about digital technology, pre-service teachers learn about methods with digital technology during a methods course. Finally, an integrated approach implies that pre-service teachers are simultaneously enrolled in a technology course, a methods course, and a field experience, which provides them the opportunity to apply the content of the courses in a classroom setting. In the reviewed studies, (stand-alone) technology courses and methods courses were usually implemented over the course of one or two semesters, while field experiences appeared to take up to three weeks.

Regardless of the approach used, we identified several re-occurring strategies across the different studies. The strategies were consistent with the Synthesise Qualitative Data (SQD) model (Tondeur et al., 2012). Using a “meta-ethnography” approach to review 19 qualitative studies,[31] Tondeur et al. (2012) developed the SQD model including key strategies at the classroom level for the pedagogical digital competences training of pre-service teachers: (1) aligning theory with practice (to make pre-service teachers understand the reasons behind using digital technology); (2) using teacher educators or mentor teachers as a role model (to motivate pre-service teachers); (3) reflecting on the role of technology in education (by using discussion groups, observation, and writing in order to change pre-service teachers’ attitudes); (4) learning technology by instructional design; (5) collaborating with peers, teacher educators, and mentor teachers (by discussing and sharing concerns); (6) scaffolding authentic experiences with technology (via field experiences); and (7) providing continuous feedback. The majority of the studies evaluating a specific approach included one or several of the above-mentioned strategies.

[31] A “meta-ethnography” approach is an interpretative (rather than aggregative) strategy to synthesise qualitative data.

Approaches identified for in-service teachers

Following the classifications by Lawless and Pellegrino (2007) and Major and McDonald (2021), we identified three main approaches to enhance the pedagogical digital competences of in-service teachers, i.e., mentoring or coaching, online training (e.g., Rienties et al., 2013), and formal professional development including train-the-trainer activities, workshops (e.g., Reisoğlu, 2021), and teacher design teams (e.g., Koh et al., 2017). Mentoring or coaching models are focused on the differing objectives and needs of individual teachers. The support can be provided not only by professionals or technology-savvy colleagues but also by students or pre-service teachers (e.g., Liu et al., 2015). By linking in-service teachers with pre-service teachers and supporting them, both might benefit from this type of activity. Online training tends to be a less costly and more larger-scaled intervention and offers teachers flexibility and independence. However, such training may fail to provide teachers with sufficient opportunities to engage with specific pedagogical content. Related to formal professional development, train-the-trainer activities refer to the practice of initially training a group of teachers who subsequently teach a new group of colleagues. While such practice can scale up smaller interventions, Lawless and Pellegrino (2007) argue that they may fail to account for the individual needs of teachers. One-shot workshops are increasingly disfavoured in the literature since they are often too disconnected from regular classroom practices and do not provide opportunities for follow-up learning or feedback. Teacher design teams, on the other hand, allow teachers to learn how to use specific technologies within the context of their curricular needs by collaborating with peers on design tasks (e.g., (re)designing a lesson plan or course). Each approach clearly has its strengths and/or weaknesses. Yet, as argued by Lawless and Pellegrino (2007), it remains unclear whether the strength of one approach has a larger impact than the strength of another approach since no study has compared the effectiveness of different approaches.

Again, regardless of the approach, the reviewed studies included one or several strategies, which were largely consistent with key features of other teacher training programmes. What might be specific to the in-service training is the domain-specificity of an approach (Voogt et al., 2013) and the building of (online) communities within and across school settings (Lawless & Pellegrino, 2007). For the different strategies to be effective, specific conditions must be met. For instance, in-service teachers will only benefit from collaboration and feedback from peers if they are sufficiently supported and motivated to exchange information with each other (Reisoğlu, 2021; Rienties et al., 2013).

What is missing

Although raising teachers' pedagogical digital competences is expected to be associated with improved student outcomes, most studies focussed on changes in teacher outcomes rather than student outcomes. Improving student outcomes, however, is one of the ultimate goals of pedagogical digital competences training. The existing literature provides us with theoretical insights into which approaches are available, the reasons why some approaches might succeed or fail (Tondeur at al., 2012), and a mainly qualitative evidence base. However, there is in general a lack of quantitative evidence that relies on identification methods that allow for causal interpretation, and evidence that can be interpreted in standardised effects such that the (cost) effectiveness of professional development initiatives can be compared.

Cost-effectiveness aspects

Multiple approaches and strategies exist to enhance the pedagogical digital competences of both pre-service and in-service teachers. However, comparing the

effectiveness of the different approaches is challenging because the evaluation studies (1) were mostly based on qualitative research, (2) usually examined the effectiveness of one approach only, and (3) used different outcome measures (such as teachers' opinions, changes in TPACK values, students' course evaluations, actual technology integration in class, self-efficacy beliefs, and more). Accordingly, it is not possible to identify a single effective approach if we look at the "effects"-side only. It is important to also consider the "estimated costs"-side. As earlier literature did not make the costs explicit, we estimated the costs based on the duration (i.e. next to direct wage costs, there are also opportunity costs), the scale of the intervention, the mode of the intervention (e.g. face-to-face, online), the number of instructors, the need for field placements, and the time to develop the initiative.

While higher effectiveness is expected for the more advanced technology-infused and integrated approaches, these approaches may also come at a higher estimated cost than one-shot workshops or stand-alone technology courses. For instance, an integrated approach requires finding (technology-rich) field placements for pre-service teachers and multiple instructors to teach the different courses.

Next, consider different approaches for in-service teachers. While approaches such as mentoring or coaching and teacher design teams are expected to be effective because of the contextualised and personalised nature, these approaches may also be more costly than other approaches. Specifically, they are usually implemented over a longer period of time and/or at a smaller scale (i.e., a one-on-one or small-group setting). As a solution and as proposed by Yurtseven et al. (2020), integrating the latter approaches in online settings (in order to reach a larger audience) might be a more cost-effective way of raising the pedagogical digital competences of in-service teachers. This remains to be tested.

Table 5: Cost-effective ways to raise the PDC of pre-service teachers

Approach	Evidence base	Effectiveness	Costs
One-shot workshop	Reisoğlu & Çebi, 2020	**Low** - Less likely to include multiple SQD strategies - Students learn limited range of computer skills	**Low** - Short duration - Across or within institutions - Face-to-face or online - One (or multiple) instructor(s)
Stand-alone technology course	Angeli & Valanides, 2009 Lee & Lee, 2014	**Low to medium** - Less likely to include multiple SQD strategies (e.g., less likely to teach students how technology intersects with pedagogical and content knowledge) - Students learn a wide range of computer skills	**Low to medium** - Long duration - Within institutions - Face-to-face - One (or multiple) instructor(s)
Technology-infused approach	Admiraal et al., 2017 Banas & York, 2014 Buss et al., 2015 Tondeur et al., 2017	**Medium** - More likely to include multiple SQD strategies - Effects depend on skills of methods instructor	**Medium** - Long duration - Within institutions - Face-to-face - One (or multiple) instructor(s) who has both knowledge about digital technology and the subject area

Integrated approach	Shinas et al. 2015 Mouza et al., 2014	**High** - More likely to include multiple or all SQD strategies - Effects depend on whether field placement is technology-rich	**High** - Long duration - Within institutions - Need for field placements - Face-to-face - Multiple instructors and teacher mentors

Note: The effectiveness of the different approaches is not derived from (causal) empirical evidence but is based upon our expectations and findings of previous (qualitative) research.

Table 6: Cost-effective ways to raise the PDC of in-service teachers

Approach	Evidence base	Effectiveness	Costs
Mentoring or coaching	Liu et al., 2015	**High** - Adapted to individual curricular needs of teachers - Both mentors and mentees may benefit from training	**High** - Within institutions - Face-to-face - "One-on-one" setting (small scale)
Online training	Rienties et al., 2013	**Medium** - Timing and location flexibility - Fewer opportunities to engage with specific pedagogical content	**Low** - Across institutions - Online (large scale)
Train-the-trainer	Lawless & Pellegrino, 2007	**Medium** - Guidance by a colleague may be more credible and relevant - Potential failure to account for local needs and provide relevant training in specific context	**Low** - Across or within institutions - Scale up smaller intervention, reaching a large audience
One-shot workshop	Reisoğlu, 2021	**Low** - Disconnected from regular classroom practices - No opportunities for follow-up learning or feedback	**Low** - Across or within institutions - Short duration
Teacher design teams	Koh et al., 2017	**High** - Includes multiple key strategies: learning instruction by design, collaboration, reflection - Adapted to curricular needs of teachers - Opportunity to build communities of colleagues	**Medium to high** - Across or within institutions - Long duration - Small groups of teachers (small scale)

Note: The effectiveness of the different approaches is not derived from (causal) empirical evidence but is based upon our expectations and findings of previous (qualitative) research.

3.1.5. Stimulating parental involvement

What the evidence shows

Previous research has shown that when schools were given additional resources and responsibilities, parents reduced their role in education and training in response (Das et al., 2013; Houtenville and Conway, 2008), although sometimes parents also intensify their efforts in a response to increased school resources (Datar and Mason, 2008). Parents' efforts also decrease as parents are convinced of the quality of the school and teachers (Cunha, 2018; Greaves et al., 2019). Conversely, parents will put extra effort into their child's education if they suspect that educational quality (in general or in a school) is declining, or if the child needs additional educational support. In terms of time commitment, parent involvement and time spent in school by students also appear to be substitutes (see overview in Maldonado, 2022).

Evidence shows that parental involvement might be a (cost-)effective measure to improve (non-)cognitive learning outcomes. Parental involvement can have a positive effect on children's academic performance by motivating their children, teaching them knowledge, or influencing behaviour (Cunha et al., 2017). Moreover, Maldonado and De Witte (2021b) show that parents can also benefit from the learning material they go through with their child, or the material can facilitate engaging in certain topics of conversation. Parental expectations for their child's educational attainment have also been found to be central in shaping educational outcomes, particularly where children have additional educational needs (McCoy et al., 2016). Parents can also reinforce gender or other stereotypes in relation to what is seen as appropriate learning for their child or how they perceive their child's performance in different domains. For example, research has shown that parents can impart, and children take on, the view that boys are good at maths from a very young age (McCoy et al., 2021).

The capacity and opportunity for parents to support their children's education varies widely. Disadvantaged students often do not have a place to work quietly, are more likely to reside in a stressed house and are less likely to have parents present to motivate them. Thus, unequal home learning environments have further magnified existing inequalities in the context of the COVID-19 pandemic (Mohan et al., 2021). At school, opportunities are in theory equal for all students and education is therefore seen as the way to compensate for students' unequal home learning environments. Observational data show that parental involvement is positively correlated with socio-economic status (Avvisati, Besbas, & Guyon, 2010). Hence, promoting parental involvement may have greater benefits for disadvantaged students compared to more affluent students, by starting from a lower level of parental involvement. Another downside of parent involvement is the high opportunity cost to parents in the form of the time investment that cannot be used for other purposes (Maldonado, 2022).

Parent involvement in the learning process

Parent involvement is a multifaceted concept encompassing different parenting practices. Formal involvement, such as supervision at home, can be distinguished from personal involvement, such as interest and aspirations, and cognitive-intellectual involvement, such as providing a stimulating home environment (Grolnick & Kurowski, 1999). Parents can also play an important role in the development of socio-emotional skills, through the transmission of their values, attitudes, and ways of living to their children - who bring these skills into the classroom and the learning process. It can also be noted that the skills of parents (for example in specific disciplines or areas) can be a channel for transmitting different capabilities and enthusiasm for specific disciplines, which policymakers, principals and teachers should keep in mind when designing interventions. Indirect involvement with school, through general supervision

at home and participation in activities related to school organisation (e.g., membership of school boards or parents' councils), appear to be less important to children's learning process (Hill & Tyson, 2009). Therefore, we focus on the effects of involvement in the learning process that rely on direct interaction between the parent and their child.

The nature of parental involvement changes as children get older (EEF, 2022), with a move from supporting basic skills towards meta-cognitive skills development. Our focus is on forms of involvement in secondary education that have lower costs and can be rolled out on a large scale, particularly information, collective homework, and tutoring.

Effects of parent involvement

Meta-analyses of parent involvement typically show slight positive correlations between parent involvement and student achievement (Boonk, Gijselaers, Ritzen, & Brand-Gruwel, 2018). Nevertheless, there are also studies where the correlation turns out to be negative (Hill & Tyson, 2009). This is explained by the fact that correlations cannot exclude reverse causality. It is possible that parents make efforts mainly when their child is experiencing difficulties in school. Experiments with randomised assignment to an intervention and a control group allow for causal interpretation. Most of the existing literature on parent involvement does rely on correlational and qualitative analyses. Experimental studies tend to focus on very young children (e.g., Mayer, Kalil, Oreopoulos, & Gallegos, 2019), improved information about school performance (e.g., Dizon-Ross, 2019), or reinforced information to parents around absences, grade point averages, and uncompleted homework (e.g., Bergman & Chan, 2021). This evidence shows that frequent general (positively worded) communication from the school, and personalised communication, is an effective strategy to reduce poor attendance and improve school performance.

Providing information to parents

Maldonado and De Witte (2021a) identify the effects of providing subject-specific information to parents in a lesson series on "financial and economic competencies" in a randomised experiment. The results showed that the financial literacy increased to an equal extent when the subject matter information was or was not provided to parents. This implies that the added value of handing out subject matter information to parents is not an effective measure to increase (subject-related) knowledge. However, the experiment established a significant added value of providing information on students' tested skills. The positive effects on proficiency were independent of student background characteristics. These findings are in line with surveys showing that parents have a stronger influence on behavioural outcomes than cognitive outcomes (McNeal, 2001). As noted in section 4.2, providing information and resources to parents in their own language is also important.

Effects of homework with or without parent involvement

Homework has been found to have a positive effect on learning outcomes, especially in secondary education (EEF, 2022). Homework allows students to practice the material and develop skills to work independently. Although parents can best encourage their children to complete their homework, for many of them homework remains something abstract over which they have little control. Maldonado and De Witte (2022) examined the effects of going through homework with parents in a step-by-step way as part of a financial education class series. The added value of parental involvement in homework was not significant on average, as an alternative homework assignment without parental involvement produced similar effects for the average

student. Nevertheless, encouraging parental involvement had significant positive effects on the financial skills (e.g., paying, fraud detection, or marketing skills) of disadvantaged students. Before the intervention, there was little communication at home in these families about the specific learning content of financial literacy. These results contrast with classical survey studies suggesting that parental involvement can only benefit affluent students. The results go against this common assumption, showing that socio-economically disadvantaged parents are also looking for a targeted way to help their children. For them, well-structured homework provides entry points to talk about school and the learning material it teaches.

Effects of parents as teacher

Many parents convey learning materials to their child themselves when teacher shortages result in disruptions to student learning. An experiment by Maldonado and De Witte (2021b) examines the effects of this practice. It evaluates in a randomised manner the effects of parental tutoring in secondary education. More specifically, in random schools, students were taught by a teacher, while students in other schools were taught by their parents. In both groups, the learning content, objectives, and didactic approach were similar and prepared by the same didactic team. This study found that, on average, students' knowledge increased more as a result of in-class lessons than when parents provided the lesson. However, this average effect occurs because not all parents provided the lesson for their child. The results for the students where parents were effectively involved show that the lesson provided by parents produces similar learning effects as an equivalent lesson in school. A parent can therefore briefly take over the teacher's role, provided there is adequate didactic elaboration. Since a teacher teaches an average of 18 students and a parent in a one-on-one relationship, it does lack the benefits of the school context.

Moreover, the study finds that this method of parent involvement also generates positive learning effects for the parents themselves. Due to selection effects in non-binding initiatives, it is often difficult to impart essential knowledge and skills at a later age. The results of the study, however, point to a promising way to reach parents through their children, and in this way to still teach certain learning content at a later age.

What is missing

Reflecting the growing marketisation of education and the increasing opportunity costs of parents, many countries have seen an increasing use of private tutoring in primary and secondary education. In some countries, this increase comes partly as a response of parents and students to declining academic performance as measured by international tests or polls. In other systems like Ireland, high levels of shadow education participation stem from the high stakes examination system rather than perceptions of educational standards (McCoy and Byrne, 2022). Measuring the extent of this "shadow education" is a challenge, but surveys suggest wide variations ranging from 11.9% of students in the Netherlands (De Geus & Bisschop, 2017), up to 60% of final year secondary students in Ireland engaging in such tuition (McCoy and Byrne, 2022). Regardless of the rationale, much of the evidence highlights shadow education as a mechanism that contributes to the reproduction of social inequality in the experience of schooling, highlighting how access to shadow education as an educational resource is socially stratified, accessible to those with greater levels of family resources, and in some countries, those attending schools with higher socio-economic student intakes (see McCoy and Byrne, 2022).

The policy challenge and consequent research question is whether to seek to equalise access to such tuition or reduce the incentives to engage in the first place. For example, in Ireland one intervention is providing additional tuition in a group of

schools serving socio-economically disadvantaged populations, to enable all students to access to such resources[32].

Further research is also needed to explore (cost)effective ways to involve low SES-parents. First experimental evidence suggests that well-structured homework provides entry points to talk about school and the learning material it teaches, which is particularly useful for low SES households. However, further research should examine the external validity of these findings.

Cost-effectiveness aspects

Table 7: Cost-effective ways to enhance parental involvement

Approach	Authors	Evidence base	Effectiveness	Costs
Weekly text message to parents with an exercise plus a phone call to assist parents (Botswana)	Angrist, Berman & Matshen, 2000	**High**	**High**	**Medium**
Individualized message to parents of high school students at risk of school dropout (US)	Kraft & Rogers, 2015	**High**	**High**	**Low**
Daily phone call and written message to parents in mandatory summer schools (US)	Kraft & Dougherty, 2013	**High**	**High**	**Medium**
Text messages to parents (Brazil)	Cunha, Lichand, Madeira, & Bettinger, 2017	**High**	**High**	**Low**
Summer literacy events to parents (US)	Kim & Guyan, 2010	**High**	**Low**	**Low**

[32] Power2Progress programme initiated in 2022 in Ireland: https://power2progress.ie/

3.2. Digital education

Key policy conclusions:

- The use of *digital technologies for teaching and learning can offer huge opportunities* to boost educational outcomes, if properly planned and designed. At the same time, *mitigating the risks of digital exclusion or inappropriate use of technology is vital.*
- The *impact of digital education on student outcomes mainly depends on which technologies are selected for use, how they are implemented in the classroom and integrated into the teaching process*. This points to the importance of raising teachers' pedagogical digital competences.
- *Low-tech behavioural interventions that contribute to parental involvement seem promising* given their very limited costs and positive effects on test scores.
- The potential of using *digital tools beyond classroom hours has not been fully realised and more robust evidence of the effectiveness of this is needed*.
- It is important to *further develop a different paradigm for instructional design and delivery of content for adults*, as they have more sophisticated needs and expectations than young learners.
- *The European Commission should promote new experiments in digital education* to broaden the existing knowledge as developments in this area have been rapid and several aspects are relatively new or lack a solid research base.

EU policy framework for digital education

Digital transformation has changed the society and the economy with an ever-deepening impact on everyday life. The **Digital Education Action Plan 2021-2027**, adopted in September 2020, is the EU's policy framework to support the sustainable and effective adaptation of the education and training systems of EU Member States to the digital age. The Action Plan addresses the challenges and opportunities of the COVID-19 pandemic and offers a long-term strategic vision for high-quality, inclusive and accessible digital education in the EU.

The Action Plan has two long-term strategic priorities: (i) fostering the development of a high-performing digital education ecosystem, and (ii) enhancing digital competences for the digital transformation. In this report, we will focus more specifically on the first aspect: the use of digital technologies in the educational system, which is an important step towards the development of a high-performing digital education ecosystem.

The Action Plan defines a set of key enabling factors that need to be fulfilled in order to achieve the successful transformation of education and training towards digital:

- tackling connectivity gaps;
- tackling equipment gaps;
- supporting education and training institutions with know-how on how to adapt and digitise in an inclusive manner;
- addressing accessibility and availability of assistive technologies;

- fostering closer dialogue on digital education between stakeholders in the economy and education institutions;
- developing guidelines for digital pedagogy, drawn from best practice and experience, and upskilling teachers.

These can be considered the basic building blocks needed to take full advantage of the opportunities offered by digital technologies to education and training.

Setting the scene

When talking about digital education, the question is not, whether to invest in it, but what the minimum – or necessary – requirements and standards to aim for are.

The effectiveness of digital education is in itself a complex and multifaceted issue that can be divided into a number of distinct research topics. Our work has identified topics such as a model and cost assessment for adequately equipped and connected classrooms, the development of digital learning content, the use of learning analytics to increase learning outcomes, the impact of artificial intelligence on learning, quality assurance of online assessment and degrees, or effects of digital use in homes on learning outcomes, just to mention a few. Developments in the area of educational technology have been rapid and several of these topics remain relatively new and lack a solid research base.

For the specific purpose of this section, we define digital education in a broad sense, as encompassing all possible uses of technology in teaching activities. A distinction is proposed between (i) online and blended learning, and (ii) synchronous and asynchronous learning (Table 8).

Table 8: Modes of digital education

Online learning	**Blended learning**
All teaching activities are conducted online, and no on-campus activities are included into the teaching experience	A substantial part of the teaching activities are realised on-campus, with students and instructors conveying in the same place. Indicatively, at least 30% of activities happens on-campus.
Synchronous learning	**Asynchronous learning**
The teaching activity, when conducted online, is conducted through live sessions where the instructor and the students are connected at the same time and specific spaces for interactions are designed	The teaching experience, when conducted online, is conducted through activities which do not require the students and the instructor to be connected at the same time (e.g. pre-recorded videos, tests, remote cases, etc.)

In this report, we also refer to *digitalisation* as a strategy or process that goes beyond the implementation of technology to imply a deeper, core change to the entire "business model" and the evolution of work. According to this definition, digitalisation is a transformative change that affects all aspects of modern social life, including education. *Digitisation*, on the other hand, is the conversion of analogue to digital, and how information and communication technology (ICT) is used for accessing, gathering, manipulating and presenting or communicating information.

The cost side of the digitalisation challenge is worth investigation. With this, we mean both recurrent expenses (e.g., software licences, internet access, data bundles, etc.), and investment. Whatever the concrete nature of division into investment and

recurrent expenses is, the follow-up costs remain substantial, since they also comprise the development and production of content in its various forms.

Ultimately, the proper use of digital equipment, tools as well as learning management systems requires teacher pre- as well as in-service training, which demands that teacher training institutions (often higher education institutions for pre-service training and specific teacher training centres for in-service-training) are equally well-equipped and the trainers are trained accordingly.

For this report, we have focused on what we consider being the most important and central topics in this area, namely the knowledge base regarding the effectiveness and efficiency of digital education in school, higher education, and adult learning.

Although the use of digital tools in school education is a much-researched area, the extent of effectiveness and efficiency in digital education in general has received less attention. There seems to be a consensus among practitioners and scholars that digital tools have benefitted the efficiency and effectiveness of schools´ daily organisation, particularly in supporting administrative personnel in performing administrative tasks (e.g., financial management) and the daily organisation of the school (e.g., planning of the rooms). When it comes to digitalisation at the level of the direct learner/teacher relationship, the experiences are more ambivalent.

Research in the area of school education can be categorised into two broad categories. The first primarily addresses the effectiveness or efficiency of digital learning on student academic performance by comparing innovative digital instruction with traditional instruction (De Witte & Rogge 2014). The second examines the relationship between ICT use and student learning outcomes using cross-sectional data, especially large-scale survey data (Skryabin et al. 2015).

Although there is still limited robust evidence on the impact of the use of digital tools within schools, there is even less evidence on how digital tools can be used out of the classroom, i.e. outside of the standard curriculum and activities performed in school, in particular for compensatory education. Research has shown that policies such as intense tutoring may help increase the educational attainment of low-achievers, but they require significant resources (Nickow & al. 2020). However, there is potential to leverage digital technologies to help better connect families, students and schools and to develop compensatory programmes that could be more intensive at a lower cost or reach more students. This has become all the more important during the COVID-19 pandemic, which has forced teachers and schools to increase the use of digital technologies. Nevertheless, the period has also widened the educational gap already existing between high-performing and low-performing students.

Innovations in digital education were first implemented in higher education, under the assumption that relatively older students can manage the use of technology in a more mature way than students in primary and secondary schools. As a consequence, experimentation and innovations in higher education online learning were implemented on a wider scale since the early 90s. Overall, this is a policy area in which some conclusions can be drawn about the effectiveness and cost of interventions and programmes.

Finally, there are different practises at the intersections between lifelong learning, education, and digital technologies that can be implemented in widely different ways and produce different outcomes, and they would deserve further investigation.

While focussing on digital education, it is worth mentioning that digital skills and competences cover different aspects and levels, as highlighted by the DigComp 2.2 Framework. Table 9 shows the different levels of digital skills, starting with information and data literacy and communication and collaboration, which are basic skills, to content creation, safety aspects and problem solving.

Table 9: The Digital Competence Framework for citizens (DigComp 2.2)

Digital Skills				
Information/ data literacy	**Communication and collaboration**	**Digital content creation**	**Safety**	**Problem solving**
• Browsing, searching and filtering data, information and digital content • Evaluating data, information and digital content • Managing data, information and digital content	• Interacting through digital technologies • Sharing information and content through digital technologies • Engaging in citizenship through digital technologies • Collaborationg through digital technologies • Netiquette • Managing digital identity	• Developing digital content • Integrating and re-elaborating digital content • Copyright and licenses • Programming	• Protecting devices • Protecting personal data and privacy • Protecting health and well-being • Protecting the environment	• Solving technical problems • Identifying needs and technological responses • Creatively using digital technologies • Identifying digital competence gaps

Source: *Vuorikari, R., Kluzer, S. and Punie, Y., DigComp 2.2: The Digital Competence Framework for Citizens*

The 2018 International Computer and Information Literacy Study (ICILS) indicates that eighth-graders in the participating EU Member States (Denmark, Finland, France, Germany, Italy, Luxemburg, and Portugal) scored on average 509 points, which is slightly above the overall average of 500. Denmark's students scored 553, with a significant improvement from the previous cycle, while this was not necessarily the case in all other EU Member States. Finland ranked third (531) - following Korea - and Germany fourth (518).[33] The evidence shows still a high share of young people with only basic competences, which do not allow the proficient use of digital technologies. For example, the share of students with level 1 or 2 proficiency is one third in Germany, more than one fourth in Finland and one-sixth in Denmark, while only a small share achieves the highest competence level. Similar patterns can be observed in other EU countries. This is the reason why, in 2021, the EU Member States set the EU-level target to reduce the share of low-achieving eighth-graders (13-year-olds) in computer and information literacy (measured by ICILS) to below 15% by 2030.[34]

It is important to mention that, in the digital world, acquiring digital skills has become just as important as mastering basic skills. All of them are parts of the key competences each pupils should become proficient in. Nevertheless, it is evident that people who can hardly read and write and/or do not understand simple sentences will be excluded from the digital world, apart from simple and passive consumption of

[33] For a more detailed analysis: https://education.ec.europa.eu/sites/default/files/document-library-docs/icils-2018-policy-note.pdf

[34] Council Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond (2021-2030): https://op.europa.eu/en/publication-detail/-/publication/b004d247-77d4-11eb-9ac9-01aa75ed71a1

content. Research reveals that the switch from the passive to active use of digital content and tools is almost as difficult as the shift from low and unqualified to the medium and, particularly, highly skilled. Therefore, the use of digital technologies in education should serve two purposes: developing digital literacy skills, and fostering the acquisition of basic skills.

It is impossible to assess in a transparent and complete way the effects (and costs) of programmes/policies promoting the use and adoption of digital education without considering their multifaced nature. All policymakers who decide to promote the use of digital education should take the various factors at play into consideration. The different positive and negative factors that are shaping the use of digital tools in the educational domain should be considered in a systematic framework, to assess how the benefits counterbalance the costs of adopting digital education in the specific contexts. For example, it is worth considering the heterogeneity of effects and the differences in capacity, by grade, schools' socio-economic conditions, teachers' and principals' experience, etc.

This report presents a preliminary assessment of what can be found in the research literature on the effectiveness of digital education, complemented by professional and expert discussion in order to interprete the available evidence. The area is divided into the following research topics:

Topic 3.2.1	**Digital education in school**
Topic 3.2.2	**Digital technologies outside the classroom**
Topic 3.2.3	**Digital education in higher education**
Topic 3.2.4	**Adult learning and digital education**

3.2.1. Digital education in school

What the evidence shows

While effectiveness denotes the extent to which digitalisation can improve education outcomes, efficiency refers to the extent to which digitalisation can supplement traditional instruction methods (De Witte & Rogge 2014). More specifically, the impact of digitalisation on student attainment depends to a considerable extent on which technologies are selected for use and on how they are deployed in the classroom. This means that process factors are probably more prominent than structural factors. This, in turn, points to the importance of raising teachers' pedagogical digital competences (see also section 3.1.5).

This section focuses on the effect of digital education on students´ academic performance. Along with the direct effects on students' academic achievements, the literature encompasses a number of other potential advantages of digital education (Skryabin et al. 2015). They include, among others, enabling opportunities that benefit students' reflection and analysis, making it possible for students to work more at their own pace, allowing more immediate and personalised feedback based on a given student's learning progress and conditions, helping schools and teachers in bridging the gap between students' in-school and out-of-school learning, and improving students' attitudes toward digital education (Frolova, Rogach & Ryaboca, 2020). T eaching digital skills is an important preparation for the labour market, where they are required in most professions. Also, nowadays, digital skills are a crucial part of daily life needed for participation in society.

There are few studies of digital education in school using large-scale survey data. Having said that, a number of interesting studies build on data from TIMSS 2011, PIRLS 2011 and PISA 2012. For example, Ferraro (2018) shows that the use of ICT

at school has a positive and strong impact on maths test scores. Drawing on national tests with more than 2,000 students in Italy from 2011/2012, Comi et al. (2017) found that the effectiveness of digital education at school depends on the way in which technology is used by teachers and on their ability to integrate ICT into their teaching process. According to Skryabin et al. (2015), the national ICT development level is a significant positive predictor for individual academic performance. Eickelmann, Gerick & Koop (2016) found that characteristics at the school level, such as the IT equipment used by schools, school leadership, aspects of school goals and educational strategies as well as teachers' attitudes, play a major role in the integration of digital technologies into teaching and learning.

The problem with this research, though, is that while the articles were published in recent years, they draw on data that are often 10 years old. In 10 years, a lot has happened when it comes to digital education in EU school settings. This is true both when it comes to hardware and software, but also to the digital competence of both teachers and students. Thus, it is difficult to know to what extent the results of this research are still valid.

Recent research seems to focus more on student academic performance by comparing innovative digital education with traditional teaching methods. For example, Arvanitaki & Zaranis (2020) conclude that using digital tools and augmented reality (AR) applications with primary school students has a positive effect on learning geometry as compared to the traditional teaching method. Hubalovsky et al. (2019) confirm that educational objectives can be achieved more effectively for some students using learning analytics. Agelii & Grönlund (2016) show that ICT use must be well integrated into pedagogy to be useful.

In a meta-study of digitalisation of education in modern scientific discourse, Frolova, Rogach & Ryabova (2020) conclude that, among other things, there is a relationship between high academic performance of students and the use of digital technologies.

There are a number of studies which look at the impact of access to technology on student performance. These include Hull and Dutch (2019) who study the results of the implementation of a "one laptop per child" (also called 1:1) programme in a North American school district. They found no impact in the short term, but maths scores improved in the medium term (4-5 years). Thus, the difference between the short-term and medium-term impacts highlights the importance of long evaluation periods for technology programmes.

What is missing

Regarding research on school education, cost assessments are lacking as well as research looking at student learning outcomes using cross-sectional data, especially large-scale survey data from more recent times. Furthermore, if cost assessments are to be useful, there needs to be a common understanding of definitions of key concepts and a common framework for understanding what factors influence the effectiveness and efficiency of using digital tools in education. In short, we need a common language for describing, defining, and measuring education contexts so that we can understand what makes any two schools "similar" in the ways that matter most to the implementation of education technology (EdTech Evidence Exchange, 2021).

Cost-effectiveness aspects

Table 10: Cost-effective ways to foster digital learning in school education

Approach	Evidence base	Effectiveness	Costs
Establish a common understanding of definitions of key concepts, a common framework for understanding what factors influence the effectiveness and efficiency of using digital tools in schools.	High	High	Low
Promote new experiments in designing and delivering digital education in EU school settings and compare effectiveness and efficiency in different digital education programmes or arrangements.	High	High	High
Finance more evaluations of the effectiveness of digital education in schools, including cost assessments using well-established methods for collecting cost data.	High	High	Medium

3.2.2. Digital technologies outside the classroom

What the evidence shows

After reviewing interventions that focus on implementation of digital technologies within schools, here we focus on interventions using digital technologies outside of the classroom in primary and secondary education. These can be classified into three broad categories:

1. *Interventions using Computer Assisted Learning (CAL) to provide practice/tutoring activities outside the class*. The goal of these interventions is to provide an engaging way for students to learn and practice subjects outside of the classroom. The potential gains of using CAL are the direct and individualised feedback that students may receive while working at home.
2. *Interventions that replace in-person tutoring with online tutoring.* These interventions leverage the use of digital tools to provide tutoring in a cheaper way than in-person.
3. *Low-tech behavioural interventions that aim to facilitate the transmission of information to parents.*

In terms of outcomes, most of the reviewed studies focus on the short-term achievement of students. Some limited studies also consider students' satisfaction and motivation. These aspects are equally important as students need to be motivated to perform extra-curricular activities or attend non-compulsory compensatory courses.

Article selection was guided by existing literature reviews (see in particular Bulman & Fairlie 2016, Lewin & al. 2019, Escueta & al. 2020, Sahni & al. 2021), complemented with a google scholar search. The selection of studies and academic papers to be considered here follows three main criteria: (i) published in high-level academic journals or considered as meeting high standards of evaluation by platforms that review educational research (such as What Works Clearinghouse, Education Endowment Foundation or Eric.ed.gov); (ii) evaluation of effectiveness based on quantitative, econometric methods – preferably, using an approach based on Randomised Control Trial (RCT); and (iii) reporting details about the specific digital

education setting implemented. Some non-published papers are also included in the list because they are very recent and/or because they report findings that are specifically related to the most relevant content of this section. We also restricted the analysis to recent studies (2015 onwards) implemented in developed countries. This severely limits the number of available studies.

Computer Assisted Learning (CAL) for homework

The use of CAL for homework allows teachers to select, adapt and review homework done by students, while allowing students to get more tailored content. Three studies using randomised control trial methods across different countries show significant effects of the use of CAL for homework in improving maths scores, with effects concentrated among low-performing students (Roschelle & al 2016 in the US and Bartelet & al. 2016 in Denmark for 7th grades students, Bettinger et al. 2020 in Russia for 3rd grade students). Evidence on the impact of CAL for homework on language skills is more limited and points towards more limited effects on test scores (Bettinger & al. 2020). An interesting aspect of the study by Bettinger et al. is the analysis of the effectiveness of the time spent on CAL programmes. In their experiment, using CAL for 20-25 minutes per subject/week has significant positive effects on the test scores and motivation of 3rd grade students, but doubling its time use provides no additional gain. This emphasises the need to better understand the optimal dosage of CAL for use both in and out of the classroom at each educational level. The finding by Agasisti et al. (2017) of a negative association between the intense use of computers for homework and PISA test scores indeed suggests that the use of digital tools may not always have a positive impact on students' learning. Moreover, Bartelet et al. (2016) also show that the application by teachers is key to encourage the use of these digital tools when they are not compulsory. Overall, the use of CAL outside the classroom, and in particular for homework, seems to be a promising tool to help low-performing students, as a complement to traditional learning practices. However, their success depends on the way in which the technology is used by teachers, as well as the quality of software used, the availability of IT equipment at home, and the time devoted to the use of such tools. Moreover, there is very limited information about the full costs of implementing these programmes.

Online tutoring

There is limited robust empirical evidence on the impact of online tutoring with randomised experiments. Evidence points towards a positive effect of online tutoring during the COVID-19 pandemic, when tutoring was useful in reaching students who would not otherwise have access to tutors (Carlana & La Ferrara 2021). This confirms the results of earlier non-randomised small-scale studies, which suggest that providing online tutoring to students is better than no tutoring (Chappell et al. 2015). However, a randomised experiment conducted across UK classrooms that provided online maths tutoring, with tutors who were graduates located in India or Sri Lanka, did not yield any significant effects (Torgerson & al. 2016). Overall, while these programmes might reduce the cost of reaching students in some specific settings, there is a lack of evidence on their effectiveness as compared to in-person tutoring.

Low-tech behavioural interventions targeting parents

One promising aspect of ICT use in educational programmes relates to the development of low-tech behavioural interventions that target parents. These interventions provide information to parents with the aim of helping them to engage in activities that will support the development of their children, or to follow more closely their children's school outcomes (see also section 3.1.5 on promoting parental involvement). Web interfaces where teachers can provide information about grades and absences to parents have been implemented in different countries and at

different educational levels, such as in Finland[35], and have been evaluated with randomised control trials in the US and UK. They leverage mobile phone equipment to reach parents through text messages at a very low cost. Interventions at the early stages of education target parents of pre-schoolers or kindergartners by sending them messages aimed at fostering childrens' development. They find very promising results in terms of childrens' later literacy skills, with strongest effects in the bottom ability group (York & al. 2019). Further research suggests that personalised text messages that are tailored to the initial achievement level of the child might be more efficient than standard messages (Doss & al. 2019). Interventions at ISCED 2 level focus on providing information to parents about their children's school attendance and homework completion also seem promising. Experiments in the US and UK (Miller and al. 2017; Bergman and Chan 2019, Bergman 2020) found strong effect on students' behaviour and more mixed effects on students' achievement (from limited to very positive).

What is missing

Evidence on the use of ICT outside of schools reveals some promising areas for intervention but also highlights evidence gaps:

- The use of CAL outside the classroom, as for within-school blended teaching, shows great promise. However, the efficiency and costs of such interventions vary greatly, including the costs of initial equipment for schools and families, the existence of free versus commercial software, and the training needed for teachers to be able to best optimise the use of these tools. Most studies include limited assessments of the full costs incurred in the use of CAL. Moreover, most of the evidence comes from the US and the UK, and there is a need for more EU-based evidence. There is also a lack of evidence on the optimal duration of use of these programmes at different educational levels, and on their potential use for specific compensatory sessions not directly related to school homework.
- While there is some evidence that CAL can be very useful for compensatory education in developing countries (Banerjee & al. 2007, Muralidharan & al., 2019), there is limited robust empirical evidence on the use of CAL in compensatory courses outside the school curriculum in industrialised countries.
- Low-tech behavioural interventions that support parental involvement in their children's education also seem to show some promise. Given their very limited costs (between a few cents when the programme is completely automatised to 5-10 dollars per students), these programmes can be considered as very cost-efficient, even with moderate effects on test scores. However, since these programmes rely on behavioural aspects of the relationship between parents, schools and students, their effect might be dependant of the cultural and institutional context. More research is therefore needed from EU countries, as well as research on how to scale up these programmes at the lowest possible costs.
- Overall, more robust evidence is needed from EU countries. Moreover, studies on CAL should collect data on all costs, including the costs of equipment and maintenance, the cost of buying/developing specific software in the language of the country and the cost of teacher training.

[35] For a description of the system used in Helsinki: https://www.hel.fi/helsinki/en/childhood-and-education/comprehensive/cooperation/wilma/

Cost-effectiveness aspects

Table 11: Cost-effective strategies of intervention outside the classroom using digital technologies

Approach	Evidence base	Effectiveness	Costs
Develop experiments to better understand how digital technologies can be used out of the classroom for compensatory education	**High benefit of performing causal evaluation**	**High**	**Medium**
Develop experiments to better understand the optimal use of Computer Assisted Learning in education	**High benefit of performing causal evaluation**	**High**	**Medium**
Develop the use of low-tech behavioural interventions to enhance the communication between schools, students and parents	**High**	**Medium**	**Low**

3.2.3. Digital education in higher education

What the evidence shows

The role of digitalisation in higher education has been identified as a priority topic by the European University Association (EUA), since the publication of its *Trends 2018* report. It has been acknowledged that digitalisation is challenging, and it has been transforming the way students learn and institutions plan and deliver educational programmes (this even before the COVID-19 pandemic). The report shows that digital education is increasingly embedded in higher education institutions, which are promoting a more strategic use of it.

Three main educational outputs might be considered to assess the effectiveness of digital education in higher education in a comprehensive way:

- *Learning outcomes* – the skills and knowledge acquired by students, as measured for example through standardised tests
- *Satisfaction* – related to the students' overall educational experiences, the degree of interaction between students, etc.
- *Long-term impacts on employability*, by comparing whether students attending digital education programmes actually obtain benefits in the job market

In this brief review, we report on some key evidence, mostly related to the first output (outcomes), which represents the main focus of the academic (empirical) literature. This section addresses the following question: i) is there evidence about the effectiveness of using digital education in the context of higher education?; and ii) is there evidence on the relative costs of such interventions?

The area of digital education in higher education is of paramount importance from a policy perspective, for three main reasons:

- Digital education has been argued to be an important mechanism in providing wider access to higher levels of education.

- Widening access to higher education can happen without increasing costs proportionally, under certain hypotheses (so, it can be a cost-effective strategy for increasing the higher education level across the population).
- Digital education has the potential to create opportunities for disadvantaged students, allowing them to access higher education at lower costs (for example, without living costs, etc.).

The selection of studies and academic papers for review follows three main criteria: (i) published in high-level academic journals; (ii) include an evaluation of effectiveness based on quantitative, econometric methods – preferably, using an approach based on a Randomised Control Trial (RCT); and (iii) report details about the specific digital education setting implemented. Some non-published papers are also included in the list because they are very recent and/or because they report findings that are specifically related with the content of this section. Most reviewed studies focus on effectiveness only, with a minority of them examining the cost side, and consider student achievement as the main output.

Several studies demonstrate that blended learning generates (or can generate, under certain conditions) positive effects for student outcomes. This is the case when comparing with online-only arrangements for remote education. Thus, the results for students attending blended courses are comparable with those attending a more traditional, on-campus educational experience (and both modes are associated with higher student results than online-only settings). This finding seems consistent across a variety of contexts (although almost all in the US context) and with different, specific design of the educational experience.

The satisfaction of students is rarely examined, so we cannot assess the impact of digital education arrangements on this important dimension. Israel (2015), however, reports lower levels of satisfaction for online students (when compared with on-campus students), although there were no differences in achievement across different delivery modes (on-campus or blended).

Much less is known about the costs of providing digital education in higher education and empirical evidence points to different conclusions. A few studies collecting specific data in this area show that costs for producing and delivering courses through remote education might be not that much lower than those required in the context of planning and delivering the courses on-site. Nevertheless, other studies point into a different direction. Bowen et al. (2014) identify substantial cost savings, although in the specific context of community colleges in the US. Deming et al. (2015) also suggest that costs can be lower in courses delivered with remote education. Protopsaltis & Baum (2019) do not find real differences in the cost structures and amount of resources needed to develop on-campus vs online courses.

What is missing

There are mainly three aspects that are missing in the policy discourse and/or in the empirical evidence available about the use of digital learning in Higher Education and the benefits it can generate:

- The cost of provision for high-quality solutions, especially in cases where blended opportunities are offered to the students (synchronous vs asynchronous modes, online vs on-campus). In this vein, while the literature points at demonstrating good results from experiments involving blended learning (when compared with purely online), the evidence about costs is much lower.
- The potential effects on equity. One major policy concern about using digital learning solutions extensively in the HE experience relates with the unintended consequences for socioeconomically disadvantaged students. On one side, DL

might help disadvantaged students to attend courses and initiative which might be otherwise impossible (for example, by reducing maintaining costs such as house renting and transports). On the other, if teaching methods are not innovated, and/or if the teaching strongly involves on-campus active learning, students who are not attending in the classroom might be penalized. Moreover, disadvantaged students might have less technologically-advanced materials, supplies and broadband than their more affluent peers, with negative consequences on learning - all else equal. All these factors claim for more robust empirical assessments of the effects of DL across the distribution of students by socio-economic status, as well as for developing targeted support for less affluent students in leveraging the DL opportunities offered to them.

- The effectiveness of resources invested as capital spending for adequate digital infrastructures in the universities. The amount of resources invested as capital funding in European universities should be constantly monitored, given its potential beneficial effects on the quality of universities' operations. In this vein, the recent investments realized by universities for equipping classrooms with last-generation tech solutions (also in response to the COVID-19 pandemic) should be scrutinized, and evaluated in the light of the potential benefits generated for students' experience and learning).

Cost-effectiveness aspects

Table 12: Cost-effective strategies for digital education in higher education

Approach	Evidence base	Effectiveness	Costs
Providing opportunities for high-quality blended learning	High	High	High
Specific arrangements to promote more equity in the digital learning opportunities for all students (equity)	Low	To be evaluated	Medium/ High
Capital spending for equipping universities with high-tech modern solutions of digital education	Low	To be evaluated	High

3.2.4. Adult learning and digital education

What the evidence shows

Digital technologies have for decades been adopted to support online and networked learning, for example, in the form of online courses and programmes for professionals. They can be used for tailored/modular provision of learning, which is particularly important for lifelong learning due to the more heterogeneous starting points of adult learners. Moreover, they have the potential to create the flexibility that especially adult learners, with their many competing responsibilities, need. This can be achieved through blended learning, modular Massive Open Online Courses (MOOCs) or individual learning accounts (ILAs). Nevertheless, the potential of those practices has not been fully used yet and robust evaluations on their effectiveness are still rare.

The Digital Lifelong Learning Index of Readiness (Beblavý, Baiocco, Kilhoffer, Akgüç, Jacquot 2019) measures the current situation of digital education in EU Member States and lists what policies countries have put in place to create good conditions for

lifelong digital education. The main conclusion is that progress is uneven and all countries have room for improvement. The gap between the best performing EU Member States and those lagging behind is large across nearly all indicators linked to the three broad categories that, according to the report, are the most relevant to understand digital education readiness: i) learning outcomes and participation; ii) institutions and policies; and iii) the availability of digital education.

Another type of research examines whether digital teaching and learning in adult learning is implemented effectively (Anthonysamy, Koo, Hew 2020). The starting point here is that adults have other reasons for learning compared to younger learners and, therefore, teaching and course structure may need to look different. Anthonysamy, Koo, and Hew (2020) found that learners must develop metacognitive processes, utilise resource management and motivational belief strategies to elevate their digital literacy competency. The role of self-regulation is inevitable in fostering digital literacy enhancement as it may contribute to the more efficient and critical use of digital tools. They conclude that the ability to self-regulate is at the heart of twenty-first-century learning to foster sustainable lifelong learners.

Moreover, Ferreria and MacLean (2018) state that regardless of whether their motivation is intrinsic or extrinsic, adults undertake a course of learning with much more sophisticated needs and expectations than younger learners. According to Ferrerira and MacLean (2018) a different paradigm for instructional design and delivery of content is needed if educational technology is to live up to the promise of enhancing online learning outcomes. The instructional model needs to be changed – from the model rooted in a one-size-fits-all industrial mindset, to one applying a set of adult learning principles. The elements required for the principles of self-concept to be manifested suggest a different role for the instructor: one that defines an instructor more as a facilitator of needs than as merely a transmitter of knowledge.

Finally, some researchers have examined the impact of social media technologies on adult learning. Alsaadat (2018) concludes that the use of social media can improve adult learning outcomes and academic accomplishment. According to him, social media is increasingly proven to be beneficial in adult learning and has a huge potential for adult education. With traditional lifelong learning, there is not one ideal method for education using social media tools. Nevertheless, effective deployment and use of technology in educational settings can, at least to some extent, reduce educational and social inequalities and provide learners with access to educational resources in ways not previously possible, particularly in resource-constrained settings where more classic digital means, such as online forums, can be unpopular and unsuccessful. Hylén (2015) comes to similar conclusions.

What is missing

Adult learning is a field where digital technology can reveal all their potential, at the maximum possible level of application. In the current public and scholarly debates, two topics will deserve more attention (and the provision of more evidence) in the next future:

- The potential role of Massive Open Online Courses (MOOCs) and other form of Open Knowledge. In the past decade, the promise of MOOCs was not only to allow access to students from low socio-economic background to the best professors in the world, but also to create and enlarge opportunities for graduates to continue their learning all along their lives. The evidence about how well these digital instruments are serving this purpose is still limited.

  The systems for assessing the competences of adults can benefit extensively from the use of digital tools. For example, artificial intelligence (AI) and Machine Learning (ML) techniques can be combined to create platforms, software and ICT

tools to identify skill needs and educational opportunities that match the necessity to develop a specific set of skills (see, for example, Perez-Ortiz 2021).

Cost-effectiveness aspects

Table 13: Cost-effective strategies for adult learning

Approach	Evidence base	Effectiveness	Costs
Using MOOCs and other Open Resources for LLL	Low	Medium/High	High
Platforms for LLL based on AI and ML	Low	To be evaluated	High

3.3. Management, infrastructure and learning environments

Key policy conclusions:

- *Research activities studying the impact of learning environments on education outcomes should receive financial support* because school design needs to evolve to respond to changes in teaching and learning.
- *Developing common tools or frameworks, and defining indicators* for the assessment of the current condition and design of new learning spaces, and their impact on education outcomes is key.
- *An assessment of the current state of building stock* would allow for the establishment of priorities for the renovation and maintenance of educational facilities.
- *Clear criteria and priorities for the allocation of construction, operation and maintenance budgets should be designed at national level* tosupport the quality and longevity of education infrastructure..
- *Multiple use of educational facilities after school operating hours* might not necessarily generate savings but it brings important non-monetary benefits. The school becomes the centre of their neighbourhood, the area is revitalised and the community is brought together, resulting in improved well-being.
- *Key funding instruments* such as performance based funding in higher education *needs to be based on smart performance measurement systems,* which could also include indicators on the use of infrastructure and learning environments.

EU policy framework for education infrastructure

The need for smart, effective and inclusive investment in education infrastructure has been high in the EU political agenda. The **European Green Deal**[36] states that focus should be placed on renovating schools and hospitals, as the resources saved through building efficiency will be available to support education and public health, and sets the goal of leveraging EUR 3 billion for investment in education infrastructure. At the same time, the **Communication on a Renovation Wave for climate neutrality and recovery**[37] stresses the importance of scaling up investments in building renovation, including in education infrastructure. Finally, the proposal for a new **European Directive on energy performance of buildings**[38] will facilitate the renovation of homes, schools, hospitals, offices and other buildings across the EU to reduce greenhouse gas emissions and energy bills, and improve the quality of life for millions of Europeans.

The **2020 Commission Communication on Achieving the European Education Area by 2025**[39] also envisages actions for *"fostering new sustainable education and*

[36] EUR-Lex - 52019DC0640 - EN - EUR-Lex (europa.eu)

[37] https://eur-lex.europa.eu/resource.html?uri=cellar:0638aa1d-0f02-11eb-bc07-01aa75ed71a1.0003.02/DOC_1&format=PDF

[38] proposal-recast-energy-performance-buildings-directive.pdf (europa.eu)

[39] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0625&from=EN

training infrastructure and renovating existing buildings ('renovation wave'), thereby creating conducive environments for this change" under its green and digital transition dimension. In the same Communication, the European Commission expresses its willingness to promote the greening of education infrastructure and acknowledges that most school and many higher education buildings are not equipped to face the demand for new competencies and pedagogies. The Communication also specifies that the European Commission will provide specific support to local, regional and national authorities to facilitate mutual learning, analysis and sharing of good practices on investment in education infrastructure.

Moreover, within the strategic priority areas of the **Digital Education Action Plan**[40], an effective digital capacity planning is foreseen that *"requires the development and ongoing review and updating of digital strategies addressing technology gaps in infrastructure, devices and developing relevant organisational capabilities in education, including the capacity to deliver hybrid modes of learning and teaching (remote and on-site)."*

Finally, the **European standards for built environment 17210**[41] sets the minimum functional requirements and recommendations for an accessible and usable built environment, following *"Design for All"/"Universal Design"* principles that facilitate equitable and safe use for a wide range of users, including persons with disabilities. These requirements and recommendations are applicable across the full spectrum of the built environment, including education infrastructure. They are relevant to the design, construction, refurbishment or adaptation, and maintenance of built environments. These requirements aim at avoiding pupils are excluded from the general education system on the basis of their disability.

Setting the scene

Definition of physical learning environments

Buildings, classrooms and equipment are crucial elements of learning environments in schools and universities. Education facilities are expected to provide a safe, secure, accessible, well-ventilated, well-illuminated, well-connected and well-maintained physical environment, to foster teaching and learning activities.

There are three common elements (explicitly or implicitly) present in all topics that underpin the importance of this area:

- *Budget spent on educational infrastructure*: education state budgets include amounts earmarked for the construction of new educational facilities, or the renovation and maintenance of existing ones. According to a recent CEB report[42], 6% of education expenditures or about EUR 48 billion, were allocated to education infrastructure in Europe in 2017 (based on Eurostat data).
- *Large stock of (aged) educational buildings*: they represent 17% of non-residential buildings in the EU and they are among the oldest. Around 75% of educational buildings in the EU were constructed before 1980[43].

[40] https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en

[41] https://www.en-standard.eu/bs-en-17210-2021-accessibility-and-usability-of-the-built-environment-functional-requirements/

[42] Duthilleul, Y., Woolner, P., and Whelan, A. (2021). *Constructing Education: An Opportunity Not to Be Missed*. Thematic Reviews Series Council of Europe Development Bank, Paris.

[43] https://www.europarl.europa.eu/RegData/etudes/STUD/2016/587326/IPOL_STU(2016)587326_EN.pdf

- *Effect of physical learning environments on learning outcomes*: well-built and well-maintained infrastructure can have positive effects on student well-being and learning outcomes. Policy makers are increasingly interested in understanding the link between the physical learning environment and its impact on student performance and learning outcomes. It is assumed that concrete evidence about the impact of learning environments on education outcomes may lead to better informed policy and investment decisions.

The importance of educational facilities is also emphasised by the **UN Sustainable Development Goal 4**[44], in particular **its target 4.a** *("Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all"*).

The OECD Centre for Educational Research and Innovation (CERI) has been working on "Innovative Learning Environments"[45] and has focused on how people learn and under which conditions and dynamics they can learn better. A **learning environment** is defined by CERI as the interaction of four key elements – *learners, teachers* or in the ideal world "those engaged in promoting and facilitating learning", *content*, and *resources* (facilities and technologies) – through the intervening relational medium of the organisation.

The **physical learning environment**, being an influential element in the complex education process, is included under the heading "resources", and it can be defined as the physical spaces (including formal and informal spaces) in which learners, teachers, content, equipment and technologies interact. It is the result of interactions between physical resources (learning spaces, material and technology), learners, educators, content, learning leadership, society and policy.

The OECD framework defines the concept of an "adequate", "effective" and "efficient" physical learning environment. Adequate learning environment is the learning environment that meets the minimum requirements to ensure users' comfort, access, health, safety and security. An effective learning environment supports the varied demands of teaching and learning to enable a school to achieve its educational objectives. Finally, an efficient learning environment maximises the use and management of space and resources to achieve maximum output in terms of student and teacher outcomes.

The full list of topics covered in this section is presented here below:

Topic 3.3.1	**Design of learning spaces**
Topic 3.3.2	**Learning environments: impact on pedagogies and education outcomes**
Topic 3.3.3	**Use of school infrastructure after school operating hours**
Topic 3.3.4	**Management of the education infrastructure network**
Topic 3.3.5	**Allocation of construction, operation & maintenance budget**
Topic 3.3.6	**Performance-based funding in higher education**

The first topic *3.3.1 Design of learning spaces* addresses key questions, such as "how can we design schools that will be fit-for-purpose in 30 years?"**.** The topic

[44] *"Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all",* https://sdgs.un.org/goals/goal4

[45] OECD Centre for Educational Research and Innovation (2011), *The Nature of Learning: Using Research to Inspire Practice*

explores building characteristics and interventions in infrastructure that support innovative pedagogies.

Topic 3.3.2 Learning environments: impact on pedagogies and education outcomes discusses the links between physical learning environment and education outcomes. Specific evidence is presented about: i) the impact of physical characteristics of classrooms on student outcomes[46]; and ii) the impact of different spatial arrangements in classrooms on the learning outcomes of disadvantaged students[47].

Topic 3.3.3 Use of school infrastructure after school operating hours applies mainly to primary and secondary school and (potentially) VET facilities. It discusses the potential benefits as well as operational issues linked to this policy by presenting cases from EU Member States.

Topics *3.3.4 Management of the education infrastructure network*, *3.3.5 Allocation of construction, operation and maintenance budgets,* and *3.3.6 Performance-based funding in higher education* are related to educational governance and management (planning, supervision, coordination, and implementation). Decision-making processes underpinning the construction and renovation of educational infrastructure are key to ensuring that investments in facilities are well designed, target schools/universities in most need, and yield high-quality and sustainable buildings. Policies about the management of the education infrastructure network relates to the allocation of operational resources and administration of the educational system within and across existing schools and universities. Policies about the allocation of construction, operation and maintenance budgets range from budgets being allocated to one central entity, to regional administration and to allocations to schools/universities directly. They also include the distribution of responsibilities in relation to the construction, operation and maintenance of education facilities. Finally, Performance-based funding (PBF) is a concrete example of a broadly used funding instrument in higher education that has a direct impact on the management of higher education institutions.

3.3.1. Design of learning spaces

What the evidence shows

The design of learning spaces can foster - or hinder - the teaching and learning of 21st century skills and competences[48]. Learning has moved from uniformity and conformity in the 19th and 20th centuries to being individualised and collaborative, from a delivery-driven by teachers to learning-led by learners. Activities are carried out in a variety of spaces and not necessarily - or exclusively - in a single classroom with a uniform spatial layout where students sitting in rows of desks face a teacher and a blackboard. As a result, learning spaces must evolve – as well as our design processes for building new educational infrastructures.

This topic addresses the issue of designing learning spaces that can adjust to current and future pedagogies. The famous axiom of architecture *"Form Follows Function"* introduced by architect Louis Sullivan expresses the principle that the shape/form of a building or object should directly relate to its intended function or purpose. When

[46] Barrett, P. S., F. Davies, Y. Zhang, and L. Barrett (2015), *The Impact of Classroom Design on Pupils' Learning: Final Results of a Holistic, Multi-Level Analysis*

[47] Barrett, Peter; Treves, Alberto; Shmis, Tigran; Ambasz, Diego; Ustinova, Maria (2019), *The Impact of School Infrastructure on Learning: A Synthesis of the Evidence,* International Development in Focus; Washington, DC: World Bank

[48] OECD Centre for Educational Research and Innovation (2011), *The Nature of Learning: Using Research to Inspire Practice*, OECD, Paris.

applying this axiom to buildings of any level of education, it is evident that the shape/form of the educational facility should follow the function of pedagogy, teaching and learning. According to Eurocodes EN 1990[49], the indicative design working life is 50 years.[50] During the life of an educational building, the pedagogy applied in it is anticipated to evolve. Buildings should be designed with the ability to adapt to the pedagogies over time and facilitate contemporary teaching practices that require specific layouts, furniture and equipment.

The characteristics of educational infrastructure that are determined by its design concern the following areas: i) flexibility and adaptability of the space; ii) organisation of the space and the different functions; iii) student density in the space; iv) introduction of specific spaces/areas in the facility; v) stimulation and individualisation of the space, furniture and equipment; and vi) safety and security, energy efficiency, accessibility, inclusiveness, comfort (light, temperature, acoustics, quality of air), access to technology, access to clean water and sanitation facilities.

Interventions in educational infrastructure to support innovative pedagogies is related to:

- Designing/creating/building innovative spaces, new spatial arrangements or teaching and learning settings corresponding to new innovative pedagogies. Such spaces range from indoor innovations (e.g. fab-labs, maker spaces, multi-purpose spaces, break out rooms, space for independent work, common spaces, etc.) to outdoor spaces (e.g. school yards, open sports courts, etc.).
- Providing appropriate lighting, air quality, temperature, acoustics, ventilation, hygiene, running water and accessibility conditions.

The size of the school and the classroom are very much related to the design of a facility. Different countries may have different standards as to what they consider as a large, medium or small educational institution (in terms of student population and capacity).

Discussions about the design and characteristics of an educational facility were on the spotlight the past few years because of COVID-19. These discussions, however, were limited to specific features of the facilities, the ones that were relevant to coping with the pandemic (e.g. air quality, density of students inside classrooms, hygiene facilities, outdoor facilities, etc.).

How to improve investment in the design of learning spaces

Evidence suggests that well-designed buildings and facilities with integrated ICT can be the catalyst for teachers developing innovative pedagogies that impact on student learning (OECD, 2013 & OECD, 2017b). Improved student learning is most likely to be achieved if there are certain preconditions in the physical learning environment. Evidence also suggests that flexible spaces can encourage more effective teaching, better planning, the use of more diverse pedagogies, and personalised learning. They can also encourage students to be self-reliant learners capable of working in groups (OECD, 2013 & OECD, 2017b).

Adapting to modern pedagogy and improving the quality of buildings has been identified as an important trend in the EU report *"A study on smart, effective, and inclusive investment in education infrastructure"*.[51] This trend is about moving from

[49] https://www.phd.eng.br/wp-content/uploads/2015/12/en.1990.2002.pdf

[50] The design working life is the assumed period for which a structure or part of it is to be used for its intended purpose with anticipated maintenance but without major repair being necessary.

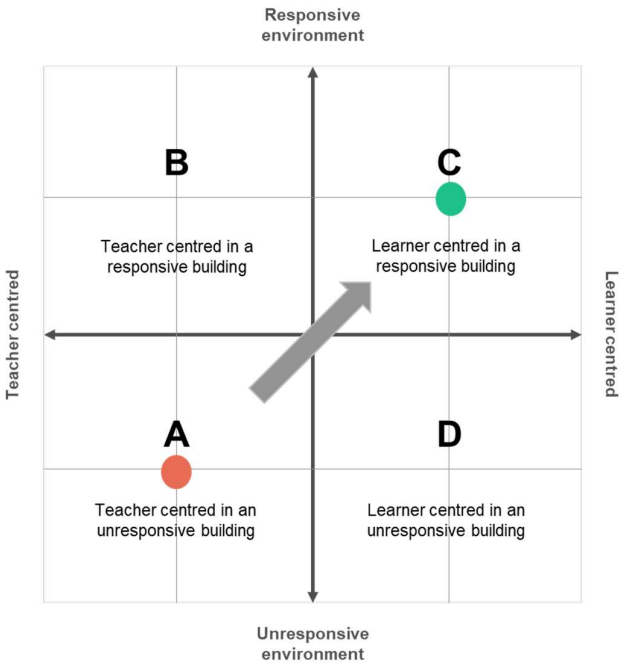
[51] A study on smart, effective, and inclusive investment in education infrastructure - Publications Office of the EU (europa.eu)

traditional learning environments and starting the process of contemplating - or even implementing - innovative learning environments. It is about providing schools with spaces that provide multiple opportunities for learning. The design of learning spaces and their architecture should be informed by innovations in teaching practices. The report also highlights that such shifts to accommodate modern pedagogy are more likely to happen in countries which have fewer challenges in relation to the accessibility, safety and health of their education buildings.

In 2019, the OECD published the "*Analytical Framework for Case Study Collection"*, which resulted in the "*Final Report: OECD Case Study Collection on Transforming Learning Environments"* (2020). The collection of case studies on effective learning environments explored how schools around the world are transforming from traditional teaching-led learning environments supported by conventional school building design to innovative pedagogical approaches supported by responsive spatial environments. The evidence collected is intended to help inform decision makers at the local, regional and national level, as well as school leaders as they seek to develop effective learning environments. This report includes six case studies from Australia, Chile, Greece, Italy, Japan, and the UK.

The analytical framework includes a model for the evaluation of schools with two broad parameters characterising: a) the pedagogical environment and b) the spatial environment (Figure 6). A given school might be learner centred or teacher centred in a building that is responsive or unresponsive to its needs. The aim was to allow case studies to be "mapped" along a spectrum: from a teacher-centric to a learner-centric pedagogical approach; and, from a responsive to a non-responsive spatial environment, and to illustrate how schools are changing their pedagogical approaches and consequently their spatial environment, and to provide insights into the process of change.

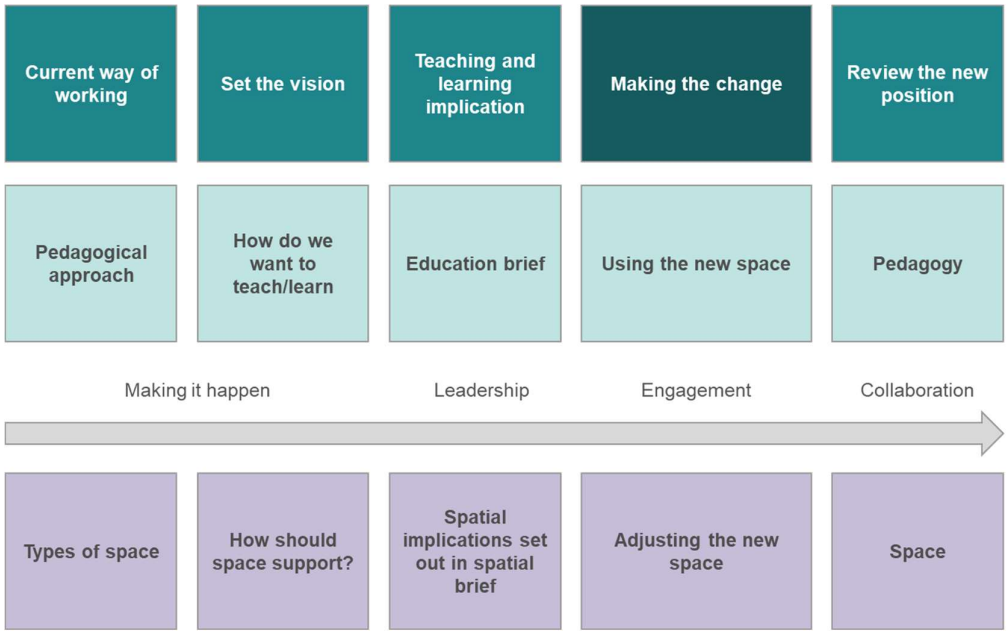
Figure 6: Two-parameter model about the transformation of learning environments



Source: OECD (2019), Analytical Framework for Case Study Collection

The process of change was summarised as a process flow, as shown in figure 7.

Figure 7: Process of transformation of learning environments



Source: OECD (2019), Analytical Framework for Case Study Collection

There is a vast number of additional publications, studies, case studies, reports and papers about the design of learning spaces, including the following:

- The OECD *"Designing for Education: Compendium of Exemplary Educational Facilities 2011"* (2011c), which showcases over 60 recently built or refurbished educational facilities from 28 countries. Collectively, these projects demonstrate state-of-the-art design in this field.
- The Council of Europe Development Bank "*Constructing Education: An Opportunity not to be Missed",* which proposes a framework for multi-stakeholder collaboration combining architectural and educational perspectives. The four stages of this framework include: initial planning and preparation of the architectural brief; construction; hand-over of the facility and moving in; and Post-Occupancy Evaluations (POE).
- The book "*Design of Learning Spaces",* which starts from an educational perspective, and - building on work in architectural design - provides an overview of issues in the design of learning environments, covering the physical design of spaces and how that design impacts on the organisation of people in schools, their relationships and their teaching and learning.

What is missing

The literature about the design of learning spaces would benefit from studies about how well the adapted/redesigned physical environment has supported innovative pedagogies, and what would be the areas of improvements – if any.

Cost-effectiveness aspects

There is no cost-benefit or cost-effectiveness analysis related to the design of learning spaces. In order to measure the cost of a learning environment design element, one could measure the cost of the element (if embedded in the infrastructure from inception and/or if inserted in the facility at a later stage) after construction of the facility.

Table 14: Cost-effective ways to design learning spaces

Approach	Evidence base	Effectiveness	Costs
Provide a variety of spatial layouts rather than the single classroom layout with desks facing a blackboard	Low	High	Medium
Provide STEM spaces, makers lab, media lab	Low	High	High
Provide spaces for learning outdoors	Low	High	Medium
Design circulation areas as additional learning spaces	Low	Medium	Medium

3.3.2. Physical learning environments: impact on education outcomes

What the evidence shows

Policy makers are increasingly interested in understanding the link between the physical learning environment and its impact on student performance and learning outcomes. Unfortunately, there is limited quantitative data on this.

The potential link between the physical learning environment and education outcomes is rooted in the two models: the OECD Centre for Educational Research and Innovation (CERI) Framework, where the building is one of the four key elements that define the "learning environment"; and *the Reggio Emilia approach*, where the school building is referred to as the third teacher in the learning process.

As explained earlier in this chapter, the OECD CERI has been working on "Innovative Learning Environments"[52] and has focused on how people learn and under which conditions and dynamics they can learn better. They define a "learning environment" as the interaction of four key elements – learners, teachers, content, and resources (facilities and technologies), and the physical learning environment is included in the latter element.

Much earlier, in the 1940s, pioneering Italian teacher and psychologist Loris Malaguzzi conceived *the Reggio Emilia approach* to learning on the premise that children develop through interactions: first with the adults in their lives (parents and teachers), then with their peers, and ultimately with the environment around them. The physical environment, according to Malaguzzi, is the *"Third Teacher".*

More recently, the OECD Group of National Experts on Effective Learning Environments published the *Framework for the LEEP Module on the Effectiveness and Efficiency of the Learning Environment*[53]. This framework guided the work and supported the design of a tool that would assist in the evaluation of the physical learning environment and would provide the evidence base for the link between learning environment and education outcomes. The work resulted in the *OECD School User Survey: Improving Learning Spaces Together*[54], a tool that collects data about the use of school buildings from the three main user groups: students, teachers and school leaders.

[52] OECD Centre for Educational Research and Innovation (2011), *The Nature of Learning: Using Research to Inspire Practice*

[53] OECD (2017b), *Framework for the LEEP Module on the Effectiveness and Efficiency of the Learning Environment*

[54] OECD (2018), *OECD School User Survey: Improving Learning Spaces Together*

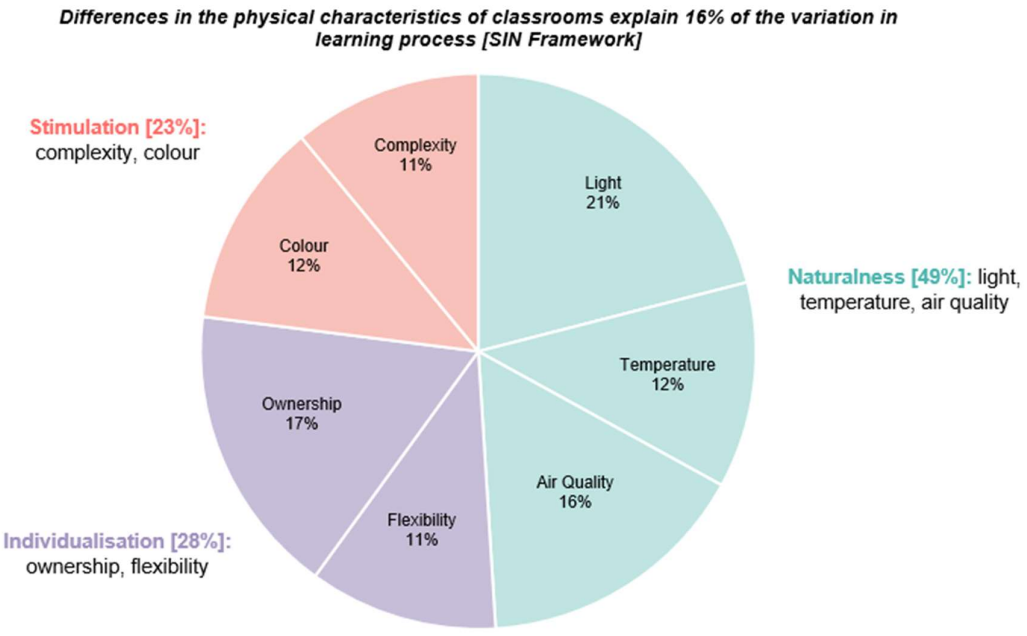
Analysing the impact of physical learning environments on education outcomes and creating a sufficient evidence base is expected to inform the decisions of policy makers towards more targeted investments in the area of construction of new education infrastructure, and the renovation of existing ones. Such targeted decisions will result in both financial savings and educational benefits.

The physical learning environment is one of the factors determining the classroom climate and practice. Recent literature suggests that good architectural and educational design fosters good teaching practice and learning. Additionally, the quality of the building design may affect both teacher and student behaviour, morale and practices, and subsequently may influence learning outcomes.

Despite the large number of studies on the influence of the physical learning environment on learning, there is a lack of quantitative evidence to support the link between physical learning environments and learning outcomes. Specific evidence is only presented in two areas: i) the impact of physical characteristics of the classrooms on student outcomes; and ii) the impact of different classroom spatial arrangements on the learning outcomes of disadvantaged students.

A 2013 study[55] by the University of Salford (UK), examined the links between the educational environment and the academic performance of students. Data were obtained from 3,766 students, aged 5 to 11 years. The study concludes that differences in the physical characteristics of classrooms explain 16% of the variation in learning progress over a year. The overall impact of 16% is driven by a wide range of factors, expressed in the *"Stimulation – Individualisation – Naturalness"* (SIN) framework (Figure 8).

Figure 8: Impact of physical characteristic in learning process



Source: Barrett, P. S., F. Davies, Y. Zhang, and L. Barrett (2015), The Impact of Classroom Design on Pupils' Learning: Final Results of a Holistic, Multi-Level Analysis

[55] Barrett, P. S., F. Davies, Y. Zhang, and L. Barrett (2015), *The Impact of Classroom Design on Pupils' Learning: Final Results of a Holistic, Multi-Level Analysis*

In 2019, the World Bank published a report[56] about the impact of school infrastructure on learning. The report focuses on how school facilities can affect children's learning outcomes, identifying parameters that can inform the design, implementation, and supervision of future educational infrastructure projects. It reflects on aspects for which the evidence could be strengthened, and identifies areas for further exploratory work. The authors reviewed and included a summary of seven large literature reviews on the subject, published between 2002 and 2016, which is presented in table 15.

Table 15: Summary of literature reviews on the impact of school buildings on learning

Author/Date	Title	Method	Main findings/future work
Schneider 2002	Do School Facilities Affect Academic Outcomes?	Literature review of 137 sources	The review found that spatial configuration, noise, heat, cold, light, and air quality all affect learning. However, more definitive findings are needed.
Woolner et al. 2007	A Sound Foundation? What We Know About the Impact of Environments on Learning and the Implications for Building Schools for the Future	Team literature review of 200+ sources	The review found clear evidence that extremes of environmental elements affect learning but not as much once the elements are raised above minimum standards. It strongly recommended to involve users in the process of change. However, overall, there was not enough empirical evidence to inform the design of future infrastructure projects.
US National Research Council Committee 2006	Green Schools: Attributes for Health and Learning	Team literature review of 392 sources (general—applied to green design).	Generally, the review found that pupils' health and learning were positively affected by good indoor air quality, thermal comfort, good acoustics, well-maintained systems, and clean surfaces. The study's focus on health highlighted problems associated with excessive moisture. More research is needed at the individual level of analysis.
Blackmore et al. 2011	Research into the Connection between Built Learning Spaces and Student Outcomes	Literature review of 700+ varied sources	The review found very little empirical evidence specifically linking design elements of learning spaces to student outcomes. The review found that studies tended to over-emphasise the design stage and not pay enough attention to how it interacts with users, to the dynamics of implementation, or to the relevance of the design to types of educational practice.
UNESCO Institute for Statistics 2012	A Place to Learn: Lessons from Research on	Literature review of 91+ sources	The basics of IEQ are well known, but the "learning environments research" field is developing rapidly. However, its conclusions are hard to apply in practice

[56] Barrett, Peter; Treves, Alberto; Shmis, Tigran; Ambasz, Diego; Ustinova, Maria (2019), The Impact of School Infrastructure on Learning: A Synthesis of the Evidence, International Development in Focus; Washington, DC: World Bank

	Learning Environments		outside the developed world.
Davies et al. 2013	Creative Learning Environments in Education: A Systematic Literature Review	Literature review of 210 sources (including how the physical environment affects creativity)	The review highlighted the importance of light, colour, sound, and micro-climate in engendering creativity but also space, flexibility, the availability of resources, and links to outside actors. It stresses the link between design elements and pedagogical issues such as how to strike the right balance between freedom and structure in learning.
Bluyssen 2016	Health, Comfort, and Performance of Children in Classrooms	Literature review of 100+ sources	The review found evidence that design elements have affected learning, absenteeism, and, mainly, health. It concluded that there is a need for more experimental and/or longitudinal research with parameters for children.

Note: IEQ = Indoor Environmental Quality
Source: Barrett, Peter; Treves, Alberto; Shmis, Tigran; Ambasz, Diego; Ustinova, Maria (2019), The Impact of School Infrastructure on Learning: A Synthesis of the Evidence, International Development in Focus; Washington, DC: World Bank

The teaching styles used in the classroom are related to the spatial characteristics of the physical learning environments, such as dimensions, furniture and equipment. Additionally, the use of space in one teaching style or another is determined both by the spatial characteristics of the physical learning environments and by the inclination of the teachers to use traditional teaching styles or introduce new innovative ones. Therefore, the use of space and its resources may enable or constrain teaching and learning.

Recent studies of innovative learning environments also indicate there are positive associations between school improvement, spatial (re)design and student learning. Evidence suggests that well-designed buildings and facilities with integrated ICT can be the catalyst for innovative pedagogies that can impact on student learning.

The Council of Europe Development Bank (CEB) published in 2021 the report "*Constructing Education: An Opportunity not to be Missed*". The CEB has developed a robust framework to guide investments in the sector so that they can better contribute to promote students' learning outcomes. Some of the suggestions of the report include that *"most of the evidence tends to warn of the negative effects of a poor environment"* and that *"research into the effect of the physical environment demonstrates few direct impacts on student learning, but suggests many indirect effects achieved via both learning and teaching processes"*.

Finally, a lot of work on this field has been conducted outside the EU by the University of Melbourne. Since 2009, the Learning Environments Applied Research Network (LEaRN[57]) has brought together international experts from diverse disciplines and sectors to investigate, imagine and improve physical learning environments. They have noticed a significant correlation between more flexible environments and high-impact teaching and student deep learning, and they have identified factors that impede or, on the contrary, assist teacher transition to innovative learning environments.

[57] https://sites.research.unimelb.edu.au/learn-network

What is missing

Future research would need to identify and study the appropriate indicators related to learning outcomes. Such indicators may include academic scores, as well as indicators related to the development of 21st century skills (communication, creativity, collaboration, critical thinking, etc.). The link with other outcomes (health, well-being, etc.) may also be explored.

Cost-effectiveness aspects

Based on our research, there is no cost-benefit or cost-effectiveness analysis related to the impact of learning environments on education outcomes. In order to measure the effectiveness and efficiency of any relevant policy, the first step would be to define some indicators to measure education outcomes (see above).

In comparison, the cost of potential policies might be easier to assume or calculate. For example, the cost of applying team teaching to a school is largely different if it is addressed from the (architectural) design phase, rather than when the building has been built and walls would need to be demolished.

Table 16: Cost-effective ways to configure learning environments

Approach	Evidence base	Effectiveness	Costs
Design learning spaces/classrooms so that sufficient daylight is available	Medium	High	Low
Provide openings for natural air and ventilation in each learning space	Medium	High	Low
Insert noise insulation and elements for better acoustics in the learning spaces	Medium	High	Low
Provide comfortable temperature in the spaces during summer and winter, by applying adequate energy systems and equipment	Medium	High	Medium

3.3.3. Use of school infrastructure after school operating hours

What evidence shows

The size and number of educational facilities - and especially school buildings - across EU Member States constitutes a considerable stock and sizeable public sector asset. Depending on the national context, these school buildings are most certainly not utilised to the same degree as, for example, hospitals. Schools are operational on specific weeks/months of the year, during weekdays and more or less for one third of the day. Therefore, government owned school buildings possess an underutilised potential, in terms of their available space and time:

potential = (available space) X (available time)

There is a copious literature on the *after-school care*[58], especially for the US, Australia and some EU Member States. After-school care can be described as the possibility given to students to extend their stay in school after school operating hours, with or

[58] Literature in this area includes analysis of learning outcomes in schools where after-school care is provided, and the learning effects for students of lower socio-economic background and/or minority origin. The development of programmes for this specific after-school period also features in the literature.

without the provision of additional educational activities. The main difference between the concepts of *"after-school care"* and *"after-school use"* is the target audience: "after-school care" targets only the student population of a specific school unit, while "after-school use" is broader and may target the whole community population. This chapter focuses on "after-school use".

The use of school infrastructure after school operating hours applies mainly to primary and secondary education buildings. Policy conclusions on this topic could also include building infrastructure serving VET.

With state budgets being challenged in the last few years, it is important to look again at the stock of school buildings as a valuable public asset. It is critical to analyse the possibilities for better utilisation of school buildings in a manner that it will create value to the student population and wider communities. The extended use of school infrastructure will not create savings; however, there are non-monetary benefits associated with such policies. Savings will be created if school buildings are used for activities that were previously accommodated in other buildings rented by the public sector.

There is limited literature on after-school use, as well as limited information about the benefits of such use. Nevertheless, there are a small number of articles/reports that present cases of after-school use of infrastructure, which suggest that a few countries or cities have introduced such policies.

Interesting examples of these policies in the EU could be found in Greece (Athens Open Schools), Portugal (Parque Escolar) and Belgium (My school, a quality space).

Greece: Athens Open School

Athens Open Schools was an initiative designed in order to establish and support a network of 25 municipality-run public schools in Athens as self-sustaining centres for learning, culture and social services for the benefit of local communities. The governance and administration of the programme was shared by the Municipality of Athens and Athens Partnership[59], a Special Purpose Vehicle company that was funded to support the Athens Open Schools and other similar programmes funded by donors. The Athens Open Schools operated between June 2016 and August 2019, exclusively funded by donors (the Stavros Niarchos Foundation, SNF[60] and the John S. Latsis Public Benefit Foundation[61]).

During the first year of operation, between June 2016 and August 2017, 14,000 children and adults[62] registered for activities in 25 schools. The benefits of the Athens Open Schools may be grouped into the following categories:

- *Education, training and lifelong learning:* the offered activities almost always contain a learning element.
- *Well-being:* improvement in participants' well-being (children can engage in activities after school operating hours; parents and children can join common activities, etc.)

[59] Website: https://athenspartnership.org/open-schools

[60] Website: https://www.snf.org/

[61] Website: https://www.latsis-foundation.org/eng

[62] The Athens Open Schools programme was open to non-EU citizens [including refugees or migrants] that attended the public schools of Athens and/or resided in the Municipality of Athens.

- *Urban environment and society:* the school becomes the centre of their neighbourhood, the area is revitalised and the community is brought together, resulting in improved neighbourhood cohesion.

Portugal: Parque Escolar

The Parque Escolar programme targets secondary schools across Portugal and is primarily a building renovation programme. The OECD has reviewed the Parque Escolar Programme, as early as 2009 and 2012. As of August 2021, 176 schools have been renovated by the programme. Two of the programme principles are related to design and construction requirements: i) integration between the various functional areas (teaching and non-teaching areas); and, ii) guaranteed conditions for their integrated operation. Moreover, the third principle of Parque Escolar is about opening up some school areas for use by the wider community and creating functional and safe conditions so that the buildings - during school or after-school hours - can be used by the local community for evening classes, cultural and social events, sports and recreation.

One of the main concepts of Parque Escolar, the *"double ring layout"* concept, allows both school users and the wider community to use school buildings. Opening up the school after school hours would generate income for the school.

Belgium: My school, a quality space

"My school, a quality space. Guide for basic education"[63] is a user-friendly guide developed by perspective.brussels, the Brussels Planning Office, to help all stakeholders assess the quality of school spaces and identify improvements to be made. It is a manual for renovation of school infrastructure. The quality of school infrastructure is assessed through five major themes[64]. This guide suggests that the sharing of spaces between the school and the community represents a real opportunity for school users and the general public, the inhabitants and users of the neighbourhood. The school being open to the neighbourhood may become a lever for urban development. It may also contribute to the visibility of the school in the city and respect for the neighbourhood through greater ownership of it. The guide addresses the issue of spatial adjustments (to allow access to the school from the public space), as well as adapted management methods based on agreements and partnerships.

What is missing

In all above mentioned cases, there is no direct evaluation of the benefits of schools being open after school hours for the student population and the community in general. It would be worth assessing the costs and benefits of such policies.

Cost-effectiveness aspects

In order to create a framework for the evaluation of after-school use of the school infrastructure policies, specific goals and indicators should be linked to the effectiveness and efficiency of the policies. Such indicators may include:

- Number of registered participants
- Percentage of school students, parents and other community members participating

[63] Link: https://perspective.brussels/sites/default/files/documents/mon_ecole_un_espace_qualite_0.pdf

[64] The five themes are: adaptability and flexibility; safety; health and comfort; environment; and openness to the city

- Number of hours of activities per week/month
- Number of participants per week/month
- Variety of activities and target audience (e.g. learning activities for students, adult learning, practical skills for adults, sports, recreation activities, etc.)
- Variations in the learning outcomes of students participating in the activities.

Additional dimensions include non-monetary aspects, such as community cohesion, work-family balance, a decrease in criminal behaviour, greater citizens trust in state/regional/municipal services. Defining measurable indicators for non-monetary aspects would be challenging.

The cost of such policies may be easier to calculate or extrapolate. Data that would be necessary in order to conduct a cost-effectiveness analysis relate to the operation of school infrastructure for additional hours, as well as to the actual activities:

- Cost of activities
- Cost of administration (registrations, selection of activities, procurement and payments, co-ordination, etc.);
- Cost of security services (if necessary)
- Cost of cleaning services
- Cost of energy, water and/or other utilities
- (when applicable) Additional costs to adjust the infrastructure to host activities after school operating hours (such as dedicated access or circulation).

Table 17: Cost-effective uses of school infrastructure after school operating hours

Approach	Evidence base	Effectiveness	Costs
Open schools to the community after school operating hours	Low	High	Low
Provide educational classes/seminars to students after school operating hours	Low	High	Low
Provide opportunities for extracurricular activities and hobbies to students after school operating hours	Low	High	Low
Provide opportunities for adult learning after school operating hours	Low	High	Low
Develop frameworks for the shared use of school facilities by the community	Low	High	Low

3.3.4. Management of the education infrastructure network

What the evidence shows

The management of school and higher education infrastructure networks is key to ensuring a safe learning environment for students. School management is multifaceted, as it may refer to the management of educational activities (staff, curriculum, and decisions over the budget for educational expenditures) or the management of infrastructure (in terms of operation or renovations). Studies show that, while there is wide variation in the autonomy of schools within and across countries, the different aspects of school autonomy are usually positively correlated (Hanushek et al. 2013, Bloom et al. 2015), making it difficult to separately analyse the impact of autonomy on different aspects of school management.

It is appropriate to analyse the relationships between the different agents (physical and/or legal entities) that are present in the process of operations, management and decision-making. In any given education system, there are two distinct levels involved in this process:

- *Level 1*: policy makers that guide or take (high-level) decisions about the management of the education infrastructure network
- *Level 2*: day-to-day "operators" of the educational facility.

Depending on the level of autonomy of the system, these two levels may be mutually exclusive. In many cases, there may be additional levels between the policymakers and the "operators".

The day-to-day operators of the school are the school Masters, the educators and the additional school staff - where applicable. The educational institution personnel is responsible for the efficient operations of the unit, both in terms of pedagogy and infrastructure. In the first area, they deliver the pedagogy, apply the curriculum, draft and execute the time schedule, coordinate the staff, perform any assessment or tests, connect with and guide the students, interact and inform the parents, etc. In the area of infrastructure, they make sure that the school building is adequate to their needs, they implement the day-to-day activities, i.e., they open and close the school doors, regulate/control the lighting, heating, air-conditioning (if applicable), make sure the technology they need for their teaching is functioning, coordinate cleaning and security services, coordinate the repair of minor damages, etc. The "operators" usually report to a higher level of authority, that of policy makers, that guide or take decisions about the operations of a school facility.

The complexity of the system is reinforced when one takes into account the fact that the higher level of authority on these two areas (education and infrastructure) may lay on different agents. For example, in a system like Greece, the decision-making level about educational matters (which include pedagogy, curriculum, staffing of schools and salaries) is the Ministry of Education. On the other hand, the entities responsible for the operations and management of the infrastructure is the Municipality Authority where each school is located. The Ministry of Infrastructure and a dedicated public sector agency are responsible for the construction of new facilities. This responsibility is shared with the Municipalities.

The system is challenged when a request outside of the business-as-usual context occurs. For example, when a school facility requires any life-cycle maintenance, extension works or even the construction of a new unit, it also requires additional funding and resources than it is allocated on an annual basis for such technical matters. Moreover, the educational personnel is usually not trained to address complex technical issues of maintenance, life-cycle repairs or additional construction projects in the building infrastructure. The educational personnel is legally obliged to report to the Ministry of Education. However, the issue that needs to be resolved requires resources and decisions by a different level of authority, which is the Municipality or the Ministry of Infrastructure. The coordination, direct communication, information gathering and sharing between the different actors is then fundamental.

The above example is illustrative of the complexity of the system that drives the management of the education infrastructure network. It does not necessarily prove that a complex management system is not efficient or effective. It only highlights the fact that clear frameworks of communication, coordination and escalation are necessary. Assessment frameworks should also be in place and should involve the coordination of different agents.

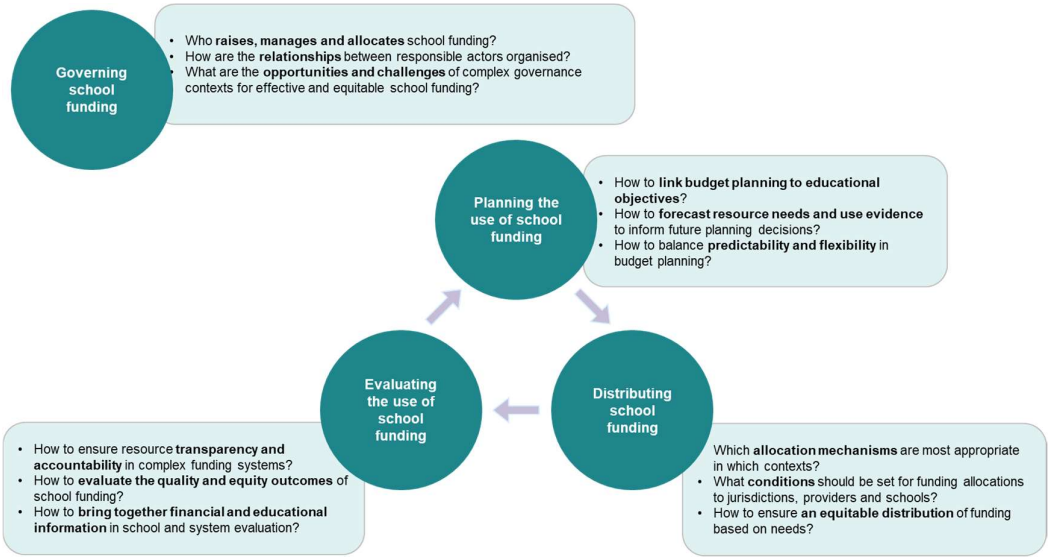
The key beneficiaries of education infrastructure are the students and the school staff. The management of the education infrastructure network involves three broad groups of stakeholders: students and their families; school staff; and policy makers (national, regional or local educational authorities). While families (and their children) are the main beneficiaries of education, they do not manage schools; they rely on school staff for the day-to-day operation.

The management of education infrastructure is complicated for the following reasons:

- The effect of school management on student learning is assumed to be primarily indirect. One of the challenges is to identify the mechanisms through which management may affect students' outcomes and identify the variables that may affect the effectiveness of different management practices.
- Decentralisation of management is not always accompanied with a decentralisation of funding or funding-related decisions.
- Information is imperfect. Moreover, if school management is done at a centralised level, imperfect information at the central level may lead to an inefficient or inequitable allocation of resources.

Figure 9 summarises the main questions related to the management of infrastructure networks and school funding. It emphasises the need to take into account both efficiency and equity aspects, and to consider school management jointly with school accountability.

Figure 9: Main questions related to the management of infrastructures and school funding

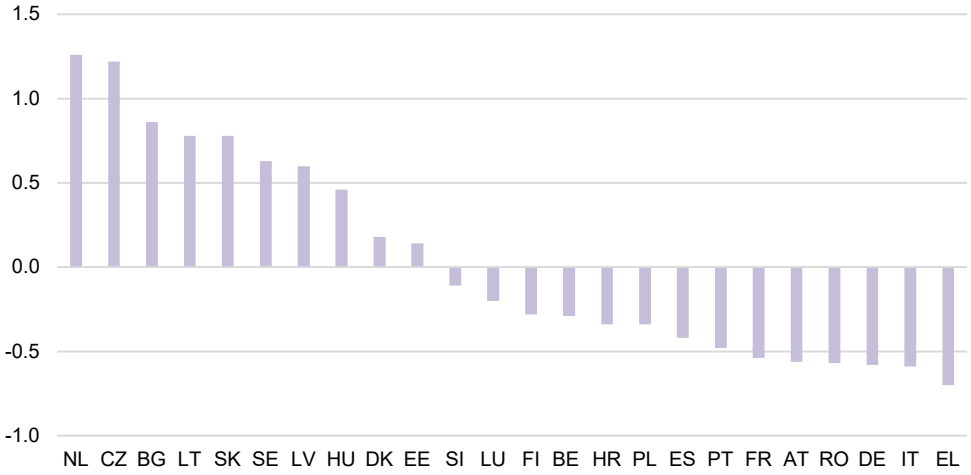


Source: OECD (2017), The Funding of School Education: Connecting Resources and Learning, *OECD Reviews of School Resources*

EU Member States have very different school management systems, from centralised to very decentralised management. Figure 10 shows the level of school autonomy in resource allocation calculated by the OECD with 2012 PISA data, confirming the existence of very different levels of autonomy across EU Member States. Over the past two decades, several countries have encouraged school autonomy as a means of raising students' oucomes. The main rationale for increasing autonomy is to transfer more power to those who are likely to have better information on how to run their school, such as school principals, local governing bodies, or parents. Increased

autonomy usually necessitates reliable accountability systems to monitor school results.

Figure 10: Index of school autonomy in resource allocation in OECD countries, 2012



Source: OECD, PISA 2012

The accountability of the school system refers to the institutional mechanisms put in place in order for policy makers, as well as parents and tax-payers, to monitor the performance of students and schools. Accountability systems include a range of mechanisms, *"from simply requiring schools and districts to report on progress to policy makers and the public, to placing consequences - rewards for high performance and sanctions for poor performance - on the results of performance measures."* (National Academies of Sciences, Engineering and Medicine, 1999). The type of accountability system that may best help enhance the quality and efficiency of educational systems is still debated, as research suggests that it varies according to the level of performance of schools. Bergbauer, Hanushek and Woessmann (2021) show, using PISA data, that the development of accountability measures based on standardized tests scores, instead of internal reporting and teacher monitoring, may help increase efficiency in low- and medium- performing countries, but less so in higher performing countries (Bergbauer, Hanushek and Woessmann, 2018). Indeed, Finland is an example of a quality educational school system where accountability is based on trust in teachers' and headmasters' professionalism in judging what is best for students and in reporting their learning progress (Sahlberg, 2007). Nevertheless, the development of comparable standardised measures of students' outcomes across schools, even if it is not directly used for "consequential accountability", may help assess the impact of management in school systems.

Evidence at the primary and secondary school levels

The analysis of the impact of management of the education infrastructure network faces two main challenges.

First, it is often very difficult to disentangle the question of the management of school infrastructure from the management of staff and other pedagogical decisions. As emphasised in the OECD report on the *Funding of school education* (2017)[65],

[65] https://www.oecd.org/governance/the-funding-of-school-education-9789264276147-en.htm

countries with a strong focus on school autonomy in resource allocation over the budget allocation, also often have some autonomy over the organisation of teaching hours and staff allocation. Autonomy reforms which have been recently implemented usually affect several aspects of school management simultaneously.

Second, it is difficult to evaluate the impact of different management systems without a good counterfactual. The level of autonomy of schools is often correlated with other characteristics of the educational system and it is therefore difficult to assess the causal impact of school autonomy by comparing the management of educational infrastructure across countries with cross sectional data. Hanushek et al. (2013) have used PISA data to estimate the impact of changes in the degree of school autonomy over time on students' outcomes in a panel of countries, controlling for country effects that do not vary over time. Their results suggest that the impact of school autonomy on students' performance is very heterogeneous.

While more school autonomy is associated with better academic results for highly developed/high performing countries, it seems to have a negative effect in developing countries. The analysis of PISA data shows that school autonomy itself is not necessarily enough to achieve efficiency in the allocation of educational resources, but that accountability also matters. Indeed, while there is a positive correlation between increased autonomy and PISA scores in countries where schools are more accountable, the correlation is negative in less accountable systems (OECD, 2011). These results highlight the need to take into account the local context when assessing the impact of school autonomy reforms.

Indeed, scientific studies have mainly focused on the analysis of specific school decentralisation reforms that have been implemented over the past thirty years. We can cite in particular large policy reforms implemented in three countries: Sweden, the US and the UK. Overall, even though the evaluation of country-wide reforms (such as Sweden or the UK) is complicated by the difficulty in constructing a valid counterfactual, the existing evidence points toward very heterogeneous effects.

- *Sweden* started a large school decentralisation reform in 1992, transferring decision powers over the allocation of funds to municipalities and implementing a large-scale school voucher programme that led to the development of publicly funded but privately operated schools. Several studies have tried to assess the effect of the reform on school segregation and students' outcomes, finding moderate effects on segregation and limited effects on students' outcomes (see review of the evaluations of the Swedish reform in Epple and al., 2017). The most recent study (Tyrefors & Vlachos, 2017) even points to a negative effect of students attending voucher schools compared to municipal schools at the secondary level, with effects more negative for low achievers. These results show that in certain contexts, school autonomy combined with school choice can have adverse effects on students' performance and equity. It is important to note that the context of the reform was very specific, as it coincided with a severe economic downturn, and that it was part of a larger decentralisation reform implemented by the Swedish government.
- *The US* has experienced the development of the *"charter school movement"*. Charter schools are usually publicly funded schools, which have more autonomy than traditional public schools over financial, staffing and management decisions. They were originally designed as testing grounds for trying out innovative approaches to improve academic achievement in the US but have expanded substantially over time (enrolling more than 5% of primary and secondary school students in the US in 2015 and an important share of students in some urban districts such as Washington DC, Philadelphia, Detroit, New Orleans). Many small-scale studies have evaluated the marginal impact of going to charter schools by exploiting the random assignment of students at

oversubscribed charter schools, where admission is determined by a lottery. Results are very heterogeneous (from negative to very positive). The general conclusion is that positive effects are usually found in deprived urban neighbourhoods with very poor-performing public schools. Successful schools are usually those who adopted intensive after class tutoring programmes (for a review, see Chabrier et al. 2016).

- *The UK government* started a movement of *"academisation of schools"* in 2002, but the movement intensified with the Academies Act in 2010. Like charter schools, academy schools are publicly funded schools with more autonomy in their management and allocation of resources than traditional public schools. Since 2010, academies can decide to become purely decentralised institutions (stand-alone trusts or SAT) or join Multi-academy Trusts (MAT). MATs constitute chains that bind schools together into institutionalised structures with varying degrees of centralisation. While there are still relatively few papers on the effect of this dramatic reform, the existing literature suggest that the effects might be heterogeneous. Eyles & Machin (2019) find positive effects of the academisation of schools before 2010 on students' test scores, comparing schools that transitioned early to academies to schools that transitioned later. However, the results of studies on the second wave of academisation suggest that there is no significant association between the degree of decentralisation and performance (Bertoni et al. 2020, Neri et al. 2021). These heterogeneous effects might be potentially correlated with the characteristics of schools that voluntarily transformed into academies in the early 2000s, which were usually lower performing schools, with large potential for improvement.

Overall, the very heterogeneous results found in the scientific literature suggest that the level of decentralisation is partly an endogenous choice that depends on the specific context. However, the greater autonomy given to specific schools to experiment with new management and teaching practices seems to have been useful to identify promising policies to reduce inequalities within schools and help improve students' performance in deprived neighbourhoods, when combined with transparent accountability measures.

Evidence at the higher education level

Studies at higher education show an inconclusive linkage so far between higher education autonomy and performance, and there is a lack of comparable evidence in the field, and a range of interacting variables that need to be controlled for, including national wealth, funding, institutional age and size (Enders et al. 2012).

Performance-based funding is a policy tool that does not seem to work quite as unanimously as a tool to increase education quality as intended, as the mechanisms required for effective monitoring and effort maximisation rarely exist in any higher education systems (Mizrahi 2021). For a more detailed analysis, see also chapter 3.3.6.

The introduction of managerial accountability measures have been widespread in higher education. A comparative study of the Nordic countries finds a complex interplay of these measures with academics' perceptions of the measures showcasing that higher education organisational changes are complex, and dynamic mechanisms. Performance-measurement may cause mistrust when considered out of tune with experienced meaningfulness, which in itself may negatively impact higher education performance (Hansen et al 2019).

A further complicating aspect of education governance mechanisms is that policies in the field are implemented in a context-diverse manner across institution types, as

Caspersen et al. (2017) show with higher education learning outcome implementation.

What is missing

There is still very limited scientific evidence on the overall effects of different management practices on students' outcomes. This is partly due to the difficulty in disentangling the causal effect of management from other variables that vary with each educational system. Indeed, management reforms often change practices not only for the management of infrastructure, but also for decisions regarding staff and pedagogical content. Moreover, some management reforms have been coupled with school choice, such as in Sweden. In order to better understand the role of management, we need to be able to evaluate separately the impact of different management practices regarding infrastructure from other areas of decision-making at the school level. Moreover, the effectivenessof management practices seems to be related to the reliability of the accountability system, but this relationship needs further attention.

Cost-effectiveness aspects

Management practices may vary widely for a fixed amount of resources used, so management reforms have often been promoted to bring improvements without generating large cost increases. However, it is difficult to assess the cost of different management organisations and there is very limited cost-benefit evaluation of such policies.

Table 18: Cost-effective ways to of manage school infrastructures

Approach	Evidence base	Effectiveness	Costs
Separately evaluate the impact of different aspects of school autonomy	Low	High benefit from increased knowledge	Medium
Develop measures of student's outcomes from yearly national exams to follow student's performance over time and implement accountability systems	High	High	High
Link autonomy and accountability in school management	High	High	Medium

3.3.5. Allocation of construction, operation and maintenance budget of schools and educational institutions

What the evidence shows

There is evidence that school building and renovation programmes that significantly increase the quality of facilities have a positive impact on students' attendance and test scores (Benhenda 2020; Lafortune, J., & Schönholzer, D. 2021). The decision-making processes that lead to the construction and renovation of schools are key to ensuring that investment in facilities is well designed, targets the schools that need it most, and yields high-quality and sustainable buildings. A large part of the stock needs to be renovated, both to improve the learning environments of students (including better ICT equipment) and to make them more energy efficient. There is

also a need to adjust the stock (closure or opening new school buildings) in line with each country's demographics.

However, pressure on educational budgets may lead to underinvestment and low maintenance budgets, with long-term negative consequences on the quality of the building stock. An attempt to estimate the gap between the actual and optimal level of investment has been made by the European Investment Bank (EIB), but more specific country estimates are not always available as they require detailed country level data. The EIB estimates the annual infrastructure investment gap for the EU27 up to 2030 at roughly EUR 155 billion[66], i.e. 1.2% of the EU27 GDP in 2020[67]. The gap in education infrastructure comprises approximately 5.2% of the total and amounts to EUR 8 billion per year. For Germany, the KfW Bank estimated a substantial gap in school infrastructure investment of about 44 million euros in 2020 (1.2% of GDP)[68]. Some studies assess the cost of building renovation – and, in particular, energy efficient renovation.[69]

However, based on our research, there is no clear evidence on how to best organise the allocation of construction, operation and maintenance costs. The OECD report on school funding (OECD, 2017) notes that the major basis for the allocation of funding for capital expenditures across OECD countries is the assessment of needs. This often entails the targeting of funding towards schools with the greatest need for renovation or remodeling, including emergency repairs. There is, however, no systematic review of the efficiency of different methods used for the allocation of construction, operation and maintenance funds.

A few EU Member States have launched individual initiatives that could be used as case studies, but they have not been evaluated. Examples include:

- Bottom-up initiatives to assess the state of the building stock and facilitate funding (e.g., in France https://www.banquedesterritoires.fr/mon-diag-ecoles)
- Top-down initiatives to assess the need for renovation and establish priorities for renovation (e.g., World Bank team working with the government of Romania https://blogs.worldbank.org/education/why-education-infrastructure-matters-learning)

In terms of management of funds allocated, some lessons may be learned from the failure of the *Building Schools for the Future (BSF)* programme in England. Launched in 2003 with a total budget of £ 55 billion, the BSF programme aimed at renovating all secondary schools in England, through the development of public-private partnerships. However, the programme was scrapped in 2010, after the renovation of only one fifth of schools. Bruman et al (2018) carefully assessed the energy performance of five of the newly constructed schools and concluded that the CO^2 emissions in these buildings were higher than the median of the existing secondary school buildings. They identified building procurement issues and operational problems that led to limited energy performance, as well as low air quality and thermal comfort. The study highlights the need to refer to detailed frameworks and key indicators in order to be able to evaluate whether the construction meets the target with objective metrics, and to take into account feedback in relation to building

[66] European Investment Bank. (2018). *Investment Report 2018/2019: Retooling Europe's Economy*. https://www.eib.org/attachments/efs/economic_investment_report_2018_key_findings_en.pdf

[67] Based on calculations made by the authors of the European Commission forthcoming report "Smart, effective and inclusive investment in education infrastructure" using Eurostat data on GDP and main components (output, expenditure and income) (NAMA_10_GDP).

[68] https://schulen-planen-und-bauen.de/2020/08/06/handlungsbedarf-fuer-guten-schulbau-groesser-denn-je/

[69] https://www.sciencedirect.com/science/article/pii/S1876610217355546?via%3Dihub

utilisation after the construction period in order to optimise building performance. Given the low quality of the new buildings, it is not surprising that a subsequent study found that the new schools had no effects on students' outcomes (Thomson, 2016).

Overall, this case study shows the difficulties in defining public tender rules and contracts that will ensure that newly built or renovated buildings will be energy efficient and favour the well-being of students, as these qualitative aspects are not easy to measure and not always taken into account.

Funding of capital expenditure on education

A good definition of capital expenditure on education can be retrieved from UNESCO Institute of statistics. According to UNESCO, capital expenditure on education is the expenditure for education goods or assets that yield benefits for a period of more than one year. It includes expenditure for construction, renovation and major repairs of buildings and the purchase of heavy equipment or vehicles. It represents the value of assets acquired or created, i.e., the amount of capital formation during the year in which the expenditure occurs[70].

With public/state budgets being squeezed in periods of recession, the budget for capital expenditure on education is subsequently challenged. OECD countries allocate on average 9% of their total education spending to capital expenditure from primary to tertiary level (OECD Education at Glance 2021[71]). Three key parameters are considered in relation to funding capital expenditure:

- *Type/source of funding:* Capital expenditure on education typically comes from the public/state budget. Additional sources of funding include EU structural funds targeting expenditure on education, as well as loans from development banks (European Investment Bank, Council of Europe Development Bank, etc.). A small percentage of the total budget may be covered by sponsorship or donations, however information on the total numbers is not easily retrieved. Outside of the EU, countries are also using infrastructure bonds to fund capital expenditure in education (e.g., Mexico).
- *Procurement method:* Procurement is the process of preparing for the implementation of a project. It involves selecting the best contractual arrangement for a particular project, inviting tenders, and agreeing the various contracts required to start the project. Governments usually apply traditional public procurement methods, governed by national legislation and EU Directives (depending on the size of the project). For an educational infrastructure project, the procurement may involve only the construction or both the design and construction of the facility. An additional procurement method and source of funding is Public-Private-Partnerships (PPPs). They have an enhanced scope to the one of traditionally procured projects and the funding of the project is a blend of public and private finance. Frameworks of transparency, accountability and control are necessary in public procurement[72].
- *Contracting authority:* Depending on the size of the project, the type of funding and the procurement method, different contracting authorities may procure and contract the project. These vary between central government agencies to local level. Very rarely, schools may be the legal entities that act as contracting authorities.

[70] http://uis.unesco.org/en/glossary-term/capital-expenditure-education

[71] https://doi.org/10.1787/b35a14e5-en

[72] https://www.oecd.org/gov/ethics/48994520.pdf

What is missing

There is no direct evaluation of the efficiency of different decisions in relation to the construction and renovation of educational buildings. Assessing the need for construction and renovation necessitates good information on the state of the building stock combined with an assessement of demographic trends. However, there is no clear evidence on how to best organise this data collection.

The UK experience emphasises the need to specify targets in terms of building quality (and in particular, environmental standards), and to ensure that incentives for meeting these targets are integrated at the procurement stage. It also highlights the need to take into account the future use of educational buildings (during and after teaching hours) in the design phase.

This example also shows that the management of the allocation of construction, operation and maintenance budgets for schools and educational institutions is key to ensuring that investments deliver high quality outputs. The construction or renovation of buildings can be implemented directly by public authorities or done through a public private partnership. In both cases, the definition of contracts and tender regulations are instrumental in ensuring the high quality of buildings.

There is no evidence on how to best allocate resources, with a lack of research on the best management practices to achieve the construction and renovation of high-quality facilities. There is no common framework that provides explicit and objective metrics for quality infrastructure in school buildings and how to measure them in the existing stock.

We also lack empirical evidence on how various aspects of educational buildings and renovation affect teachers' and students' outcomes. Additional information on this aspect can be found in section 3.3.2.

Cost-effectiveness aspects

The following table presents some approaches that could help better understand how the allocation of construction, operation and maintenance budget of schools and educational institutions could be better monitored.

Table 19: Approaches to measure the cost-effectiveness of practices related to the allocation of construction, operation, and maintenance budgets

Approach	Evidence base	Effectiveness	Costs
Develop a methodology and framework to assess the state of the building stock and establish priorities in renovation	Low	Expected benefit from increased knowledge	Medium
Develop a framework for measuring the quality of education infrastructure with explicit and objective metrics	High	Expected benefit from increased knowledge	Medium
Assess how procurement rules affect the quality of newly constructed buildings	Low	Expected benefit from increased knowledge	Low

3.3.6. Performance-based funding in higher education

What the evidence shows

In recent years, the policy discussion was dominated by debates about how to increase efficiency and effectiveness of spending in higher education with the aim of boosting students' outcomes and research's quality. Performance-based funding (PBF) is an allocation mechanism that distributes funding based on a formula that includes indicators on the achievements of the institutions (Jongbloed & Vossensteyn, 2001). Today, most countries in the European Higher Education Area (EHEA) apply an output-based funding formula to improve efficiency, at least partially based on institutional performance (Claeys-Kulik & Estermann, 2015).

The applied performance indicators measure progress to or achievement of outputs such as European Credit Transfer and Accumulation System (ECTS), number of degrees awarded, publications, citations, competitive research funding received, patents, student satisfaction (Kivistö & Kohtamaki, 2015). Often the formula is based on ratios, percentages, or other quantitative values mixing input and output elements (e.g. staff-student ratio, employment ratio of graduates, retention rates, number or percentage of students completing a fixed amount of credits per academic year/semester etc. (Kivistö, 2008). Often the formula is related to policy objectives (e.g. increasing higher education attainment; fostering entrepreneurship; increasing knowledge transfer) and enables institutions to adapt their organisational practices to systemwide goals (Pausits, 2015).

PBF has also been used to provide clarity and transparency among the institutions, stimulate competition and provide a fair overall funding system (see Table 20). Further to this, such an approach makes (public) higher education institutions more accountable regarding their activities, funding and cost schemes. Therefore, PBF is a tool to improve the performance of the institutions as well as to justify their activities following certain policy goals in a cost-effective way (Kivistö & Kohtamaki, 2015).

Table 20: Intended and possible PSF goals

Goals concerning PBF	Grouping of goals
• Increasing efficiency, productivity, and effectiveness • Focus from inputs to outputs and service orientation • Increasing transparency • Enabling measurement and visibility	*Operation related goals: performance and accountability*
• Implementing policy • Informing policy and decision-making • Providing incentives • Motivating	*Policy and decision-making*
• Rewarding if possible, Punishing (if necessary) • Competing on funding	*"Sticks" and "carrots" internally and externally*

Source: Kivistö & Kohtamaki 2015, p. 220

Even though there is a considerable debate about indicators used in the funding formula as well as the above-mentioned ratios including exclusively quantitative measures, PBF has been widely implemented to support the performance or target agreements between the government (funder) and higher education institutions. Although these agreements do not always have a direct and substantial effect on the

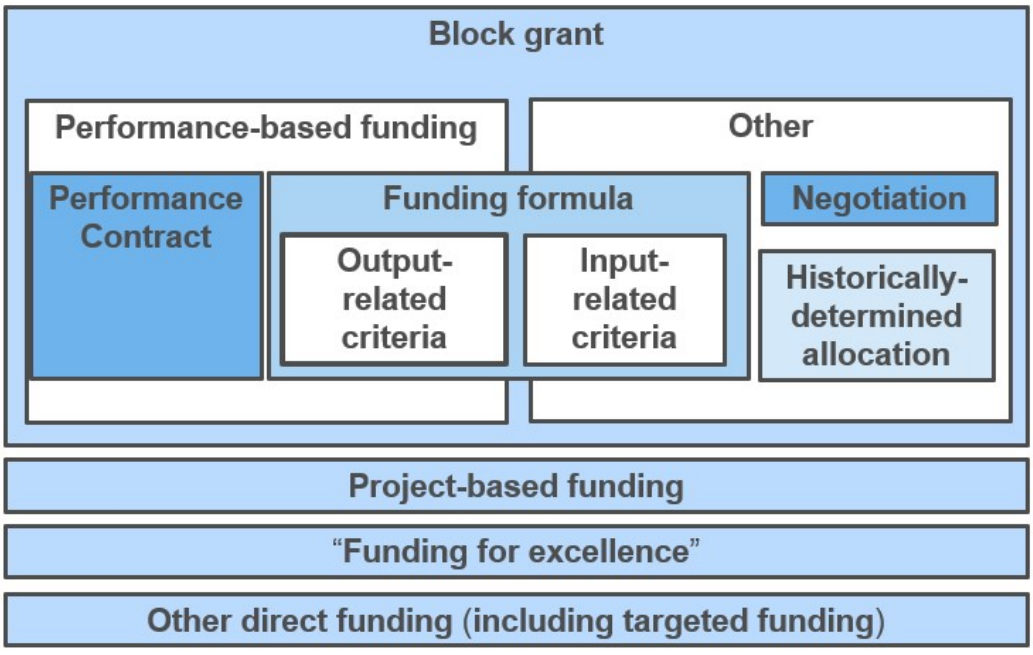
level of the funding (Claeys-Kulik & Estermann, 2015), they provide a structured negotiation process regarding measurable and verifiable objectives covering a dedicated period (often three years) for the institutions (Pausits, 2015).

An EUA report on performance-based funding (Claeys-Kulik & Estermann, 2015) provides the following assessment approach to look at the effects of PBF and steering mechanisms in 28 EU higher education systems, which can also be used to evaluate the efficiency in general:

- *Contextual factors:* the overall funding system and the importance of the performance-based elements with regard to funding allocation (What is the share of funding distributed based on performance?)
- *Formula/contract inherent factors:* the number, combination and weight of indicators or the nature of the contract and the conclusion procedure (Does the formula/contract give clear incentives?)
- *Institutional characteristics:* the size and the profile of the higher education institution, the internal governance and management structure as well as the institutional income and cost structure (How does the internal funding distribution work? What is the share of PBF in the overall institutional income structure? How is funding related to costs?)

The main method to distribute funding to institutions in the EU are block grants/ funding. Most EU Member States have a mix of different allocation modalities including, as the European University Associate (EUA) report (Claeys-Kulik & Estermann, 2015) shows, a great diversity between systems (Figure 11). A substantial part of the block funding may be kept for specific expenditures, such as salaries and infrastructure. There are two basic PBF approaches: first, there is a bonus, if the negotiated targets have been achieved or the institution overperforms them; and second, performance as an integral part of the funding formula.

Figure 11: Simplified overview of public funding allocation mechanisms



Source: Claeys-Kulik & Estermann, 2015, p.17

However, indicators are key to evaluate the performance and effectiveness of the institutions and investments. Therefore, the aim and purpose of the measures, the

choice of indicators (fit-for-purpose) should be reflected and balanced regarding institutional diversity and systemwide goals as well. In order to increase not only effectiveness but also efficiency, those indicators need to be linked to the overall ecosystem (e.g., national action plans and programmes, the EU ambition to create world-class scientific knowledge) as well as to institutional strategies. Those indicators should support meeting national and institutional strategies and not the other way around: national and institutional strategies should not follow the predefined indicators.

Although PBF enjoys a wide popularity in current years, there has been limited evidence indicating that PBF driven educational policy has knowingly impacted higher education institutions' outcomes (Dougherty & Reddy, 2013; Rutherford & Rabovsky, 2014; Hillman, Tandberg, & Fryar, 2015; Alsheri, 2016). PBF is a policy tool that does not seem to work quite as unanimously as a tool to increase education quality as intended, as the mechanisms required for effective monitoring and effort maximisation rarely exist in any higher education systems (Mizrahi, 2021).

However, a literature review (Dougherty and Reddy, 2011) pointed out a number of factors which may be responsible for the limited effects of PBF: appropriateness of the performance measures employed; instability in funding, indicators, and measures; the brief duration of performance funding programmes; funding levels that are too low and not well enough insulated against the ups and downs of the state revenue cycle; shortfalls in regular state funding for higher education; lack of a clear connection for academic staff between performance and funding; inequalities in institutional capacity; unequal distribution of knowledge and expertise about performance funding within institutions; and "game-playing" by institutions.

Still, the introduction of managerial accountability measures has been widespread in higher education. A comparative study of the Nordic countries finds a complex interplay of these measures with academics' perceptions of the measures showcasing that higher education organisational changes are complex and dynamic mechanisms. Performance measurement may cause mistrust when considered out of tune with experienced meaningfulness, which may negatively impact higher education performance (Hansen et al, 2019). A further complicating aspect of education governance mechanisms is that policies in the field are implemented in a context-diverse manner across institution types, as Caspersen et al. (2017) show with higher education learning outcome implementation.

On one hand, numerous studies (e.g., Cattaneo et al., 2019; Hu, 2019, Li & Kennedy, 2018;) provide evidence that, even if PBF may not have a dedicated impact in all envisaged areas, single effects such as on graduation rate (Hu, 2019), on short term certificates (Li & Ortagus, 2019) or on earnings of graduates (Rosinger et al., 2021) may be positively related to the framework. On the other hand, another study (Hillmann & Corral, 2018) finds that PBF affected negatively minority serving institutions (in the US). "*Performance-based funding regimes are most likely to work in noncomplex situations where performance is easily measured, tasks are simple and routine, goals are unambiguous, employees have direct control over the production process, and there are not multiple people involved in producing the outcome."*(Hillmann, 2016).

A European Commission's upcoming report on the state and effectiveness of national funding systems of higher education to support the European Universities Initiative provides additonal evidence of the impact of PBF on education. The report finds that PBF may incentivise the performance-orientation in higher education institutions, offer a transparent way to distribute core funding to them; and support the strategic dialogue between institutions and funding authorities. However, the report concludes that the overall impacts of PBF highly depend on national contexts and approaches in which they are implemented.

At the macro level, Sundström and Besselaar (2018) find the following factors explain efficiency differences at the science systems level: (a) the level of competition, including share of project funding, performance-based funding systems, national evaluation systems; (b) the level of institutional autonomy with financial, organisational, staffing and academic autonomy; and finally (c) academic freedom.

At the meso level, performance-oriented funding models should be intuitive by providing institutions incentive to support students. However, besides graduation rate, PBF falls short as it is rather difficult to outline and measure success, also in relation to research. Therefore, Hillmann (2016) proposed a shift from a "merit-based" performance regime toward a "need-based" equity-funding system.

What is missing

Higher education instutions not only rely on academics and staff as resources in general, but also on the physical (and research) infrastructure in use. The existing PBF approaches are not properly linked to the performance of the existing institutional infrastructure. For example, in the US, dedicated infrastructure performance indicators (see the work of the Association of Higher Education Facilities Officiers or the Facilities Performance Indicators Survey by APPA) have been introduced to link different resources and evaluate the infrastructures' performances in light of the existing institutional strategies and operations in research, teaching and third mission.

In light of the broadly used PBF approach in the EU, it would be important to develop this tool further and identify dedicated indicators to measure the teaching infrastructure performance of the institutions. Today, the PBF indicators do not reflect the physical enviroment and provide little evidence on the relation between institutional and infrastructure performances in teaching.

Cost-effectiveness aspects

Table 21: Approaches to measure the cost-effectiveness of performance-based funding

Approach	Evidence base	Effectiveness	Costs
Separately evaluate the impact of PBF	High	High	High
Incentives to improve specific aspects, such as students' learning outcomes	Low	High	Low
Align infrastructure performance metrics with operational and institutional goals based on PBF	Low	High	Low

3.4. Equity and inclusion

Key policy conclusions:

- *ECEC has positive effects especially for the development of disadvantaged pupils*, both for socio-emotional and cognitive skills. Therefore, investing in ECEC is essential and it is particularly cost-effective.
- Nevertheless, *the quality of ECEC is crucial and it should be combined with policies that help to increase take-up among disadvantaged pupils*, who do not always have access to ECEC.
- *Reducing school segregation brings benefits both in terms of equity and quality of education*. Therefore, it is important that desegregation policies are implemented in EU Member States.
- There is *no "optimal level of tracking"*, rather there is a need to find the right balance between differentiation and tracking. Nevertheless, *early tracking seems to have negative effects on equity and inclusion*.
- *Financial resources need to be differentiated according to learner needs.* Schools with higher proportions of disadvantaged pupils would benefit from receiving targeted additional resources. However, the nature and scale of interventions are key to determine the impact of priority education policies on student outcomes and equity.
- *One-to-one tuition and peer tutoring programmes are highly recommended* if they are implemented in an individualised way or through small groups, and interventions should be cohesive, coherent, and sustained.
- *Mentorships and summer programmes are appropriate student-based compensatory policies* but special attention should be paid to their policy design and implementation.
- *Needs-based grants in higher education have a positive effect on completion rates* of disadvantaged students but *they increase enrolment rates only when they provide adequateresources*.

EU policy framework for equity and inclusion

Inclusion and access to quality education and training form the cornerstone of the 1st principle of the **European Pillar of Social Rights**, which states that: "*Everyone has the right to quality and inclusive education, training and life-long learning in order to maintain and acquire skills that enable them to participate fully in society and manage successfully transitions in the labour market"*.

The **Commission Communication on achieving the European Education Area by 2025** foresees a number of flagship initiatives to boost the inclusive dimension of education.

Among these, '**Pathways to school success**'[73] aims at promoting better educational outcomes for all through fostering inclusive and supportive learning environments, as an essential condition for building more equitable and flourishing societies and economies. This initiative will address simultaneously the EU-level targets for 2030 on

[73] Proposal for a Council Recommendation on Pathways to School Success published by the European Commission on 30 June 2022: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2022:316:FIN

basic skills and early leaving from education and training[74], while fully taking into account the crucial role of well-being at school. It has the ambition to set in motion processes of reflection and change, provide guidance on possible policy solutions, launch collaboration and dialogue with policy-makers and stakeholders, and support concrete action by relevant stakeholders. Pathways propose a new framework of actions and invite EU Member States to actively promote educational success through integrated and comprehensive strategies including monitoring, prevention, intervention and compensation and combining universal measures with more targeted ones for specific groups at risk.

Furthermore, **the EEA Strategic framework Working Group on Equality and Values in education and training (2021-2025)** is a platform for mutual learning to support reforms towards inclusive and gender equal education and facilitating the further implementation of the *2018 Council Recommendation on promoting common values, inclusive education, and the European dimension of teaching*[75]. It concentrates its efforts on innovation for gender equal education (e.g., on addressing the underperformance of boys); inclusion of children with disabilities and special education needs, ethnic and racial minorities; fighting school segregation; or tackling all forms of discrimination and promoting equality and diversity.

Both this Working Group and Pathways to School Success reflect in their activities the educational dimension of the **Strategy for the Rights of Persons with Disabilities[76]; the EU anti-racism action plan[77]; the EU Roma strategic framework for equality, inclusion and participation[78]; the LGBTIQ equality strategy[79]; the Action plan on integration and inclusion[80]; and the Gender equality strategy[81]** to ensure equal access to quality and inclusive education for all.

Setting the scene

More equity in education also means more quality. Research shows that education systems that improve equality of opportunities and reduce inequality in students' learning conditions are also the ones that get better academic results and improve student wellbeing. Equity involves a dimension of fairness, a complex concept with no single definition as there are different theories of social justice in political philosophy. Beyond the many debates, all authors agree that fairness is at least making sure that personal characteristics and social circumstances – for example gender, socio-economic background or ethnic origin, disability, age, sexual orientation, religion or belief – are not obstacles to achieving life opportunities. In education, this means ensuring that all children can have the same learning opportunities to realise their potential.

Equity and compensatory policies embrace a wide range of interventions. Here we will focus particularly on those education policies that are crucial to increase the

[74] Targets established by Council Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond (2021-2030). In particular, it will address the following targets: the share of low-achieving 15-year-olds in reading, mathematics and science should be less than 15% and the share of early leavers from education and training less than 9%.

[75] https://eur-lex.europa.eu/TodayOJ/

[76] https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8376&furtherPubs=yes

[77] EUR-Lex - 52020DC0565 - EN - EUR-Lex (europa.eu)

[78] https://ec.europa.eu/info/policies/justice-and-fundamental-rights/combatting-discrimination/roma-eu/roma-equality-inclusion-and-participation-eu_en

[79] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0698

[80] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0758&qid=1632299185798

[81] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0152

effects of equity gains on educational quality. The highly cited book *The Spirit Level,* by Wilkinson and Picket, showed in 2009 that more equal societies always do better. Higher equality generates positive outcomes in many areas, education being no exception. More equal societies usually present better academic results - which are also more independent of students' socio-economic background - and present higher levels of student well-being. Equality and non-discrimination are fundamental EU values, inscribed in Article 2 TEU and protected by Article 21 and 23 of the Charter. They should be sufficiently protected everywhere and in all areas across the EU.

This section presents a selected number of policies that show quality outcomes coming from increasing education equity:

3.4.1. Early childhood education and care

What the evidence shows

Large socio-economic inequalities in cognitive and socio-emotional development emerge early in life. They can be traced back to inequalities in home, educational, emotional, and material environment.[82] Early interventions, such as investment in early childhood education and care (ECEC), have been advocated to tackle such inequalities. ECEC refers to various forms of non-parental childcare and early education occurring before school, mainly between ages 0 to 6. There has been a steady increase in ECEC participation for children in the EU and a majority now attends formal care or preschool. Indeed, in 2020, 80.5% of children in the EU aged between three years and the minimum compulsory school age received formal childhood education and care. Participation in ECEC is still lower for children aged less than three years, as more than half (53.4%) were cared for exclusively by their parents in 2020. This share varies considerably across the EU Member States, from a low of 21.9% of children aged 0-3 cared for by their parents in the Netherlands and Portugal, up to over 65.0% in Czechia (66.3%), Lithuania (69.5%) and Bulgaria (71.8%), peaking at 80.2% in Germany (Eurostat)[83].

These large differences in ECEC attendance across EU Member States reflect wide variations in ECEC and parental leave policies, as well as cultural differences especially for younger children (Eurydice, 2021). Table 22 below shows that some countries (e.g., Denmark and Sweden) offer universal access to subsidised and quality regulated ECEC from infancy, following extensive parental leave. Other countries (e.g., Belgium, Portugal, Poland, and Spain) introduced universal legal entitlement to ECEC from age 3. Most countries have made the last year of ECEC compulsory (typically starting at age 5), and a few countries have recently lowered the age of compulsory attendance to 3 years (Hungary and France) or 4 years (Greece and Bulgaria). In contrast, outside the EU, countries such as the US have more

[82] See Cattan, S. et al. 2022, for recent evidence from the millenium UK cohort study.

[83] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Living_conditions_in_Europe_-_childcare_arrangements#Childcare_arrangements

limited public support for ECEC or parental leave, and public funding for ECEC was historically targeted at low-income preschool children.

Table 22: Legal framework for ECEC in EU 27

	Starting age		
	Universal entitlement to ECEC (*)	Compulsory ECEC	Compulsory primary education
Belgium FR	2y6m	5y	6y
Belgium DE	3y	5y	6y
Belgium NL	2y6m	5y	6y
Bulgaria		5y	7y
Czechia	3y	5y	6y
Denmark	6m		6y
Germany	1y		6y
Estonia	1y6m		7y
Ireland	2y8m		6y
Greece		4y	6y
Spain	3y		6y
France		3y	6y
Croatia		6y	7y
Italy			6y
Cyprus		4y8m	5y8m
Latvia	1y6m	5y	7y
Lithuania		6y	7y
Luxembourg	3y	4y	6y
Hungary		3y	6y
Malta			5y
Netherlands		5y	6y
Austria		5y	6y
Poland	3y	6y	7y
Portugal	3y		6y
Romania		5y	6y
Slovenia	11m		6y
Slovakia		(5y)	6y
Finland	9m	6y	7y
Sweden	1y	6y	7y

Note: Abbreviation "y" means years, "m" means months. Age in brackets indicates the situation from 2021 September. (*) A universal legal entitlement to ECEC exists when every child of a certain age has an enforceable right to benefit from ECEC provision.

Source: European Commission/EACEA/Eurydice, 2021 Structural Indicators for Monitoring Education and Training Systems in Europe – 2021. *Eurydice, 2021*, chapter 1, table 1

With the increase in public funding to support the development of large ECEC programmes in many EU Member States, it is important to assess the benefits of such investments. Researchers in education have studied the potential benefits of ECEC since the 1960s, with two main questions. First, can they help reduce inequalities among low and high socio-economic status (SES) children? Second, can universal ECEC benefit all children and society as a whole? The potential benefits of ECEC investments are very large, as early investment in children, which increase

cognitive but also socio-emotional skills, might have positive complementarities with later educational investments and produce long-term effects (Heckman et al. 2013). In addition to the direct effects on children cognitive and non-cognitive skills, their potential benefits also include "spillover" effects on children's long-term outcomes (such as earnings, health, lower crime rates, etc.), on families and on society as a whole. They might create jobs and gives stability to parents' jobs and wages, affecting female labour force participation and fertility. In this review, we will focus on the evaluation of the direct short and long-term impacts of ECEC on children, but it is important to keep in mind the larger benefits of ECEC for parents and society.

Research shows that the benefits of ECEC for children are large, especially for disadvantaged children. However, the quality of the childcare is crucial, as the effectiveness of ECEC hinges on the difference between the benefits of organised childcare, such as center-based or preschool, compared to parental or other informal care. Such benefits might be heterogeneous. Given the variety of policies for ECEC across countries, it is important to better understand the effects of ECEC according to these different dimensions.

The first dimension of heterogeneity that is very important to consider is indeed children's background, as children from low-income families are less likely to attend ECEC. Data from PISA 2015 show that students from low SES groups in OECD countries were almost three times more likely to report that they did not attend ECEC programmes compared to students from high SES groups (Balladares, J. et M. Kankaraš (2020). When they enter ECEC, low-SES children tend to enter at a later age than children from more advantaged background. Given the potentially cumulative effects of ECEC on children, assessing the specific effect that high quality ECEC might have for low-SES children is particularly important for the design of policies aiming at reducing long-term inequalities. The second dimension of heterogeneity is the age of children, as the type of care needed for infants, toddlers and pre-school children might vary susbstantially. Our aim is to provide a summary of the vast literature on the effects of ECEC on children's outcomes and refer to the previous literature review done by the CARE project for extensive analysis (Melhuish et al. 2015)[84], as well as recent literature review by Van Huizen and Plantenga (2018). We also complement existing reviews by specific recent evidence on EU Member States. Our focus, whenever possible, is on studies relying on experimental or quasi-experimental identification of the effects, which provide the best possible methods to estimate a causal impact.

Evidence on the effectiveness of ECEC policies

One of the challenges of the evaluation literature is to establish a clear causal link between attendance in ECEC and later outcomes. Indeed, as ECEC is not compulsory until age 5 in most EU Member States, attendance in ECEC is a parental decision. This implies that the characteristics of children attending ECEC are often very different from the characteristics of children who are cared for by their parents, as low-SES children are usually much less likely to attend ECEC (Blossfeld et al. 2017). Not controlling for this selection effect might lead to biased estimates. For example, Balladares and M. Kankaraš (2020) analyse PISA data and show that students attending ECEC outperform those that do not (OECD, 2020). However, the relationship is much weaker when considering family background, and the effects appear to be heterogeneous, as the quality of provided care seems crucial to get positive benefits.

[84] https://ecec-care.org/

Causal estimates of ECEC initially came from studies evaluating experimental programmes targeted at low-SES families conducted in the US since the 1960s. More recent literature evaluates the impact of large-scale programmes implemented in EU Member States, using quasi-experimental analysis (Germany, Nordic countries, Spain, or Ireland).

Empirical estimates from US programmes targeting low-SES children

Since the 1960s and 1970s, several experimental ECEC programmes were developed in the US, such as the Abecedarian, HeadStart or Perry pre-school programmes. These programmes use ECEC as an intervention for disadvantaged children. They were initially implemented as a randomised control trial, selecting randomly a group of beneficiaries among participants. This allowed researchers to compare the short, medium, and long-term impacts of the programme on treated families, compared to the outcomes of the "control" group. Results show large gains, with substantive short- and long-term effects on cognition, social-emotional development, school progress, antisocial behaviour, adult earnings, health (obesity or smoking behaviour) and even crime (Barnett 2011). Cost-benefit analysis for these programmes show high returns, in particular for the Perry Preschool. This experimental programme targeted low-SES children aged 3-4 years-old, who attended class for two and a half-hours a day during regular school weeks for two years. The estimated returns are between USD 7 and USD 12 for each USD 1 invested (Barnet et al, 2007, Heckman et al. 2010). Programmes targeting younger children, such as Abecedarian, also show large benefits (USD 2.5 for each USD 1 invested according to Barnet et al. 2007), although the initial costs are higher than for pre-school. In these two programmes, even if initial gains were larger than longer-term effects, especially for cognitive skills, the long-term gains were still positive and significant. The fact that these programmes generate positive long-term effects on a wide range of outcomes suggests that the effects might be partly mediated by the acquisition of non-cognitive skills at very young ages, on top of direct short run effects on cognitive skills.

Empirical estimates from large scale programmes

Positive effects of ECEC for disadvantaged children found in experimental studies in the US are very promising. However, they might not be directly transferrable to EU Member States, as they differ on three main aspects. First, many EU Member States have developed universal ECEC programmes that are offered to all children, and one may wonder whether the results of experimental programme can be scaled up. Second, the organisation and quality of ECEC may also vary widely. Third, effects might be heterogeneous and universal programmes might have different impacts on children depending on their socio-economic background.

Results from studies providing causal evidence of the effect of universal ECEC confirm the strong benefits for disadvantaged children, in all contexts studied (Germany, Spain, Norway, US, see details of studies below), both at early ages (0-3) or at ages 3-6. The results for the entire population of children are more mixed and seem to depend on the specific context. Indeed, most studies on universal preschool programmes show either positive average effect (Cascio Schanzenbach. 2013 for the US, Felfe et al. (2015) for Spain) or neutral effect for cognitive or non-cognitive outcomes (Cornelissen et al. 2018 for Germany, Blandel et al. 2017 for UK, Datta Gupta and Simonsen, 2010). The evidence is more mixed for early ECEC, with some papers finding clear positive effects of universal ECEC in Norway (Drange & Havnes 2019) and other papers finding negative effects (Baker & al., 2008).

There is indeed growing evidence showing that the effects of ECEC are heterogenous, and consistently larger for disadvantaged children than for children of advantaged background. Studies on the expansion of universal childcare in Germany (Felfe and Lalive, 2018 for early childcare and and Cornelissen et al., 2018 for children aged 3+) Norway (Drange and Havnes (2018) for infants and Havnes and Mogstad, 2015 for children aged 3+) and Spain (Felfe et al. 2015) all find positive gains of ECEC attendance in socio-emotional and cognitive skills of disadvantaged children, at all age levels. Given the more limited effects of childcare on children of more advantaged backgrounds, these findings suggest that childcare attendance can contribute to the reduction of socio-economic inequalities. However, despite the large potential gains for disadvantaged children, this type of universal childcare programme often fails to attract these children, even though ECEC attendance is heavily subsidised. In other words, universal childcare tends to attract children from more advantaged families that benefit relatively less from such programmes. A related important question is the timing of kindergarten enrolment, which affects the duration of and exposure to ECEC. Existing evidence suggests that earlier and longer exposure is beneficial for low SES children. For example, Szabó-Morvai et al. (2017) finds that lowering the age of kindergarten enrolment (to 3 years instead of more than 2 years old) benefits children from low-SES mothers in Hungary. This confirms that kindergarten is beneficial for low-SES children from a very early age. Overall, studies on universal ECEC confirm the strong benefits of giving access to ECEC to disadvantaged families. When it comes to the effects of ECEC for the entire population of children, two points are worth noting. First, preschool for children aged 3+ seems to have overall either neutral or positive effects. Given the positive additional effects of access to ECEC for families, the overall effects for society can be considered as positive. Second, the effects of universal ECEC for infants and toddlers depend crucially on the difference between the organisation and quality of formal care and family care provided at home. Low-quality ECEC is detrimental for all children, with particularly negative effects for high SES children, compared to family care.

Quality and intensity of ECEC programmes

Studies that provide causal evidence of the quality of ECEC (i.e., care facilities, staff qualifications, continuity of care, adults/children ratio, attention given to children, or organisation of the curriculum) are much less developed, but existing evidence points to its importance Blossfeld et al. (2017) make the distinction between structural and process quality. The first relates to characteristics of the childcare institutions and caregivers and tearchers, such as the teacher-child ratio, the centre's resources, and teachers' qualifications. Process quality relates more to interactional outcomes between children and educators and is more difficult to measure. Qualitative studies emphasise the role of quality (Melhuish, 2015), although there is a lack of rigorous studies that would help to understand better which aspect of the organisation of care matters most (Barnett, 2011). Studies that find positive effects are consistently those with high quality ECEC (Esping-Andersen et al., 2012; Van Huizen and Plantenga, 2018), especially universal programmes with regulations that ensure high quality ECEC such a high adult/children ratio, as in Denmark or Norway. Another important aspect that seems to matter for toddlers and infants is the continuity of care. Drange and Ronning (2002) indeed find that, in Norway, child test scores are lower in both language and maths if the sickness absence is high in the ECEC center.

Finally, there is also a lack of evidence on the intensity of care. Datta Gupta and Simonsen (2015) and Felfe et Larissa (2018) find that long days of care seem to be more detrimental for infants than shorter days, but Felfe and Larissa find that the effect of full-day care is positive for children with a migrant background. Experimental evidence from the US shows positive effects of disadvantaged children of both part time and full-time day care (Barnett, 2011). Overall, there is still limited research on

the effect of both intensive (number of hours per day or week) and extensive (number of years of attendance) margins of ECEC attendance on children's outcomes.

Therefore, existing literature and evidence available on the effects on the benefits of ECEC provide some clear conclusions for policymakers:

- Investing in ECEC for disadvantaged children is crucial. The benefits of investing in early ECEC interventions for low SES children are higher than for children from a higher SES programme, and the costs of non-investing are significantly higher for disadvantaged students
- Given their heterogeneous effects, universal programmes have the potential to level the playing field and reduce inequalities, if all children attend them
- However, access of disadvantaged children to ECEC continues to be significantly lower than that of the most well-off. Among the disadvantaged, children with a migrant or Roma background, children with special educational needs and disabilities, are the ones with lower participation rates.
- High quality care is associated with positive effects while lower quality ECEC is correlated, with negative effects on children's outcomes, especially on socio-emotional skills.

What is missing

While evidence on the positive effects of ECEC interventions has increased significantly in the last decades, there are areas for which we still lack specific evidence. These are some of the crucial ones:

- More natural and experimental studies are needed to assess the mid- and long-term benefits of early childhood interventions, especially to gain precision on the 'net effects' of ECEC programmes
- Despite the importance of investigating the effect of the quality of care on children's outcomes, there is lack of causal evidence on this particular aspect. In particular, there is still limited robust evidence on the effects of the quality of teaching staff or the adoption of different pedagogies. For infants and toddlers, childcare is often organised around play-based activities, routines and informal interactions with other children and caregivers. On the other hand, children aged 3-6 often attend pre-school, where more emphasis is put on a specific curriculum for pedagogical development. More experimentation is needed to understand which curriculum works best at which age
- There is a lack of evidence on the impact of intensive (number of hours per day or week) and extensive (number of years of attendance) margins of ECEC attendance on children's outcomes. More experimental estimates allowing to better understand whether outcomes vary along these margins would be very useful
- While several governments have attempted to increase the participation of disadvantaged children in ECEC programmes, there is little evaluation on the effectiveness of different policies. There is little evidence on the factors that prevent higher participation of low SES pupils (cultural, social, or economic barriers) or pupils with disabilities.
- Studies on the cost-benefits of large-scale ECEC programmes with various levels of subsidy are needed to ensure optimal investments by EU Member States.

Cost-effectiveness aspects

Providing high quality ECEC for disadvantaged children seems to be a very effective educational policy from a cost-benefit perspective, as evidence both from experimental programmes in the US and universal programmes in EU Member States shows consistent short-term and long-term benefits for these group. Investment in ECEC for disadvantaged children also contributes to reducing inequalities between high-SES and low-SES families.

Table 23: Cost-effectiveness of early childhood education and care

Approach	Evidence base	Effectiveness	Costs
High Quality ECEC for disadvantaged children aged 0-3	High	Very high	High
High Quality ECEC for disadvantaged children aged 3-6	High	Very high	High

3.4.2. Desegregation policies

What the evidence shows

Desegregation policies aim at ending the practice of separating students among different schools base on their ethnic or social origin, academic performance or any other attribute of social or educational vulnerability. School segregation implies the homogenisation of school composition, limiting diversity among classmates and increasing the interaction of students with peers of similar background. This is a critical dimension of education inequality. Causes of school segregation are diverse and depend on many different aspects, such as residential segregation, school choice policies, admissions systems, parental preferences or the geography of educational opportunities (Bonal and Bellei, 2018). Research has identified that education systems with higher levels of school segregation reduce the opportunities of students with lower socio-economic backgrounds.

There is a large literature focusing on how school composition is an important determinant of individuals' behaviour. Peers' backgrounds are likely to influence their classmates' individual choices and outcomes. The interaction between high and low achievers favours the process of learning of disadvantaged students, which benefits from an adequate learning climate and higher expectations. On the contrary, high levels of concentration of low achievers undermine students' learning opportunities and disappoint teachers and students' expectations. Peer effects can be understood as an externality that spills over from peers' family background (Cebolla-Boado and Medina, 2011; Patacchini et al, 2017). Good students can help their weaker peers (both through the provision of help and their acting as examples), students with greater difficulties enjoy a better curriculum (since teachers prepare it for the highest performing students) and, finally, better students deepen their learning thanks to their support of low-performing students (Dronkers et al., 2011). Other research (Mickleson, 2018; González Motos, 2016) has also pointed out how contact with classmates of other origins make students more familiar with new behaviours, expectations and motivations, which are clearly related to family background. These benefits cannot occur in a context of school segregation.

School composition also impacts school quality. Research has highlighted the existence of a better learning climate, greater support from families and fewer disciplinary problems in more integrated schools (Thrupp et al. 2002). Students from families with a lower socio-economic background increase their expectations of

academic success when they move from schools with a socially disadvantaged composition to schools with a higher social composition. Likewise, students with a migrant background increase their school expectations and performance when attending more diverse schools (Baysu et al. 2016). In general, the performance of disadvantaged students is more sensitive to changes in the characteristics of the school composition (Duru Bellat et al., 2004; Dupriez et al., 2008).

Academic results differ between segregated and non-segregated scenarios, with lower inequalities in more inclusive education systems (Benito et al. 2014). PISA data have demonstrated that those countries that have been able to be more inclusive and to reduce school segregation are also the ones that have shown higher progress in terms of students' outcomes. Research has also identified that inter-ethnic networks in the educational context tend to have positive effects on processes of inclusion of socially disadvantaged students, increasing the social cohesion of communities (Stark et al. 2015; González Motos, 2016).

Finally, there is evidence that reducing school segregation is cost-effective (Basile 2012). The lost income associated with all sorts of inequalities, including educational inequalities, is considered to be significant. School segregation may produce income losses through several mechanisms. First, since school segregation lowers the academic performance of the whole education system and there is a relationship between performance and economic returns, a segregated school system can produce highly significant earning losses. Second, reducing school segregation can lead to a positive economic balance in public spending per student accounting for public savings in areas such as health, security or welfare, as well as the gain derived from labour inclusion (Billings et al. 2014; Johnson, 2011)

Tackling school segregation is a main policy priority in the EU, supported by legal[85] and financial instruments[86], and policy initiatives[87].However, EU Member States have been reluctant [88]desegregation policies. Althought their effectiveness depends largely on the specific characteristics and causes of school segregation in a given context, there are a range of strategies in the hands of policymakers to make schools more inclusive and less segregated, such as:

- *Busing*: this was the main policy implemented in the US, due to historical apartheid and high levels of racial segregation of neighbourhoods and districts. School buses took children from racially isolated neighbourhoods to attend more diverse schools in more affluent districts.
- *Re-definition of catchment areas (school zoning)*: catchment areas to determine local and proximity schools exist in those countries without school choice or with

[85] Infringements cases launched by the European Commission under the Racial Equality Directive concerning segregation of Roma children (2014 CZ, 2015 SK, 2016 HU) are currently ongoing. See also Council Directive 2000/43/EC of 29 June 2000 implementing the principle of equal treatment between persons irrespective of racial or ethnic origin (the 'Racial Equality Directive').

[86] The Common Provisions Regulation explicitly states that EU Funds should not support actions that contribute to any form of segregation or exclusion, and, when financing infrastructure, should ensure the accessibility for persons with disabilities. Et also sets relevant enabling conditions.

[87] The EU Strategy on the Rights of the Child highlights educational segregation as one the main challenges and promotes access to inclusive, non-segregated, quality education, through a non-discriminatory treatment regardless of racial and ethnic origin, religion or belief, disability, nationality, residence status, sex, and sexual orientation. The European Child Guarantee underlines that mainstream services need to be inclusive to ensure that children in need benefit fully and avoid stigma and segregation. In particular, segregation and discrimination in accessing mainstream education for Roma children, children with disabilities, children with a migrant background is an important challenge. The EU Roma strategic framework sets a headline target on reducing school segregation, in countries with sizeable Roma population.

[88] The level and characteristics of residential segregation, the diversity of educational supply, the school admissions system and socio-spatial inequalities from school location are factors influencing the opportunity and effectiveness of different instruments.

some form of controlled choice. Re-definition of catchment areas can potentially change school composition by making them more socially diverse.

- *Changing school choice regulations*: regulations about the freedom of choice for certain or all schools may impact school segregation. Some of them include different choice capacities for primary or secondary education.
- *School admission systems:* many EU Member States have different systems for primary and secondary education, usually allowing for higher levels of selection in accessing particular secondary schools. In addition, school admissions may include regulations on the systems for sorting parental preferences for specific schools. The use of these regulations may affect overall school segregation levels.
- *Distribution of students in vulnerable situation*: the policy aims to balance the distribution of students with potential disadvantages among schools within a territory. This policy requires good systems of detection and classification of disadvantaged students and a mechanism of seat reservation for them.
- *Closing schools (or classrooms):* this policy aims at achieving higher diversity in school composition by closing schools or classrooms in those territories with high levels of concentration of disadvantaged students. By closing an isolated school students from that school may be distributed among other local schools.
- *Making less demanded schools more attractive:* schools with low levels of demand that concentrate a high number of disadvantaged can be transformed by using different strategies, such as changing leadership or the school project. The most well-known example of these policies are *magnet schools*, which started in the US but are now present in several EU Member States. Magnet schools focus on a specific area (arts, science) in partnership with some external public or private body and this singular offer aims to attract more affluent families.

Despite the diversity of instruments available, desegregation policies have not been widely implemented around the world, with the notable exception of the US due to law enforcement. Several court sentences abandoning the historical doctrine of *"separate but equal"* in US schools opened the door to desegregation policies and especially to busing plans in many school districts. While these policies were active in the 1970s, they started to decline from the 1980s. However, desegregation policies have remained controversial in US education (Noblit, 2015) and their efficacy has been questioned after decades of resegregation in US schools (Frankenberg and Orfield, 2012).

In addition, evaluations assessing the impact of desegregation policies are still scarce. The lack of longitudinal data in some countries has been a barrier to evaluating the effects of specific reforms. Other difficulties include selection bias in experimental designs and causal attribution biases. Nevertheless, table 24 includes some examples.

Table 24: Evaluations of school (de)segregation policies

Study	Policy	Effects on	Method	Territory	Results
Allen (2007)	Nearest school allocation (simulation)	Reduction of segregation	Counterfactual analysis	UK (LEAs)	School segregation is almost always lower in the proximity counterfactu

					al than in the actual data
Bonal et al. (2020)	Nearest school allocation (simulation)	Reduction of segregation	Counterfactual analysis	Barcelona (Spain)	Evidence of a significant reduction of school segregation for all disadvantaged students.
Saatcioglu (2010)	Desegregation (by busing and other policies)	Dropout rates	Multilevel growth models for longitudinal data (4 cohorts)	Cleveland (US)	Minority (Black and Hispanic) dropout rates changed slightly, and only for the second cohort.
Allen et al (2013)	Lottery systems to allocate students to oversubscribed schools	Student sorting	Difference-in-differences	Brighton and Hove (UK)	Increase in student sorting but a significant weakening of the dependence of school attended on student's prior attainment
Makles & Schneider (2011)	Abolition of school districts	Ethnic segregation on primary schools	Random effects model	North Rhine-Westfalia (Germany)	Abolishing school districts does not increase systematic segregation in primary schools
Angrist and Lang (2004)	Busing	Student performance	Longitudinal regression analysis	Boston (US)	No adverse effects of increasing the fraction of minority students on non-minority students. Small positive effects of diversity on minority girls' performance
Betts et al	Magnet	Diversity and	Longitudinal	US (21	Positive

(2015)	schools	attainment	study of selected schools	schools from the MSAP)	outcome on diversity and achievement

What is missing

It appears evident that there is a clear need to promote policies to tackle school segregation as well as to increase the number of evaluations of existing experiences.

The more critical gaps in the literature are:

- *Impact evaluation of policies designed to tackle school segregation and improve school integration*. More and better knowledge is needed about the *net* impact of policies such as changing school admissions, expanding school choice or opening the educational market to new forms of educational provision (such as schools that offer special classes or curricula, or new private providers) on school segregation
- *Impact evaluation of general education policies leading to school segregation*. Educational reforms with a diversity of goals (school curriculum, school fees, teachers' work conditions, school innovation, etc.) may have potential negative effects on school segregation and generate differences in educational quality. Regular assessments of the effects of these policies on school segregation are needed
- *More studies are needed on the effects of school integration* on different outcomes (performance, students' wellbeing, students' attitudes), and a number of social benefits in monetary and non-monetary terms
- *Peer-effect mechanisms*. Studies on the effects of school composition on educational performance are based on the hypothesis that there are positive (or negative) peer-effects derived from school integration and heterogeneity. However, we need more and better knowledge on the specific mechanisms by which peer-effects operate. This requires the use of mixed methods approaches to explore how interpersonal contact impacts students' learning.
- *Tipping points research*. Behavioural economics explores the collective outcomes of micro-decisions. In the field of desegregation studies, it is crucial to understand the tipping points that alter individual decisions regarding school choice. Small differences in tipping points can make a difference in the overall level of school segregation
- *Rationalities of educational demand*. Most education policies are based on assumptions that cannot be taken-for-granted and must be investigated. In the field of school segregation studies, it is crucial to increase our knowledge on the boundaries and preferences of school choice that condition demand behaviour and impact on school segregation.

Cost-effectiveness aspects

Cost-effectiveness analyses of school desegregation are very exceptional. Problems of attribution and measurement of certain outcomes make this type of analysis complex in this area. Cost evaluation is also a matter of discussion, as some dimensions associated with costs are estimates of both monetary and non-monetary dimensions. In the US, the study of Basile (2012) is an interesting example of what type of cost-effectiveness analysis can be done. He estimates the cost-effectiveness of socio-economic school integration based on the economic payoff of increased graduation, and the costs of programmes that encourage families to choose to cross

neighbourhood borders for their children's schooling. The increase in graduation rates generates gains from increased tax revenue and savings from reduced spending associated with health care, crime, and welfare. On the costs side, he estimates an increase of 10% of public expenditure in basic education as a result of cross-neighbourhood choice. The total gain - which includes both the public gain as well as increased private earnings - is estimated at more than three times the cost, and the total return on this investment is estimated to exceed the costs by a factor of greater than five. This analysis does not include less tangible benefits, such as an increase in civic participation or better social cohesion.

Cost-effectiveness analyses of specific interventions associated with school integration and the reduction of school segregation need to be designed.

Table 25: Cost-effective ways to promote school (de)segregation policies

Approach	Evidence base	Effectiveness	Costs
Nearest school allocation	Medium	High	Low
Busing	Medium	Medium	High
Distribution of marginalised students	Medium	High	Medium
Magnet school	Low	Medium	Medium

3.4.3. Tracking and ability grouping

What the evidence shows*Tracking* involves placing students into different classrooms – often different schools (mostly in secondary school) – based on their choice of academic and vocational tracks, or often on their ability or career aspirations (Chmielewski 2014). Such placements are fixed and shape students' destinations and career paths (Loveless 2009).

Tracking is different from *ability grouping*, which by definition involves placing students into different classrooms or small groups based on their initial skill levels, readiness, or abilities. The main purpose is to create a more homogeneous learning environment so that teachers can provide instruction better matched to students' needs and students can benefit from interactions with their comparable academic peers. Such placements are not permanent school administrative arrangements that lead to restrictions on students' graduation, destinations, or career paths (Steenbergen-Hu et a. 2016, Deunk et al. 2018).

Tracking generates academic segregation as students of similar ability levels are allocated to the same schools or within the same classes (Parker et al., 2016). In early tracking, the socio-economic background correlates with performance, meaning that early tracking generates larger gaps between students from higher and lower socio-economic backgrounds. While a greater variety of school types can cater to the diverse needs of students, it can also increase educational inequalities (Ammermüller, 2005; Strietholt et al., 2019). Therefore, it can be argued that there is no unique *"optimal level of tracking"*, rather a need to find the right balance between differentiation and tracking. According to Horvac et al. (2020), there are systems where tracking starts early (between ages 10 and 13), such as Germany or the German-speaking and Flemish Communities of Belgium; or around the age of 14 to 15, such as Italy or Portugal; or relatively late trackers such as Denmark, Norway, or Finland. There are also countries where grouping by ability is used course-by-course, e.g., Ireland or the UK (ibid.). Based on PISA school level data (on 15 to 16-year old students), Poder et al. (2013) show that the countries that track most intensively are Romania, Germany, and Switzerland. However, most countries have tracks present at upper-secondary level (at the age of 17), where most countries track students to vocational or academic tracks.

Figure 12: Tracking in Europe

Source: European Commission/EACEA/Eurydice, 2020; OECD PISA 2018

Evidence about the impact of tracking

There are different types of tracking: those between programmes (academic, vocational); and those between schools (different schools, e.g. elite vs regular, private vs public). There is evidence that both types of tracking reduce education equity (harmful practice) and have mixed effects on effectiveness (e.g., PISA points), and the latter indicates that there are winners and losers as a result of it (Hanushek and Wößmann, 2006; Schuetz et al., 2008; Wößmann 2009, OECD, 2012, Poder et al. 2013).

Some examples of studies that use quasi-experimental or regression techniques and are mostly cross-country student-level studies are listed in table 26.

Table 26: Studies on the impact of tracking

Study	Method	Country (sample)	Results	Tracking features
Hanushek and Woessmann (2006)	Difference-in-differences	45 countries	Significant effect of early tracking on inequality; no clear effect on mean performance	ISCED 2
Schuetz, Ursprung, and Woessmann (2008)	Regression	54 countries (student level)	Late tracking and pre-school duration reduce the impact of family background; inverted U-shaped effect of pre-school enrolment; no trade-	Age of tracking

			off with effectiveness	
Ammermüller and Pischke (2009)	Instrumental Variables Regression	6 countries (FR, DE, IS, NL, NO, SE)	Modestly large peer effects; measurement error important; selection introduces little bias	Peer effects grade 4
Zimmer and Toma (2000)	School fixed effects estimates	5 countries (BE, FR, NZ, CA, US)	Positive peer effects; gains from high-quality peers stronger for low-ability students; mixed results on school types	Mathematics results age 13-14

Evidence about the impact of ability grouping

There are different types of ability grouping: (a) between-class (comprehensive ability classes, XYZ groupings, multilevel classes); (b) within-class (small homogenous instruction groups); (c) cross-grade grouping; or (d) special grouping (for gifted). Table 27 below reports the results from Steenbergen-Hu et al. (2016) and Deunk et al. (2018), which apply meta-analysis including only experimental papers.

Table 27: Impact of ability grouping

Type of ability grouping	Impact on effectiveness	Impact on equity
Between-class	**Negative**	**Negative**
Within class	**Positive**	**Positive**
Cross-grade	**Positive**	N.A.
Special grouping	**Positive**	N.A.

What is missing

Discussions about the mechanisms explaining why tracking is harmful are mainly related to peer effects (e.g., peer-to-peer teaching by Kimbrough et al (2017)), and some experimental evidence that the early age of assignment by ability is highly correlated with socio-economic status (SES), which means that tracking reproduces social classes (Batruch et al. (2019)). Peer effects indicate that peers can serve as socialisers, and according to social learning theory (Bandura 1969) or group socialisation theory (Harris 1995), peers influence not only learning but what is significant in life (see also section 3.4.5). Using behavioural genetics research, Harris (1995) suggests that socialisation forces from the peer group have a bigger influence on people than the hereditary environment.

A discussion on the timing of tracking is also emerging, with Jakubowski et al. 2016 showing that postponing vocational tracking from 16 to 17 years improves students' basic skills. Finally, inter-track transition can partially offset the unequal nature of this initial assignment, implementing a policy that allows transition being cost-effective. However, empirical evidence shows that a small proportion of students changes track (OECD 2017, p. 163).

Cost-effectiveness aspects

Cost-benefit or cost-effectiveness analysis of tracking or ability grouping is currently not available.

Table 28: Cost-effectiveness of tracking and ability grouping

Approach	Evidence base	Effectiveness	Costs
Postponing tracking to the age of 16-17	Medium	High	Low
Within class ability grouping	Medium	Medium	Low
Inter-track transition policies	Medium	Medium	Low

3.4.4. Priority education policies

What the evidence shows

Priority education policies aim to provide some disadvantaged sub-population with additional resources in order to achieve equal opportunity through differentiating resources according to individual needs. They are linked to the "positive action" concept, which covers temporary and proportionate measures or strategies to counter the effects of past discrimination, to eliminate existing discrimination and to promote equality of opportunity[89]. These policies first emerged in the 1970s (UK and France), traditionally targeting schools serving disadvantaged populations. A recent Eurydice report (2020) notes that while more than half of all EU countries allocate additional financial or non-financial support to 'disadvantaged schools', measures to improve the socio-economic composition of schools and incentives to attract teachers to disadvantaged schools are less common. In general, priority education policies have evolved from a systemic and uniform set of policy measures addressed towards schools or territories to a higher process of individualisation and diversification (Francia, 2013). The degree to which these shifts have promoted education equity is a matter of debate in the policy and academic community. Overall, the importance of these programmes and their contribution to the reduction of school failure has been underlined by the OECD and the EU in various evaluations (OECD, 2012; OECD, 2016; Eurydice, 2020a).

The evidence on priority education policies emphasises both a lack of a simple mapping between individual disadvantage and school/area-based disadvantage (Connelly et al., 2014; Tunstall and Lupton, 2003), and how the context in which disadvantaged schools are – that varies significantly – may impact on the effectiveness of interventions (Thrupp, 2006). Overall, much of the impact seems to stem from variation in the nature and scale of the intervention, the way in which additional funding is allocated or the diversity in its measurement.

In some cases, the additional money given to identified schools has been insufficient to overcome overall inequalities in spending. For this reason, the scale of additional funding needs to take into account potential school profile changes and needs to provide comprehensive supports to overcome strong multiplier effects. Davezies & Garrouste (2020) highlight the ecological fallacy[90] - selection into the programme is

[89] https://equineteurope.org/publications/exploring-positive-action-as-a-means-to-fight-structural-discrimination-in-europe/

[90] Ecological fallacy refers to a bias, in which characteristics of a population as a whole are attributed to individuals within that population, without any real connection between them being demonstrated.

often made at the school level, on the basis of social and academic criteria (location in deprived areas, poor academic achievement, large proportion of students from ethnic minorities or from disadvantaged social backgrounds). A second source of bias concerns the fact that individuals may select themselves into (or out of) the programme by choosing (or avoiding) a school that benefits from it. This sorting effect has become an issue across many countries.

One solution could be to increase additional resources for treated schools, in order to compensate for sorting by high socio-economic status families. However, the appropriate size of additional resources and their expected effect on families' school choices are difficult to anticipate.

Another solution could be replacing school-based policies with individual-based ones, in order to prevent the negative signal on school quality (Maurin 2004). Nevertheless, this changes the policy paradigm, as it dissociates individuals from the school and local context, therein moving away from addressing context effects. Overall, the results highlight that adverse effects on school (and potentially residential) segregation have to be taken into account ex-ante in the design of school-based priority education policies. Families' strategic school choices also have important implications in the ex-post evaluation of such policies.

A study using geocoded data and a regression discontinuity framework has evaluated the impact of the French *"Réseaux ambition réussite"* (RAR) programme, which targeted low-achieving and socially disadvantaged lower secondary schools between 2006 and 2011. The results show that selection and sorting bias may explain the programme's negative effects on students' outcomes. Once these biases are taken into account, there is no significant effect on students' outcomes as measured by the Brevet national exam scores (Davezies & Garrouste, 2020).

It is evident that the scale of funding in many priority education programmes is likely to be insufficient to overcome economic, social or educational inequalities among schools. For some programmes, most of the spending is in the form of reduced class size, which is likely to be of limited value if teachers are not able to adapt their pedagogical approaches to smaller and more diverse classes (for a more detailed analysis on reducing class size, see section 3.1.3). There is strong evidence that teaching in these schools is more challenging, and it is difficult to attract and retain teachers (McCoy et al. 2014), even with a small bonus in some countries. Using French administrative data on secondary school teachers, one study analysed a non-pecuniary, "career-path oriented" centralised incentive scheme designed to attract and retain teachers in French disadvantaged schools. They find that while the incentive had a positive impact on the number of consecutive years teachers stay in disadvantaged schools, there is no impact on the teacher experience gap nor the student achievement gap between schools serving disadvantaged and non-disadvantaged populations (Benhenda and Grenet, 2020). For a more in-deph analysis of these aspects, please refer to section 3.1.1.

Some examples of different policies and their impact are provided in table 29. Very few studies provide cost-benefit analyses, although several provide valuable analyses of the impact of targeted or priority funding on student performance, variously measured. These include studies in the UK (Hutchings et al., 2012), Ireland (Smyth, McCoy and Kingston, 2014), France (Bénabou et al., 2009) and Spain (Bonal and Pages, 2019).

Table 29: Priority education policies and their impact

Illustrative Programmes	Evidence on impact
UK: *London Challenge* resources to promote out-of-school learning, leadership and teacher retention in disadvantaged schools.	*Positive*: performance among low-income students increased at a faster rate than the national average (Hutchings et al (2012))
UK: *Excellence in Cities*. 1/3 of secondary school students in England. Three strands: Learning Mentors, Learning Support Units, Gifted and Talented programme, also Specialist schools.	*Positive*: positive effects which have increased over time. Potentially cost-effective - relatively low cost (£ 120 per pupil/year), benefits do not have to be very large to generate a positive outcome (Machin et al (2005))
France: *ZEP*. Lower ratios and salary incentives to attract and retain the best teachers. Compensatory education represents about 10% of the annual spending per pupil.	*Mixed*: no discernible effect on students' outcomes; included obtaining at least one qualification, reaching 8th or 10th grade, and success at the Baccalauréat (Bénabou et al. (2009))
Ireland: *DEIS*. 19% primary and 26% secondary schools; reduced class size, additional funding, access to planning supports, literacy/numeracy programmes, professional development supports, etc.	*Positive, given sorting*: performance gap has remained constant over time, but growing complexity of need in DEIS schools (sorting effects), so gap would have widened in the absence of the programme (Smyth et al., 2014)
Netherlands: a school with all of its students from the disadvantaged minority group 2X funding where all students non-disadvantaged. One subsidy= 70% disadvantaged minority students extra funding for personnel; second extra funding for computers and software.	*Negative:* for both subsidies negative point estimates, which are for some outcomes significantly different from 0. Extra funding for computers and software seems especially detrimental for girls' achievement (Leuven et al. (2007))
Spain: *Education priority areas*. 'maximum complexity schools' (n=340) social context of the school (parental education, occupational status, presence of migrant students, and students with special needs). These schools have more autonomy to select teachers and receive complementary human and material resources.	*Limited impact*: poor results and limited impact. Recommend Education Priority Territories as spaces of coordination between local and regional governments; Education Territory Councils, formed by all educational stakeholders with capacity to set priorities; regulation of access and human resources allocation in schools; initial and in-service training; resource allocation based on social & educational needs (Bonal & Pagès (2019)).
US: *Title 1* financed supplementary educational services in reading and mathematics in disadvantaged schools. Increases Federal revenues of schools ~ USD 460/student. Partially offset by decreases in revenues from state categorical aid grants, so that the net increase to schools is about USD 360/student.	*Limited impact*: schools appear to respond to the incentives embedded in the Title I allocation process by manipulating the fraction of their students signed up for free lunch to secure more Federal funds (Matsudaira et al. (2012).
Chile: *Subvencion Escolar Preferencial*. Increase in school vouchers used to fund	*Limited impact*: no impact on achievement gap or achievement gains. Decline in

private and public schools by 50% for lowest SES students. Funding to reduce class size, improve technology or purchase other resources. Provides schools with an incentive to become more attractive to low-income families.	achievement gap is 'illusory' after decomposition of gains into between- and within-school components, the impact of family background controls, and other analyses (Feigenberg (2018)).

What is missing

The evidence on the role and impact of priority education policies is largely mixed, stemming at least partly from the lack of rigour in the evaluation of policies and initiatives in this area. While these policies are prevalent across EU Member States, they are not regularly evaluated nor are the results of existing evaluations used in programme design.

Among the key gaps in the literature, we can list the following:

- Many studies do not include comprehensive school profile measures, thereby allowing identification of any sorting effects that might arise as well as differential impact across school settings
- Few studies include counterfactual analysis, which would allow a more rigorous insight into impact
- It is unclear if targeting approaches have differential impacts. However, there would appear to be a case for a degree of tapering of funding for schools rather than a sharp withdrawal below the specified cut-off
- Cost-benefit analysis is not included in many studies – both in terms of short term/early outcomes and longer-term benefits over the educational career.

Cost-effectiveness aspects

Very few studies provide cost-benefit analyses, although several provide valuable analyses of the impact of targeted or priority funding on student performance, variously measured. Overall, the evidence points to key components in the effective design and evaluation of these policies, such as:

- Clear outcome-linked objectives in the design of policies, with counterfactual or comparison group analyses particularly beneficial
- Including rich school profile indicators from the outset and over time. Many studies have relied on relatively limited measures of student socio-economic background, such as eligibility for free school meals, available through administrative records (Gorard, 2006)
- Considering multiple indicators capturing both academic and socio-emotional dimensions, including students' engagement, attendance, aspirations, as well as achievement
- Guarding against narrow achievement measures given that domains of knowledge subject to regular assessment can 'squeeze out' time spent on other curricular areas
- Paying attention to unintended consequences or resources being used for purposes other than for which they are intended.

Table 30: Cost-effectiveness of priority education policies

Approach	Evidence base	Effectiveness	Costs
Capturing outcome-linked measures of priority education policy impact	High	High	Medium
Measuring both academic and socio-emotional outcomes in priority education policies	Medium	High	Medium
Capturing rich/multidimensional school/neighbourhood profile measures	Medium	Medium	Medium
Measuring how resources are utilised	Low	Medium	Medium

3.4.5. Student-centred compensatory education policies

Student-centred compensatory education policies include a wide range of programmes, initiatives and interventions targeting individual students and aiming at improving the results, attendance, experience and wellbeing of most disadvantaged pupils in primary and secondary education. More specifically, student-centred compensatory education policies are oriented to improve the learning conditions of those students with socio-economic disadvantages. Research have highlighted for decades the salient weight of students' socio-economic and cultural background for explaining the differences and inequalities in students' outcomes and learning results, from classics (cf. Coleman, 1966) to more recent contributions (cf. Ladson-Billings, 2006). The existing evidence have highlighted that the learning gap is also explained by important differences of school experiences and student well-being according to social and cultural background. Actually, the educational inequalities can be expressed in terms of educational results but also access, and process (OECD, 2017). Education systems within and beyond the EU have adopted different education policies and reforms aimed to address and tackle such challenges, although most of them with modest results. A salient group of compensatory education policies were aimed to ameliorate the learning conditions of disadvantaged populations with interventions at the school or district level. A complementary approach is focused on the programmes oriented at compensating learning conditions at the student level. In the lines below some of these interventions are analysed and the existing evidence evaluating their efficiency and effectiveness is presented.

What the evidence shows

The main policies of compensatory education at the student level may include interventions of different nature and with diverse policy designs. In this document we address the following programmes and policies:

- *One-to-one tuition*
- *Peer tutoring*
- *Mentoring*
- *Summer learning programmes*
- *Grade repetition*

Among the analysed programmes and policies, there are different levels of evidence (more or less strong, prolific or scare) and results (positive, negative or mixed).

Some students need particular support mechanisms for enhancing their learning opportunities. Education systems tend to develop measures of student support that

can be labelled as universal, additional, or intensive. When a universal measure of support is not enough for improving the learning conditions of a particular student, more specific initiatives need to be developed to align the student needs with the instructional strategies and education support (Ferrer-Esteban, 2019). Additional measures are those oriented to balance the learning competences of low achievers with their peers, with measures that include catch up programmes, tutoring or mentoring. On the other hand, intensive measures are oriented to adapt the learning processes, strategies, and materials to the students' needs. According to an extensive review of reviews, which include more than 700 studies, Ferrer-Esteban (2019) suggests that initiatives of individualised student support, both of additional and intensive nature, have a positive effect on the development of students' competences. The intensive measures show a positive effect on student learning, particularly when they are prolonged in time and implemented at the individual level. For these kinds of interventions, small groups or individualised action is recommended and sessions are preferred to be shorter but regularly applied. However, not all the programmes of student support have the same designs, impacts and costs.

One-to-one tuition

The interventions of instruction reinforcement through one-to-one tuition involve an additional and intensive individual support led by a teacher or teacher assistant oriented to reinforce a learning area. The evidence suggests that this kind of interventions have a salient efficacy although the costs are relatively high. In a randomised effectiveness trial evaluating the *TutorBright Programme* (Canada), aimed at improving learning skills of children in care, Hickey & Flynn (2019) found statistically significant and positive effects on reading fluency, reading comprehension and mathematics calculation. However, spill-over effects were not found as expected (532). Other programmes of one-to-one tuition approaches were evaluated with similar methods and showing positive results. Sirinides & May (2018) conducted a multisite randomised controlled trial to assess the impacts of *Reading Recovery*, a tuition programme offering an intensive programme of individualised instruction for struggling readers. According to the evidence provided, the authors suggest positive impacts helping to "reverse struggling readers' trajectories of low literacy". With the same methodological design, Borman et al (2019) found similar results in "*Descubriendo la Lectura*" (DLL) (*Rediscovering reading*), a programme aimed at supporting students at risk. The programme targeted students with difficulties in literacy by giving them initially literacy instruction in their native languages. According to the evidence provided, treatment students outperformed control students with statistically significant student-level impacts (Borman et al, 2019). Finally, Bøg and colleagues (2019) evaluated a one-to-one tutoring programme implemented in Sweden (Läsklar). The analysis was conducted in disadvantaged schools applying a randomised field experiment and found positive effects on self-efficacy and phonological awareness of students, although impacts on motivation were not statistically significant.

Summing up, compensatory policies based on one-to-one tuition appear to be effective and generate positive effects, especially in reading and literacy. The evidence reviewed suggest that one-to-one tuition interventions might be an appropriate approach as a student-level compensatory policy, considering that most vulnerable students receive additional benefits and low achievers are more likely to benefit from such schemes (Education Endowment Foundation, 2021a).

Peer tutoring

Peer-tutoring refers to those interventions in which students from different levels of proficiency or age work together for sharing support strategies. Peer tutoring appears to be a very effective intervention for enhancing better academic results across different subjects, both in primary and secondary education levels. Moreover, peer tutoring seems to have particular positive benefits for students with disabilities, as well as those with emotional and behavioural disorders (Bowmann-Parrott, et al, 2013, p. 52). In a meta-analysis of the existing literature, Ginsburg-Block and colleagues suggest that peer assisting learning can have small to moderate benefits on social, self-concept and behavioural outcomes. More interestingly, the effects of the peer assisting learning programme where more effective for more vulnerable students, particularly, those defined as low income, urban and minority backgrounds (Ginsburg-Block et al, 2006). In a revision of the literature, Robinson et al (2005) highlight that peer and cross-age tutoring are very well-suited strategies and interventions for improving academic results of minority students and enhancing other non-cognitive skills, including socio-emotional well-being and attitudinal outcomes (Robinson et al, 2005, pp. 352). Actually, and according to a review of reviews, the impact of peer tutoring seems to be beneficial for all different profiles of students, although younger students, students with disabilities as well as social and academically vulnerable students are those that benefit the most (Alegre, 2015).

Summing up, peer-tutoring programmes appear to be generally very effective at very low cost, having positive impacts for both tutors and tutees, and contributing to a learning improvement equivalent to five months of additional progress. Moreover, it is important to highlight that peer tutoring can contribute to compensate learning gaps supporting most vulnerable students to make significant progress (Education Endowment Foundation, 2021b).

Mentoring

Mentoring refers to those programmes of support, guidance, and development in which a child or a youth is paired with a non-family adult serving as a positive reference for fostering academic results, school engagement, social competences or any other personal goal or objective.

The academic literature (DuBois & Karcher, 2005; Rhodes, 2005; Busse et al, 2018) agrees on a general and broader definition in which a programme of mentoring is composed by different key components including:

a) A relationship of guidance and support between someone with greater experience in a particular field - the mentor, and someone how need and external support - the mentee
b) A process oriented at ensuring and enhancing opportunities for personal development, as well as supporting the achievement of defined goals of the mentee
c) A relationship built based an emotional bond and through a trusting supportive relationship

When this kind of intervention is developed in the school context and more oriented towards the achievement of learning results and academic engagement, it is often labelled as *School-Based Mentoring (SBM)*, one of the most popular interventions currently in use to improve vulnerable students' outcomes (Simões & Alarcão, 2014, pp. 466). Compiled evidence of meta-analysis studies reported positive impacts of mentoring in cognitive and non-cognitive competences, including academic performance but also socio-emotional skills and student well-being (Dubois, 2011;

Raposa, 2019). Herrera and colleagues (2011) highlight positive but modest impacts of SBM in a random assignment impact study. More specifically, teachers reported small gains in academic performance, while youth reported similar improvements in perceptions of their own academic abilities (p. 356). However, these gains are rarely sustained in time after the intervention. In a randomised control trial study, Bayer et al (2013) suggest that SBM programmes might ensure a positive impact on academic outcomes only when a significant relationship is built between the mentor and the mentee. In a similar vein, other studies based on experimental and quasi-experimental evidence have suggested that mentoring programmes can reach positive benefits for higher-risk youth, reducing depressive attitudes while promoting social acceptance, academic dispositions, and grades (Herrera et al., 2013). In an experimental study using Multivariate Analyses of Covariance, Simoes & Alarçao (2013) found that a Portuguese SBM programme was effective in improving school performance in maths and language, increased satisfaction of basic psychological needs and contributed to a significant decrease of unexcused absences of the mentored students (Simões, F., & Alarcão, 2014, p. 478). A review of SBM evaluation studies suggest that, in general terms, these programmes have positive effects on pro-social outcomes for at-risk youths (Randolph & Johnson, 2008, p. 183). More recent research reinforces the same results providing evidence of small to moderate positive effects of mentoring on emotional well-being (Claro, 2021).

Although most studies reviewed tend to stand out positive results, it is important to keep some caution and nuance their impacts. According to the Education Endowment Foundation, mentoring programmes appear to have positive impacts on attainment and performance, although these impacts are small and not sustained once mentoring ends up (Education Endowment Foundation, 2021c). However, mentoring might be still a very appropriate intervention for targeting and supporting disadvantaged students aiming at improving cognitive and non-cognitive skills.

While mentoring is not generally as effective in raising educational outcomes as small group or one-to-one tuition, it is possible to target the approach to pupils from disadvantaged backgrounds and those with specific needs. Mentoring interventions may be more beneficial for these pupils, as the development of trusting relationships with an adult or older peer can provide a different source of support (Education Endowment Foundation, 2021c).

Summer learning programmes

An increasing variety of student-centred compensatory education policies are implementing programmes aimed at increasing the learning time, either by extending the school schedules or by developing summer schools. Summer learning programmes are additional classes organised during the summer as catch-up programmes combining academic and informal activities (Education Endowment Foundation, 2021d). These programmes can be targeted to students from disadvantaged backgrounds but are often open to heterogeneous student profiles. Unfortunately, summer schools are not always achieving their goals due to a poor systematisation of educational programmes, uneven quality instruction and lack of resources (Denton, 2002). Summer schools are implemented by schools, districts, or other small administrative units, giving important room to different design approaches. Consequently, it is not rare to find important levels of divergence regarding the quality, coherence, and adequacy of the programmes. In order to ensure coherence, quality and equity, public authorities should take part in supporting, coordinating and funding such initiatives. Accordingly, summer programmes targeting disadvantaged students should ensure consistency, being part of the academic school programme and exempting family fees. In terms of teaching strategies, summer programmes for disadvantaged students should focus on responding to individual needs using

different instructional materials and strategies than those that have failed during the school year (Denton, 2002, p. 18). Indeed, if the approach of the intervention is not supportive enough, more modest results are found, with small positive impacts but without statistically significant results (Maxwell et al, 2014). Some studies also find mixed evidence of particular summer programmes, with positive results in language for students eligible for Free School Meals (FSM) (with two additional months of progress) but no observable effects on maths (Gorard et al, 2014). Nevertheless, the overall existing evidence suggests positive results. In a research synthesis including evidence from 93 evaluations of summer programmes, Cooper and colleagues (2000) conclude that these approaches have positive impacts for learning and skills. In a quantitative study using administrative data and conducted in a school district in the USA, Zvoch & Stevens, (2011) found that a summer instruction programme targeting at-risk students promoted literacy gains and prevented learning losses. Similar evidence supported these results with a randomised trial design suggesting the efficacy of summer programmes for enhancing learning (Zvoch & Stevens, 2013). Not surprisingly, the students that benefited the most were those pupils coming from middle class backgrounds. Remedial programmes appear to have larger effects when summer programmes are implemented through individualised instruction or small groups (Cooper et al, 2000). It is important to highlight that although its potential benefits for disadvantaged students, summer programmes often fail at targeting the low achievers and high need populations (McCombs et al, 2011). Therefore, more efforts need to be driven towards ensuring summer learning programmes targeting students with high-needs and developing intensive and individualised approaches. Moreover, it is important to take into consideration possible non-intended effects of summer learning programmes in terms of equity. Since the most benefited are students coming from middle class backgrounds and at-risk students appear to be difficult to target and are more prone to drop out, summer learning programmes might eventually widen the learning gap if no sufficient efforts are oriented to ensure that most needed students receive intensive support during the summer.

In general terms, summer learning programmes have a positive impact on average, although the costs are high, and providing support during the school year may be a more cost-effective option. However, the positive impact of summer learning programmes is clear, representing three additional months of progress on average. Moreover, the positive impacts appear to be higher with intensive teaching approaches (small groups, one-to-one, etc.), and particularly appropriate for disadvantaged students. Existing evidence suggests that disadvantaged pupils can benefit from summer learning programmes although dropouts and aspects of access might limit their potential benefits (Education Endowment Foundation, 2021d).

Grade repetition

The practice of grade repetition is one of the most usual strategies adopted to deal with low achievers. However, the evidence is abundant and univocal and suggests that grade repetition has a low impact in improving students' outcomes, has potential harmful effects on disadvantaged students and has high economic costs for public budgets. The evidence suggests that grade repetition has larger negative effects for disadvantaged students, pupils from ethnic minorities, and younger students (Education Endowment Foundation, 2021e). Indeed, grade repetition is a school policy that tends to harm those students with more educational needs, without providing them any extra instructional support, guidance or adaptation and hence contributes to widening the learning gap and educational inequalities:

> *Grade repetition offers no clear benefit to the overall performance of a school system; and because, as PISA results show, socio-economically disadvantaged*

students are more likely than advantaged students to repeat a grade, grade repetition may also reinforce inequities in the system (OECD, 2014, pp. 3).

Grade repetition can also reinforce dynamics of school disengagement of low-performing students as far as students do not feel supported and repetition can be seen as a sanction. In fact, a study conducted in Spain has shown that 88% of the students that drop out school have repeated at least once (Enguita et al, 2010). Altogether, we can easily agree, according to the existing evidence, that grade repetition is a high-costs strategy, without positive impacts but potential harmful effects for students at-risk (EEF 2021e). In conclusion, grade repetition should be considered an inefficient, unsuccessful, and inequitable education policy (Tarabini & Bonal, 2016), especially if we are interested in promoting student-level compensatory education polices.

What is missing

It appears evident that there is a clear potential for improving educational opportunities for disadvantaged pupils promoting student-centred compensatory education policies and better addressing special educational needs in mainstream schools. The evidence provided suggests that intensive and individualised programmes are very well-equipped policies for promoting student learning, especially when these programmes are systematised, aligned to the student needs and sustained along the course. In contrast, other policy options such as grade repetition are not recommended for being inefficient and unequitable. There are some elements that need further research to determine what policy options are more appropriate in different contexts and circumstances.

The more critical gaps in the literature are:

- We need to know more about the *implementation process*: most of the evidence reviewed is focused on an output-oriented approach analysing the effectiveness of compensatory policies at the student level. However, little is known about how the implementation process mediates the success or failure of different policy approaches in specific contexts. Qualitative approaches and evaluation of the implementation processes would bring important results to consider for policy design
- *Realist evaluation approaches*: in similar vein of inquiry, realist evaluations might contribute to better understand the complexities of compensatory policies beyond generalist ideas on “what works” and “best practices”. We need more nuanced evidence trying to understand “what works, for whom and under what circumstances” (Pawson, 2006)
- Dealing with these alternative approaches of policy evaluation might help to deal with other gaps in the existing research, with particular interest on the role of *situated contexts to understand school-level factors* affecting processes of policy implementation and the outcomes of different student-level compensatory policies
- We need to fill a research gap based on an important *geographical bias*. Most of the studies on these topics are conducted in Anglo-Saxon countries but little is known about other contexts and education systems with different administrative traditions and institutional designs. What works somewhere might fail in other contexts if the circumstances of implementation vary. Accordingly, we need locally situated evidence to better understand what policy approach is more appropriate in different contexts
- We need to know more about the mechanisms that can reinforce positive outcomes. We need to go beyond causal or correlational inferences and try to

unveil causal mechanisms: this means opening the black box to understand the necessary conditions for a policy approach to generate a particular expected outcome
- Little is known about the *potential risks and undesired effects* of these policies. We should be able to consider possible unexpected outcomes trying to prevent harming impacts both in terms of equity and quality
- Existing research tend to focus on students' outcomes. However, several studies also suggest important positive impacts on *non-cognitive dimensions*. In this sense, we need to put more attention to the impacts of these policies on other factors beyond student results. It is important to take into consideration those factors that could be considered a *necessary condition* for enhancing student learning, considering for instance student well-being and socio-emotional effects
- *Longitudinal designs* are needed to identify potential benefits of sustained and structured programmes of intervention. More research is needed to identify *direct and short-term effects* but also measuring *indirect and long-term effects*.
- More comprehensive reviews are needed to know what *conditions of policy design* are more adequate for different programmes in particular contexts.

Cost-effectiveness aspects

According to the existing evidence it is necessary to reflect on the cost-effectiveness of the main interventions analysed. To evaluate the cost-effectiveness of different student-centred compensatory policies we assess, for each programme, the quality and quantity of the existing evidence, the kind of impact and the estimated economic cost. Summarising, and at risk of over-simplifying, some concluding remarks can be outlined:

- Grade repetition is not a recommended policy.
- Mentorships and summer programmes are appropriate student-based compensatory policies, but special attention is needed regarding their policy design and implementation.
- One-to-one tuition and peer tutoring programmes are highly recommended if they are implemented in an individualised way or small groups, as well as with cohesive, coherent, and sustained interventions.

Table 31: Cost-effectiveness of student-centred compensatory education policies

Approach	Evidence Base	Effectiveness	Cost
Mentorships	Medium	Medium	Low
One-to-one tuition	Medium	High	Medium
Peer tutoring	High	High	Low
Summer Learning Programmes	Low-Medium	Medium	Medium
Grade repetition	Medium	Low	High

Source: Based on Education Endowment Foundation Teaching and Learning Toolkit classification and other evidence compiled

3.4.6. Access and persistence of higher education

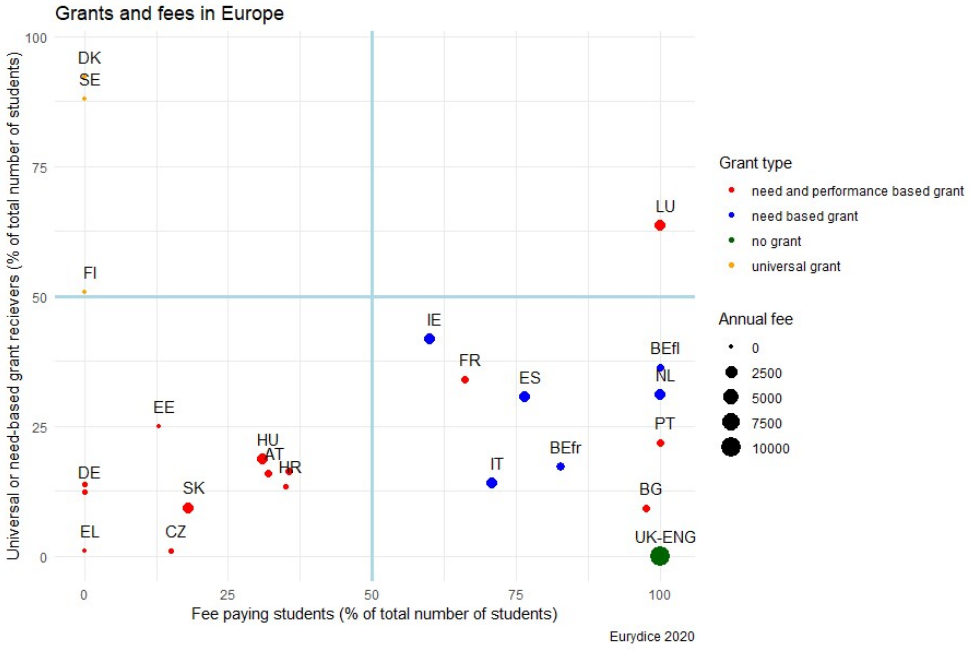
What the evidence shows

Recent trends in higher education generated a *'trilemma'* – low public costs, low private costs (tuition fees), and mass access to higher education (Ansell 2008), which

bring along changes in higher education governance models (Dobbin & Knill 2014) and more cost-sharing (Marcucci and Johnstone, 2007) between the private and public sectors. Garritzmann (2016) distinguishes between *"Four Worlds of Student Finance"*. According to that model, countries fall into four groups regarding their tuition–subsidy systems: i) a low-tuition–low-subsidy cluster (mainly continental EU countries); ii) a low-tuition–high-subsidy regime (mainly Nordic EU countries); iii) a high-tuition–high-subsidy system (mainly Anglo-Saxon countries); and iv) a high-tuition–low-subsidy cluster (some Asian and Latin American countries). The coverage of Eastern and Baltic EU countries remains patchy due to data deficiencies (e.g., Estonia followed the dual-system and from 2013 onwards the continental system). Garritzmann (2016) indicated that from the perspective of educational access, high-tuition regimes (often categorised as privately funded systems) are not the only ones with barriers to educational access, but low-support countries might also have a detrimental influence on admission regardless of the level of tuition fees. This is mainly due to (in)direct costs related to studies, such as accommodation and other living costs, especially relevant for students from remote areas. Thus, whereas in the case of high-tuition countries the problem of educational equity is explicit, in the case of countries with inadequate support access to higher education is unequal, even without tuition fees, due to other study-related costs.

A recent Eurydice report regarding higher education financing (2020b) provides a detailed comparative overview of fees and grants in the EU (Figure 13). Higher education financing varies widely by country and contains a mix of formula-based funding, performance-based funding (see section 3.3.6 for more details), tuition fees, voucher type student financing schemes, or public tenders (see also Estermann & Claeys-Kulik 2016, Claeys-Kulik & Estermann 2015).

Figure 13: Grants and fees in Europe, 2019/20



Source: Eurydice, 2020

Tuition fees

Recent European evidence in relation to tuition fees is scarce. There is evidence from the most well-known reform in England in 1998 (e.g. Murphy et al. 2019), and some evidence from Germany (e.g. Bruckmeier et al. 2015; Baier and Helbig, 2014;

Dwenger et al. 2012) and France (Moulin et al. 2016). Most of these studies show mixed results. In some cases, there are no significant effects and in others some negative effects for disadvantaged students, both in terms of access and the probability of graduation (e.g. Bruckmeier et al. 2015; Moulin et al. 2016). Havranek et. al. (2018) summarise the results of 43 studies from the 1970s to 2016, finding that there is substantial heterogeneity between individual studies and, on average, the mean tuition–enrolment elasticity is close to zero. These studies use quasi-experimental techniques or reflect on natural experiments, and are country-specific or cross-state (in the German case) studies.

Grants

Evidence from the EU confirms that the effect of needs-based grants is only identifiable when the amount of aid is large enough (e.g., in France, a fee-waiver - which amounted to EUR 174 - had small positive statistically non-significant effects, while an additional EUR 1,500 per year increased enrolments by almost three percentage points, and by almost five percentage points for enrolment in the first year of undergraduate programmes (Fack & Grenet, 2015)). Herbaut & Geven (2019) conclude that needs-based grants do not systematically increase enrolment rates but only lead to improvements when they provide enough money to cover unmet needs and/or include an early commitment during secondary school. Also, needs-based grants improve the completion rates of disadvantaged students.

Evidence in relation to other demand-side (student financing) supports, such as vouchers, has been scarce and case specific. Agastisti et al. (2008) show that vouchers are similar to universal grants and can lower fees by increasing competition between universities.

Many studies (52 in total) have used experimental (randomised controlled trial) or quasi-experimental research designs (see table 32). However, in terms of different approaches, the number of studies is limited (e.g., in the case of universal grants or performance-based grants), so no generalisations can be made. Nevertheless, it can be concluded that merit-based grants rarely improve the outcomes of disadvantaged students.

Table 32: Evidence related to grants (summary from Herbaut & Geven, 2019)

Type of intervention	Access (29 studies)	Graduation (23studies)
Universal grants	**Positive** (1)	**Positive** (1 and small effect)
Needs-based grants	**Mixed** (14)	**Positive** (12)
Merit-based grants	**Negative** (6)	**Not significant** (4)
Performance-based grants	**Positive** (4)	**Positive** (2)
Loans	**Positive** (2)	**Mixed** (3)
Tax-credit	**Not significant** (2)	**Positive** (1)

Other support measures

Herbaut & Geven (2019) find that outreach policies are broadly effective in increasing access for disadvantaged students when these policies include active counselling, but not when they only provide general information on higher education. Also, Sneyers & De Witte (2017) show that student-faculty mentoring has a significant positive effect on both retention and graduation, indicating that the effect size is bigger than in the case of needs-based grants.

School social mix

There is some evidence (Smyth and McCoy, 2021) that schools can have a bigger effect than student background in channeling young people towards or away from higher education, meaning that school social mix has a stronger effect than socio-economic status (SES). This suggests that socially mixed schools increase the chances of lower SES young people accessing higher education.

Cost-effectiveness of various support measures

Evidence from the US (Hendren & Sprung-Keyser, 2020) shows that child-related investments including college subsidies are cost-effective, indicating that the marginal value of public funds (MVPF), calculated as the ratio of willingness to pay and net government costs, in relation to these policies is very high. Despite the general patterns presented, it can be argued (ibid.) that some policies targeting children yield low MVPFs, for example youth job training programmes and college subsidies when they do not significantly increase attainment.

What is missing

The theoretical literature contains mainly negative evidence on fees, while empirical evidence shows mixed results. Some conclusive evidence related to cost-effectiveness is available in the US, but not in the EU. There are very few Randomised Control Trial (RCT)-type studies. There are few experimental studies on vouchers in the EU or debates over the applications of vouchers as an alternative for universal grants or demand-side alternative to supply-side financing. A few sources can be found (see Harman 1998, Ahonen 1996, Van Ravens 1998, Hodkinson ja Sparks 1995), and some debates related to lifelong learning and its financing.

Cost-effectiveness aspects

Cost-benefit analysis or cost-effectiveness evidence is rare in the EU. An example is Fack and Grenet (2015), which shows that in France the cost-benefit analysis is positive at all levels, but larger for master students than for undergraduate as degree completion is higher at the master level and so it generates higher returns. US-based analysis shows that subsidies to universities and colleges can be highly cost-effective. However, there is no clear analysis on the design of these subsides.

Table 33: Cost-effectiveness of access and persistence policies

Approach	Evidence base	Effectiveness	Costs
Vouchers	Low	Medium	Uncertain
Needs-based grants	High	High	Medium
Performance-based grants	Medium	High	Medium
Outreach policies	Medium	High	High
School social mix	Medium	High	Low

4. Recent education disruptions

4.1. COVID-19 implications on learning outcomes

The COVID-19 pandemic resulted in significant challenges in education investments. Due to the unprecedented school closures, many EU Member States observed a decrease in educational outcomes of their children. For example, evidence from the Flemish Community in Belgium suggests a learning deficit (i.e., lower educational outcomes compared to what students would achieve in 'normal' circumstances) of about half a school year for maths, sciences, native language skills and foreign language skills (Maldonado & De Witte, 2021). Follow-up studies suggest that similar learning deficits do not disappear quickly: one year after the first school closures, Gambi and De Witte (2021) confirmed the earlier findings and observe that the learning deficits for maths and sciences halted, while they further accelerated for native and foreign languages. A similar picture emerges in the Netherlands, where Haelermans et al. (2022) observe an accelerating impact of the school closures on some subjects (maths) while not on other (languages). In Italy, evidence of learning loss emerged early in the pandemic and such losses even related to primary education (see the work of Contini et al., 2021, about maths). A review by Patrinos, Vegas & Carter-Rau (2022) signals that in almost all EU Member States, except for Denmark, educational outcomes decreased after the pandemic (Table 34). Similarly, in a meta-study Hammerstein et al. (2021) observed learning deficits in maths, reading and science compared to earlier cohorts.

Table 34: Overview of learning deficits due to the COVID-19 pandemic in EU Member States

Country	Closure length weeks	Average learning losses (SD)	Source
Poland	20	- 0.3	Jakubowski 2022
Italy	15	- 0.19	Contini et al. 2021
Belgium	9	- 0.18	Maldonado and Witte 2022
The Netherlands	10	- 0.17	Haelermans et al. 2021
Germany	10	- 0.14	Ludewig et al. 2022
Czechia	9	- 0.11	Korbel and Prokop 2021
Spain	12	- 0.05	Arenas and Gortazar 2022
Denmark	8	0.00	Birkelund and Karlson 2021

Source: Patrinos, Vegas and Carter-Rau, 2022

It is clear that education disruptions have affected learning progress. The learning deficits, especially in the medium/long run, are composed of two elements: (i) absolute loss, where students forget what they had learned (as in a 'summer loss'), and (ii) slower learning progress, where a student learns less in a year compared to previous cohorts (King et al., 2022). Although evidence shows significantly reduced learning progress at all income levels, the COVID-19 crisis also increased learning disparities. Students from lower socio-economic background consistently suffered larger losses (Moscoviz & Evans, 2022; Chénier, Maldonado & De Witte 2021).

At a macro-level, the COVID-19 crisis reinforced the existing trends in education systems, related with stagnation of learning (Angrist et al., 2021) and within-country inequalities. Therefore, education systems currently face two challenges. First, they should try to 'build back' the COVID-19 learning deficits. As earlier evidence from long term teacher strikes suggests that learning deficits might accumulate over time, resulting in lower participation in higher education, less higher education success and lower income, significant policy attention should try to avoid this accumulating effect over time. Second, education systems should be reinforced such that they are ready for upcoming pandemics or large-scale issues. A similar 'build better' strategy should focus on all elements of an education system, including infrastructure, accountability, teacher professional development, ICT, etc. without focusing only on the problem of recovering after COVID-19, but also on developing better educational systems for the future (in a continuously changing context).

Digital education equipment

Despite average learning deficits, Hammerstein et al. (2021) observed in a meta-analysis positive learning effects of digital education in maths. With regard to the studies that showed positive effects, Hammerstein et al. (2021) point out that *"interestingly, these were studies that examined software for online learning"*, which could have led to the fact that these were students who might have been familiar with it. This suggests that digital education tools mitigated the impact of crisis on learning.

However, as shown in section 3.3 of this report, the digital equipment in European schools is frequently underdeveloped, or unevenly distributed. This reinforced the learning deficits and inequality during the school closures. For example, in Germany, several surveys consistently confirmed that grammar schools are significantly better equipped than other types of school, particularly primary schools (e.g., Robert Bosch Stiftung, 2021, 2022). In addition, almost 60% of teachers at primary schools, half of those at Haupt-, Real- and Gesamtschulen and one in four at grammar schools (Gymnasium) stated that their school was less well or poorly prepared.[91] Under these conditions, comprehensive distance education is not possible, or only possible to a very limited extent.

During school closures in Ireland, student engagement was better supported when distance teaching methods were more interactive and collaborative, and this was best facilitated in areas of the country where high-speed broadband was widely available. The evidence also shows that schools which used individual student devices in the classroom prior to the pandemic were better equipped to rapidly shift to distance learning in emergency circumstances (Mac Domhnaill, Mohan, and McCoy 2021). Technical support also remains a barrier, with evidence repeatedly highlighting the challenges for school leaders in some sectors in relation to the maintenance and upkeep of technology (Marcus-Quinn, Hourigan and McCoy, 2019).

Therefore, significant policy attention and investments should be made to improve the digital infrastructure in schools. This involves hardware (e.g., computers, connectivity), technical support, and software (e.g., in adaptive learning paths, skill drill exercises). Attention should be given to this issue, given that some recent (pre-COVID-19) assessments demonstrate that ICT usage does not always lead to better learning outcomes (Checchi et al., 2019).

[91] This finding is also confirmed in principle by McElvany et al. (2021) and Klein (2021) in relation to teachers and Wößmann et al. (2021) from the parents' perspective. See also the summarising analysis with additional evidence by Dohmen & Hurrelmann (2021).

The importance of digital competences and teachers' professional development

Having a computer or smartphone is necessary but not a sufficient condition for digital education. The PIAAC data indicate that even in the best performing EU Member States (i.e., Sweden, Finland, and the Netherlands), up to 44% of the adults had medium or high digital literacy in 2012. This suggests that large shares of parents may be digitally illiterate. In addition, limited linguistic competences particularly of parents with migrant background should also be considered, which are also of central importance with regard to the ability to move around or communicate on the internet. The 2018ICILS revealed that in Germany around a third of tested pupils have at best rudimentary digital skills and can only perform simple tasks. These findings also fit with the assessments of teachers and students during the COVID-19 pandemic, which highlights that both the technical equipment of the students and their digital competences are often (very) limited.

These results suggest that countries should include digital skills in their school curriculum and in adult learning. Although this broadening of the curriculum might come at the cost of a deeper curriculum (i.e., more advanced tasks on fundamental aspects), strong digital competences of the population might avoid digital exclusion and foster a knowledge-intensive economy. Enhancing digital skills and competences is also a priority in the framework of the new Digital Education Action Plan 2021-2027, which intends to go beyond the challenges posed by the specific implications created by COVID-19.

Furthermore, in the aftermath of the COVID-19 crisis, a significant investment should be taken to improve the professional development of teachers with respect to ICT. The digital skills of teachers play an important role when it comes to implementing distance and especially digital education. In autumn 2021 (Robert Bosch Stiftung, 2021), 56% of German teachers stated that they needed to improve their own digital skills. The awareness of the need to use digital education formats in the classroom has also risen from two-thirds to a good three-quarters; conversely, however, this means that just under a quarter of teachers are still not prepared to deal with or use them.

As investments in ICT increase, it is necessary to invest in the policy-making capacity of school managers. Before an ICT investment is made, schools should have a solid vision and plan on how to exploit the novel hardware and software. Often, the policy making capacity is too low in schools, resulting in inefficiencies (e.g., schools not using the investments). However, the crisis also made clear that complex education governance might delay the implementation of funding programmes.

Overall, the sphere of professional development, providing teachers with relevant digital competences, is particularly important in light of the European Digital Competence Framework (DigiComp 2.2). For a more detailed analysis, see sections 3.1.4 and 3.2.

Dealing with inequality

Due to the lockdowns, parents were placed under even greater obligation not only to care for their children, but above all to support them in their learning. This is even more relevant for parents of young children than for parents of children of primary and secondary school age. In this context, greater vulnerability emerged among some families, including single parents, parents with a migrant background, educationally disadvantaged parents, families with several children and families receiving social benefits (Geis-Thöne, 2021). Moreover, conditions that make learning difficult (no room of one's own, possibly no desk of one's own, lack of adequate equipment for

digital education) and parents who, due to their own lack of education, can hardly help with learning for school, come together. If this is compounded by a lack of or poor language skills of their own, then both the fundamentally important learning of the native language and communication with the day care centre or school become impossible. Children and young people who live under these circumstances are the group that is also disproportionately affected by the daycare and school closures.

Therefore, significant efforts should be made in evidence-based targeted remedial actions such as tutoring, accelerated schools, or summer schools (see also section 3.4.5). For the latter, Gambi and De Witte (2022) show that in postcode areas with summer schools the test scores of low SES students were significantly more resilient than in postcode areas without summer schools. Similar summer programmes in Germany were positively evaluated by Depping et al. (2021). Even the most recent reports by major consultancy firms call for action in implementing activities to reduce learning inequality within educational systems (see McKinsey & Company, 2022), calling for additional funding specifically devoted to this purpose (including the provision of hardware and software). Given the long-term costs of lower human capital formation, similar remedial actions are clearly cost-effective.

The transition from school to training and the labour market in times of pandemic

Another worrisome impact of the COVID-19 pandemic is situated at the transition from school to training. In Germany, a country with a strong tradition in dual learning, the number of dual training places has fallen by about 10%, while the number of school-based training contracts dropped to a smaller extent (Dohmen, 2022a). This decline in training opportunities has particularly affected youths and young adults with lower secondary school leaving certificates or intermediate secondary school leaving certificates (Dohmen, 2021, 2022a, 2022b). As the successful transition and completion of vocational training is the central prerequisite for a successful start in working life, policy actions should be undertaken to avoid young people becoming 'NEET' (not in employment, education, or training).

4.2. Integration of newly arrived migrant students

Russia's invasion of Ukraine has created the largest refugee population in the EU since World War II, creating an imperative to support the educational and socio-emotional needs of children and young adults impacted. Even before, social and political developments in the last decade have led to changes in patterns of migration within the EU (Eurydice, 2019, p.29). Refugees and asylum seekers, in particular, often experience various kinds of trauma and stress from uncertainty, and in the vast majority of cases their schooling has been halted. They face varying challenges depending on income, family composition, social networks, religious orientation, education, and legal status. When they begin school in the host country, they must quickly learn not only the language of instruction, but also new pedagogical routines and subject matter (Bartlett et al., 2017).

PISA results repeatedly confirm the importance of learning the language of instruction, for academic success, and likely a host of social and emotional outcomes. Across OECD countries, immigrant students[92] who speak the language of instruction

[92] Countries tend to define their immigrant population in different ways. European countries use several different concepts, which include factors like current citizenship, citizenship at birth, country of birth and self-reported ethnicity. When it comes to defining children of immigrants, many longstanding immigration countries consider as children of immigrants all native-born with at least one immigrant parent, or native-born with foreign nationality. Others only consider native-born with two immigrant parents (OECD, 2018). For our purposes, we focus on a diversity of

at home are roughly a half-year of learning behind their non-immigrant peers in mathematics, while immigrant students who do not speak the language of instruction at home are about a year behind. These students are at an even greater disadvantage when it comes to reading (Christensen and Stanat, 2007). Learning from provision and practice across countries, with varying types of experience and insight, can support timely and effective educational provision for migrantstudents and their families.

This section is primarily focused on systems and policies in place to support newly arrived migrant students (NAMS) across EU Member States. By NAMS, we draw on the definition provided by Eurydice who include *'first generation migrant children and young people who, as they enter the formal education system of the host country, may qualify for additional support measures to assist their integration into schools (e.g. preparatory classes, additional classes in the language of schooling, etc.)'* (Eurydice, 2019, p.169). The focus is also primarily on supports in compulsory schooling. A range of additional measures are available across higher education and lifelong learning educational settings, which are beyond the scope of this report.

The European Commission (2013) presents a comparative mapping of a wide range of national policies and measures aimed at placing NAMS in schools and addressing the various issues related to them. It also offers a deeper analysis of some of the key policies that can enable schools to welcome students from diverse linguistic and cultural backgrounds and, crucially, to take into account students' social and emotional needs in order to encourage their learning and development. More recently, they note that factors that are likely to prevent migrant children with limited proficiency in the host language from reaching their potential include insufficient resources and staff competencies; assessment tools and negative perceptions of the abilities of migrant children that results in placing them in lower ability tracks and special education classes; and lack of opportunities to develop their mother tongue competencies to higher levels (European Commission, 2015: 5). Furthermore, a homogeneous teaching workforce, where some members may not be adequately prepared to teach in newly multicultural and plurilingual classrooms, is identified as an additional challenge.

NAMS are identified as a specific category in about half of the education systems in the EU (Meehan et al., 2021, p.3). This partly reflects the historical context, and net immigration is a relatively new phenomenon for some countries (such as Ireland and Portugal), with NAMS comprising the vast majority of children with migrant background attending school (McGinnity et al., 2018, Baganha, Marques & Góis, 2009). Countries vary in the extent to which migrant students are supported under inclusive education discourse and efforts, and such students are often overrepresented in separated, special education schools (Damery and Raziano, 2021). Often this is due to language difficulty which, it is argued, is not a reason to place a child in a special institution (Schauwer et al. 2019:518).

The *Transnational Collaboration on Bullying, Migration and Integration at School Level (TRIBES)* study has been looking at integration at school across 33 countries. One working group has been focusing on the policies and practices put in place for schools to deal with integration of immigrant pupils across six European countries

populations including newly arrived migrants, refugees and immigrant students broadly defined, emanating from the nature of the evidence cited. However, for the most part the discussion centres on newly arrived migrant children and young people, given the particular needs such populations place on host country education systems.

(Norway, Malta, Ireland, Romania, Belgium and Portugal) (tribesproject.com, 2021). As a first step, Meehan et al., (2021) deal with the issue of top-level policy. Identifying what practices schools adopt to help integrate immigrant students, and whether such practices reflect top level policy, is the next step in this project.

Their analysis of educational provision for NAMS is structured under the four thematic areas of linguistic support, academic support, parental involvement/outreach to parents, and intercultural education.

Linguistic support

Across a diversity of evidence and policy reflections, there is a consensus that host language learning is key to academic and social success (Christensen & Stanat, 2007; Gándara & Contreras, 2009; Martin & Suárez-Orozco, 2018; Navarro et al., 2016). Evidence also shows that complete or partial lack of the language of instruction can lead to NAMS being placed into special classes or in a special needs school (Rodriguez-Izquierdo, González Falcon & Permisán, 2019) or *'special classes for migrants'* (Rodríguez-Izquierdo & Darmody, 2019). Researchers have criticised the *'segregating'* nature of this approach (Gibson and Carrasco, 2009; Terrén, 2008), finding that these measures not only do not reach their goal of access to the regular classroom with sufficient linguistic skills, but also impede social interaction between migrant and the indigenous students (Castilla, 2014). For more details about desegregation policies, see section 3.4.2.

Therefore, it is fundamental that schools provide sufficient and timely support for children to learn and master the language of instruction, ideally within an inclusive framework, and teachers receive effective training to be able to teach the host language as a second language (Koehler and Schneider, 2019; Meehan et al., 2021, p.4). Moreover, the Council Recommendation on a comprehensive approach to teaching and learning of languages adopted in 2019[93] stresses that language-awareness in schools could include awareness and understanding of the literacy and multilingual competences of all pupils, including competences in languages that are not taught in the school.

The European Commission (2013) identifies two strategies to engage migrant students in the learning of the language of the local community[94]:

1. Language support separate from mainstream education system (*separate model*)

[93] Council Recommendation of 22 May 2019 on a comprehensive approach to the teaching and learning of languages (europa.eu)

[94] Others (Christensen and Stanat, 2007) have identified a more detailed distinction between:

1. Immersion: These programmes provide no specific language support: students are "immersed" in the language of instruction within mainstream classrooms.
2. Immersion with systematic language support: Students are taught in the mainstream classroom, but they receive specified periods of instruction aimed at increasing proficiency in the language of instruction over a period of time.
3. Immersion with a preparatory phase: Students participate in a preparatory programme before making the transition to mainstream classes.
4. Transitional bilingual: Students initially learn in their native language before teaching gradually shifts to the language of instruction.
5. Maintenance bilingual: Students receive significant amounts of instruction in their native language; programmes aim to develop proficiency both in the native and the second language.

However, specific programmes vary substantially, even among those that may fit into the same programme category. For example, among the two most common approaches (immersion with systematic language support and immersion with a preparatory phase), an explicit curriculum does not always exist. Less than half of the countries offering immersion with systematic language support have an explicit curriculum. The number is even smaller for immersion with a preparatory phase.

2. Language support offered within the mainstream education set-up (*integrated model*).

While the first strategy (separate model) positively supports second language learning and helps children to communicate sooner with their peers, it may hinder peer and social engagement, itself an important factor for language learning (Dávila & Bunar, 2020; Meehan et al., 2021). When language support is provided within mainstream education, NAMS may form part of a culturally diverse class community that generates a stimulating learning environment (Brunello and Paola, 2014), but perhaps at the expense of speed of learning and individual learning needs (Meehan et al., 2021). Overall, there is evidence that the length of time that children without the language of instruction should spend in preparation classes should be limited and should include a transition to immersion with support. It should be longer for older children so that they make the transition once they have a basic competency (European Commission, 2015).

Meehan et al. (2021) find that in most countries studied, language support is a primary target area for policy, although policies vary considerably among them. Both European Commission (2013) strategies to engage migrant students in the learning of the language of the local, language support separate from mainstream education system, and/or language support integrated into mainstream education, are evident in each country (see table 35 below).

Table 35: Top level policies to support migrant students in six European countries

Top level policies in the participating countries – summary of fundings

Thematic Areas	Top-level policies	Belgium	Ireland	Malta	Portugal	Romania	Norway
Language Support	Separate from mainstream education system	X	X	X	X	X	X
	Withing mainstream education systems	X	X	X	X		X
	Support provided to teachers (for teaching the language of instructions)	X	X	X	X		X
	Mother tongue instruction						
Academic Support	Induction programmes specific for NAMS	X		X		X	X
	Targeted support in the form of quotas, scholarships and grants to migrants and schools						
	General support strategies – no specific from NAMS	X	X	X	X	X	
Parental	Providing adequate		X			X	

involvement	information through various communication channels						
	Publications on the school system in the mother tongue of immigrants						
Intercultural education and friendly learning environment	Training of teachers for diversity	X	X	X	X		X
	Integrating cultural diversity in the curriculum	X	X	X	X		X

Source: Meehan et al., 2019, Table 4

In Portugal language support is integrated into the curriculum: when native students are studying Portuguese in the classroom, immigrant students take a dedicated programme, *Portuguese as a Non-native Language*, at the same time in another room. Malta adopts a similar strategy (Migrant Learners Unit, 2020), while the strategy depends on the number of NAMS in the school in the French-speaking Community of Belgium – with *'bridge classes'* formed where there are more than 8 students who learn together (from 1 week to 1 year), before joining a class corresponding to their level. In Norway, the education act allows for slightly different systems in different municipalities, from special introductory schools to introductory classes, to special second language learning lessons parallel to ordinary classes (Meehan, et al., 2021).

Support for the learning of NAMS' mother tongue as a potential asset for learning the host language has also been highlighted as an important aspect of linguistic support. Research repeatedly demonstrates the importance of maintaining the learning of the immigrant students' first language, and knowledge of one's first language can be transferred and help develop corresponding skills in another language (Berasategi et al., 2019; Meehan et al., 2021). While many EU Member States recognise the importance of this, very few provide such supports. However, countries like Ireland have considerably expanded the range of foreign languages available for study at upper secondary level, with terminal secondary examinations now available in 10 curricular languages (French, German, Spanish, Italian, Russian, Lithuanian, Polish, Portuguese, as well as English and Irish).

The provision of teacher support and professional development varies widely within and across countries. In Norway, the responsibility for second language learning is decentralised: access to continuing education and training and extra economic resources for teachers, varies considerably between municipalities and regions (Båtevik et al., 2017; 2019; Vedøy et al., 2017). This is also the case in the French-speaking Community of Belgium, where staff from DASPA[95] schools report a feeling of helplessness in dealing with their situation; they report a lack of financial and human support, proper training, or a systematic approach to the inclusion of migrant populations (Unia, 2018; André, Jacobs & Alarcon-Henriquez, 2018).

[95] System of Reception and Schooling of Newcomer and Assimilated Students.

Overall, the evidence suggests that the most effective professional development will most likely cover implicit and explicit language support. Explicit language support requires that teachers have strong linguistic knowledge, so that they can effectively teach grammatical structures. They must also be aware of the language structures that present the main hurdles in second-language acquisition and how these can be overcome (Christensen & Stanat, 2007).

Academic support

While linguistic supports are considered of primary importance, studies have shown that linguistic support is more effective when combined with other types of academic support within progressive and systematic programmes of instruction that first identify the appropriate level of schooling (Meehan, et al., 2021; Faas et al., 2015; Kitching, 2012; Martin, Fergus, and Noguera, 2010). Effective programmes provide continued transitional supports such as teacher assistants, individual teaching, homework help, tutoring, mentoring, summer programmes or bilingual education (Martin and Suárez-Orozco, 2018). The combination of academic support during classes, after classes and during the holiday period tends to have a positive impact on students' academic and social development (Meehan et al. 2021). More evidence on compensatory education policies can be found in section 3.4.5.

As with language support, induction courses may take place as part of, or separate from, mainstream education. For instance, the French Community of Belgium provides induction courses only for those students in the DASPA scheme. Neither Ireland nor Portugal recognise NAMS as a specific target group. Their *'comprehensive support system[s] [are] intended to respond to the individual needs of all students. In their criteria for student support, they also consider students' additional support needs arising from their migration background – for example, social and emotional support*' (Eurydice, 2019, p.89). Academic supports are often provided through priority education programmes, as presented in section 3.4.4, so NAMS receive targeted support in the form of quotas, scholarships and grants like other students categorised as disadvantaged. As discussed, these policies can lead to greater numbers of NAMS and other disadvantaged students enrolling in such schools over time, with increasing diversity and complexity of need. Overall, a systematic, community supported, and well-resourced strategy is key to programme success (Meehan et al., 2021).

Parental involvement/outreach

The "whole school approach" considers schools, families, communities and authorities as distinct but connected systems, each having a set of relationships and mutual influences that impact the individual. The school is therefore seen as a multidimensional and interactive system that can learn and change, an open learning hub which provides support to its neighbourhood and receives support from the community[96].

In line with this approach, an abundance of evidence shows positive effects of parental involvement on academic achievement, school attendance, social skills and behaviour, wellbeing and educational aspirations (Larivée, Ouédraogo & Fahrni, 2019). For more details, see also section 3.1.5. Good relations between school and family also contribute to the development of social networks and uptake of available resources (Larivée & Larose, 2014), and support a greater sense of belonging. Support to parents of migrant students becomes even more important where parents

[96] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022SC0176&qid=1662631238868&from=EN

lack proficiency in the host language, because they are less likely to get actively involved in family-school connections (Eurydice, 2019). The European Commission advises comprehensive programmes aiming at NAMS should strive to involve their parents (European Commission, 2013).

However, the evidence across countries suggests a lack of policy driven programmes to address the needs of parents of NAMS, either to help them support their children's learning or their children's inclusion (and their own) into the school community. Engagement seems to depend on the awareness, initiative and resources of the local school administrations, leaders and class teachers, rather than top level policies. Overall, opportunities for parental involvement are limited to those for parents of native students, reflecting the unchanged nature of top-level policies in this area since the European Commission study highlighted the gap (2013, p. 70; Meehan et al., 2021). Further, providing information to parents in their own language is important, a practice evident in some countries, like Ireland (European Commission, 2013; Meehan et al., 2021).

Intercultural education

Intercultural education can be *'an education principle, a cross-curricular theme or taught through specific curriculum subjects'* (Eurydice, 2019, p.20). The literature demonstrates how to operationalise the concept of intercultural education in pedagogical practices and educational policies. It implies integrating cultural diversity in the curriculum, teacher training for diversity, improving classroom interaction between native and non-native students, and respect for cultures (Gundara 2000; Portera 2011; Cantle 2013; Catarci and Fiorucci 2016). Most of the countries participating in the Meehan et al. study (2021) offered continuing professional development programmes to support teachers' development, provided either by tertiary education institutions or non-governmental organisations. In only one of the six countries, namely Ireland, are issues related to intercultural education included in teacher competence frameworks for initial teacher education (ITE) (Eurydice, 2019, p.21). The government funded *Development and Intercultural Education* (DICE) project focuses on the development of intercultural education within primary level ITE (DICE, 2020). Ireland also provides training to migrant teachers to attract them into teaching positions, for example through the *Migrant Teacher Bridging Programme* (Marino Institute of Education, 2020). Accreditation of Ukrainian teachers has also been addressed in Ireland, with the Teaching Council finalising a tailored process to support the registration and vetting of qualified Ukrainian teachers[97].

Ireland continues to advance top level policies in this area and Norway has also taken this direction in its most recent policies. The fact that these two countries have the highest GDP per capita of other participating countries is maybe not a coincidence: such policies have a cost. (Meehan et al., 2021).

The benefits of a *'transnational curriculum'* is also noted, one that uses diversity as a learning opportunity, promotes civic engagement as curriculum, as well as a socio-politically relevant pedagogy that gives students tools to analyse social location, their own experiences, and the distinctions between school requirements and authentic learning vis-à-vis their future aspirations (Meehan et al., 2021). Beyond a stimulating and relevant curriculum, NAMS benefit from many supplemental resources (such as

[97] Teachers who do not meet all the registration requirements may be registered subject to conditions. A range of conditions may be attached to a teacher's registration in line with any identified shortfalls. The teacher will be given three years to address these conditions during which time the Council will continue to engage with the teacher, as necessary. See https://www.teachingcouncil.ie/en/news-events/latest-news/2022/tailored-registration-process-for-qualified-ukrainian-teachers.html

after-school programmes, homework help, tutoring, high-stakes test preparation, explicit college-entry information, extra-curricular activities, cultural activities, job shadowing and so forth) to newcomer students to ease their educational transition and improve their outcomes (Martin and Suárez-Orozco, 2018; Mendenhall and Bartlett, 2018; Meehan et al., 2021).

Overall, programmes in three jurisdictions (Australia-Victoria, Canada-British Columbia, and Sweden) have been identified as more successful and have a number of factors in common. First, they have systematic programmes with explicit standards and requirements in place. Second, they have curricula that may be determined at the local level but that are based on centrally developed key curriculum documents, including language development frameworks and progress benchmarks. Third, there are high standards for the programme so students acquire language skills in the context of the mainstream curriculum and can integrate into the appropriate level of instruction. Fourth, they have time-intensive programmes. Fifth, their programmes tend to offer continued support in both primary and lower secondary school. Sixth, their teachers who instruct second-language learners have received specialised training either during their initial studies or through in-service training. Some teachers have completed postgraduate degrees in teaching the language of instruction as a second language. Finally, their teachers of second-language learners tend to cooperate with class teachers to ensure they meet the needs of immigrant students (Christensen and Stanat, 2007).

The evidence also highlights the importance of leadership: school leaders can leverage school communities to promote collective responsibility for NAMS. However, schools often lack the instructional and organisational capacity, that is, the ability to deliver effective instruction and to build teacher motivation and collaboration towards making schools more responsive to newcomers (Lowenhaupt & Reeves, 2015). Given the inequities that exist in schools, relying on individual strategies that focus on either instruction, culture, or professional collaboration in isolation is inadequate: leaders need to understand the ways their work involves all of these dimensions in order to transform education for NAMS (Walter, 2018). Given the growing diversity in EU schools, initial and continuing professional development and school leadership preparation programmes alike would benefit from engaging with a more dynamic view of culture, creating a space to explore opportunities for both students and schools to adapt their respective cultural practices, and thinking critically about assimilation rhetoric and related school policies (Barlett et al., 2017).

Migrant students may have been disproportionately negatively impacted by hybrid and remote learning measures in the context of COVID-19, given poorer home learning resources (Di Pietro et al., 2020). Refugee-background students were disproportionately impacted due to their reliance on additional services provided by schools, including English language and tutorial support and counselling service (Mudwari et al. 2021), with evidence showing greater learning loss (Brown, 2020), although not in all countries (Maldonado and De Witte 2020).

Finally, understanding potential risk and resilience associated with war exposure among NAMS will be particularly important in the current context. Exposure to war and daily acculturative stress take a toll, particularly on immigrant adolescent adjustment (Patel et al., 2017). According to Eurydice (2019), much of the focus of support measures for students is centred on academic needs. Of ten countries studied in-depth, support needs that go beyond the cognitive and address migrant students' emotional and social support needs are highlighted only in Spain (Comunidad Autónoma de Cataluña), and indirectly in Portugal where learning support is provided by multidisciplinary teams that include psychologists, social workers, intercultural mediators and other specialised staff (Eurydice, 2019:22). It will

be important to identify initiatives which have been proven effective, to assist clinicians, educators, and researchers in creating solutions to difficulties in psychosocial adjustment and academic performance (Patel et al., 2017; Koehler & Schneider, 2019). However, further evidence is needed on the potential value of psychological and other therapeutic supports being embedded within school supports, as a way of providing timely, responsive and holistic interventions.

Policy measures on the education of NAMS in EU Member States tend to vary depending on context, yet at the same time exhibit some common features such as an emphasis on host language learning. Language support is the biggest challenge and concern across countries, with language of instruction still the top-level policy priority. This appears to be at the expense of other areas such as outreach to parents. Whereas Ireland is the exception with information produced in some mother tongues, generally, outreach to parents is limited to those for parents of native students (Meehan et al., 2021). In many countries NAMS benefit from universal programmes supporting under-achieving or socio-economically disadvantaged students, rather than specifically targeted programmes. This is in line with earlier European Commission guidance (2013) noting that *'universal and loosely targeted education mechanisms aimed at supporting all underachieving students or immigrant students are often more inclusive and beneficial for NAMS in particular'* (p.5). However, it is difficult to ascertain whether this is by design or default. Are polices deliberately reflective of European Commission advice, or is it simply that NAMS avail of the existing resources in the absence of an alternative? (Meehan, et al., 2021). More broadly, discourse and policy developments around more inclusive school environments would benefit from a greater consideration of the needs of NAMS, particularly those experiencing war.

Empirical research on the causal effects and effectiveness of education policies targeting people with immigrant background is quite limited so far. Early intervention appears to be the most efficient strategy to advance educational outcomes. The returns to public resources may not be immediately visible; they tend to grow over time and may become substantial only over the longer term. This makes education of migrants a social investment case: the expected future returns could well justify public resources devoted to it today (Bonin, 2017).

To conclude, key evidence on policies for the integration of NAMS can be summarised as follows:

- It is difficult to compare the effectiveness of migrant integration policies across countries, given wide variations in immigration scale and historical context, the selectivity of immigration policies and social protection supports in place
- However, it is clear that investments in systematic language support programmes are essential. Such programmes should have explicit frameworks, curriculum and standards for student progress
- In general, a blend of immersion and separation is the best approach. More widely, there needs to be a focus on migrant students within broader inclusive education discourse and efforts
- The need for consistent and responsive professional development supports for teachers meeting the needs of NAMS is also key in ensuring effective educational provision
- School leaders and teachers can frame diversity as a learning opportunity, and schools serving NAMS should use heterogeneous groupings wherein they can use the diversity of students as an educational resource
- Very few studies provide cost-benefit analyses of different integration policies/initiatives, although the evidence does suggest that meeting the

educational *and* social needs of NAMS carries with it strong economic and societal benefits for families and society at large.

A one-size-fits-all approach is unlikely to be effective. In developing their own, context responsive approach, EU Member States should test different approaches and implemented programmes should be further developed through robust evaluation, particularly as needs change over time or in the context of critical events like Russia's invasion of Ukraine.

5. Evaluation of education programmes and interventions

Education policy evaluations aim at rigourously testing the effectiveness (and efficiency) of policies, programmes and practices in the field of education. They represent an important source of critical knowledge and information for improving the learning outcomes, promoting equal access to education and fostering its competitiveness (US Department of Education, 2020). High-quality evaluations support evidence-based decisions making of authorities and practitioners.

In this chapter, we discuss two important aspects of policy evaluation that may help design effective education policies: cost-benefit analysis and impact evaluation analysis.

First consider the cost-benefit analysis. As costs are typically immediate and educational benefits arrive only in the longer term, cost-benefit analysis provides a technique to relate them and to guide public action. The cost-benefit analysis aims at comparing the costs with the monetary value of (almost) all benefits of it. It contrasts to a cost-effectiveness analysis, which related the costs to the key outcome(s) of an intervention (Cellini and Kee, 2015). It is important to take into account the specificity of education policies when performing cost-benefit analysis in this area. Indeed, assessing the costs and benefits of educational interventions is much more complex than an example of a standard project as they involve multiple costs and benefits. If it is difficult to estimate the benefits in monetary terms, cost-effectiveness analysis is an alternative approach. In this case, the consequences of a given policy action are measured by natural/physical units (Phillips, 2009). For example, one may consider the cost of different educational investments for a given increase in educational achievement of children (measured by increases in standardized test scores).

Next, consider the impact evaluation analysis. Rigorous impact evaluations are necessary to assess the effectiveness of educational policies, and the review of existing studies conducted in this report allows us to identify policies with promising effects. Impact evaluations are developing rapidly in many countries, and designing a common framework for policy evaluation could be very useful to increase knowledge about evaluation methods and detect effective policies among EU Member States. Moreover, impact evaluations currently rarely include cost-benefit analysis, while such evaluation is necessary to better assess the cost-effectiveness of the use of public funds and compare the cost-effectiveness of different policy interventions.

The objective of this part of the report is to briefly present different evaluation methods. The methodological aspects and data requirements of cost-benefit analysis are presented in the next subsection. It is followed by a short presentation of the main challenges of a rigorous evaluation and an introduction to the current methods that can be used for evaluation analysis. These methodological aspects include some technical parts, which are illustrated with examples. We conclude this part by some practical considerations for the implementation of evaluation in education.

5.1. Introduction to cost-benefit analysis for education policies

The review of the literature underlying the report revealed that the academic and institutional literature is still relatively scarce when considering a comparison of costs of the different interventions and programmes. The attention of analysts, academics and policy-makers is often concentrated on the effectiveness side (what is the result obtained by the programme or intervention?) but there is much less evidence on the

cost side (how much does it cost achieving that specific result?). Given the limited public resources, focusing on the costs is as important as focusing on effectiveness. This section aims to promote the use of Cost-Benefit Analysis (CBA), which is an instrument for comparing the benefits obtained through a programme or intervention vis-à-vis its costs. CBA compares the advantage(s) deriving from a decision (a programme, policy, or intervention) with the costs that are necessary for implementing the decision itself. This modelling requires the calculation, in monetary terms, of both the advantages ("benefits") and the "costs". The comparison between benefits and costs can be made in monetary terms (net benefits) or as a ratio between benefits and costs (benefit/cost ratio).

$$Net\ Benefit = Benefit(s) - Cost(s) \quad \text{or} \quad BC\ ratio = \frac{Benefit(s)}{Cost(s)}$$

To illustrate the technicalities related to the use of CBA in the context of specific educational policies, programmes or interventions, we refer to a hypothetical application to the case of assessing school closures during the COVID-19 pandemic. The reasons for using this simulated example are three. First, this report is not considering COVID-19 related policies, such that we can deal with a situation that is not specifically related to the discussion covered by our work, and which can be applied to it eventually. Second, this policy has been substantially implemented and very central to the strategies of many countries around the world, including the EU. Third, there are several recent articles or papers that deal (directly or indirectly) with the calculation of benefits and costs for these policies, such as for example Psacharopoulos et al. (2021), Engzell et al. (2021) and Azevedo et al. (2021). At the end of this section, we provide an additional example of cost-benefit application: we compute the costs and benefits of internationalisation in higher education.

Determining benefits in monetary terms

The first methodological challenge for applying CBA to the evaluation of an educational policy or intervention is calculating the benefits' monetary value. Determining the monetary value in this context is difficult because the policy/intervention under scrutiny could not have a direct effect on monetary choices made by individuals and societies, while being more related with the provision of public goods and/or public regulations. In the example chosen in this report, the benefit consists of the reduction in mortality or infection rates due to keeping schools closed.

A first approach for monetising benefits consists of assessing the Willingness to Pay (WTP), where the economic evaluation of a benefit is the area below the demand curve of a given good or service for the quantity being evaluated (think for example of the willingness to pay for schooling in a policy aiming at expanding education opportunities). The citizens rarely reveal their preferences explicitly, especially in areas (like education) where the service is not traded on market. As a consequence, analysts can create surveys to ask them directly about their WTP (for example how much they would like to pay for expanding educational options). The total benefit of the policy or intervention is then calculated as the sum of the WTP (Willingness to Accept - WTA) of all the citizens impacted by the policy. Not all educational policies have features that are adequate for estimating demand curves for a public good/service. Indeed, evaluating the WTP in the case of goods or services that are not traded on a market, such as education, which is largely provided publicly and freely, is particularly difficult. Typically, the direct benefits of educational policies are often expected to be in terms of increase in cognitive (test scores) and non-cognitive outcomes of children. It is not easy to put a monetary value on such gains. In the absence of direct measure of the willingness to pay for such benefits, some studies

focus on the long term monetary gains in terms of higher salary and income from better education outcomes (see Hendren and Sprung-Keyser, 2020).

Moreover, in the case of services such as education, the benefits are not only private, but also have potential additional positive effects on society as a whole. In particular, policies that increase the level of education might have overall positive effects on innovation and productivity. These *"externalities"* are not always taken into account by citizens when taking education decisions. As a result, the social benefit of educational policies may exceed the sum of private benefits. It is necessary to measure the existence of such benefits and estimate their value for society as a whole.

In the hypothetical case of assessing school closures during the COVID-19 pandemic, the monetary values of the benefit(s) could be calculated as the economic value of reducing contagion and of saved lives (some theoretical and methodological discussions about this point are in Pindyck, 2020). Similarly, depending on their personality traits, some students flourished during the pandemic. This resulted in them learning and exploring new subjects (Iterbeke and De Witte, 2021).

These externalities are, however, often not easy to measure, as their effects are not directly taken into account by individuals and markets. A more restrictive but more easily implementable approach consists in taking into account the fiscal externalities generated by a policy, e.g., the additional revenues that a government can collect with better-educated, more productive workforce (see Hendren and Sprung-Keyser, 2020).

Determining and calculating costs

When considering costs in CBA applications, an economic definition is used that refers to the concept of "cost" as the "opportunity cost" of resources utilised for a given intervention, programme or policy. Market prices for the various resources used in the policy or intervention (such as personnel, materials, depreciation, etc.) are the key measures to be used. When prices are not available, the approach can be based on shadow prices (SPs), intended as a proxy for reflecting the opportunity costs. Shadow pricing is the practice of assigning a monetary value to an item, commodity, or service that is not normally exchanged in any marketplace (see also De Rus, 2021 for additional details and suggestions).

On a practical level, costs are evaluated collecting systematic information about different categories. The total cost of a policy/intervention is then considered to be the sum of the various categories of costs, which in the first approximation can be classified in the following: (i) *direct costs*, defined as goods or services associated with the implementation of the policy, (ii) *indirect costs*, i.e. the costs that economic agents (individuals and organisations) incur as an effect of the policy, and (iii) *intangible costs*, which can be defined as individual and/or organisational consequences of the policy for which there is not a directly performed economic evaluation, as for example pain, sufferance and missed opportunities.

The three categories of costs can be described for the hypothetical case used here. Direct costs are those related to the cost of digital equipment, or some teachers or supporting personnel who might lose their job, or the costs of parents who had to stop working to take care of children. In a similar vein, governments devoted significant resources to mitigate the attainment deficits that were caused by the pandemic (De Witte and Smet, 2021). Indirect and intangible costs are the long-term effects of school closures on students, such as the lower academic achievements (the so-called learning losses) and the reduction of future income due to these negative impacts of lower learning opportunities (please note that the latter is the economic measurement of the former). For example, evidence from the Flemish Community of Belgium shows significant attainment deficits immediately after the first wave of the COVID-19

pandemic (Maldonado & De Witte, 2021), with poor resiliency one year later (Gambi and De Witte, 2021). Moreover, the school closures might bring deficits in the socio-emotional and motivational development of the affected students due to the lack of contact with classmates and the psychological strain on families during an extended stay at home (Hanushek and Woessmann, 2020).

After defining the type of costs incurred by a policy, the next step is to collect information about the costs. Practical and operative instructions exist about how to collect cost information, among which we recall here the *"ingredient method"* suggested by Levin & McEwan (2000). The breakdown of costs into "ingredients" allows the identification of their nature, an information that then can be matched with their "categories". A typical classification of costs/ingredients by nature is the following one:

- *Personnel*, the economic value of human resources required for the intervention or policy under scrutiny.
- *Facilities*, in other words the costs of physical spaces required for the policy or intervention (evaluated at the market price).
- *Equipment and materials,* which refer to furnishings, operational voices and all the materials that are required for implementing the policy or intervention.

A remainder category called *other inputs* is often considered*,* where costs for all the other ingredients which cannot be easily classified into the three categories above are included.

Taking time dimension into consideration

When policies, interventions or programmes last for many years, special attention must be paid to determining costs and benefits in a multiyear perspective, by considering the role played by inflation, as well as the necessity to discount future costs (for determining their present value). Operationally, a calculation of the Net Present Value of the programme/intervention must be realised before it is actually implemented. In so doing, costs' projections and estimations from each year must be adjusted for price inflation. In every year, the inflation-adjusted cost expressed in period *t* as considered the one for which the evaluation takes place, can be computed through the following formula, where $Cost_{t+n}$ is the nominal cost in the generic year t+n, k is the discount rate for adjusting the value from *t+n* to *t,* and $Cost_t$ is the inflation-adjusted cost as evaluated in the year t.

$$Cost_t = \frac{Cost_{t+n}}{(1+k)^{t+n}}$$

The same reasoning can be applied straightforwardly to benefits, where the present value (PV) of future benefits is lower than the one apparent from merely considering the nominal value. In direct analogy with the discounting process for costs, the present value of a benefit referred to the year *t+n* ($Benefit_{t+n}$), in the year *t* ($Benefit_t$) is calculated as:

$$Benefit_t = \frac{Benefit_{t+n}}{(1+k)^{t+n}}$$

In the example of assessing school closures during the COVID-19 pandemic chosen for the report, the discount rate k should be calculated formulating hypotheses about the factors affecting the future value of resources in the years after the policy considered, such as inflation, interest rates and students' opportunity costs. In the

case of COVID-19 pandemic, as with many other educational interventions, the benefits should be discounted across the lifetime of the students. The attainment deficits are expected to negatively affect long-run GDP. For example, a learning loss equivalent to one-third of a year of schooling for the current student cohort is estimated to mean 1.5% lower GDP on average for the remainder of the century (Hanushek and Woessmann, 2020).

Another example of cost-benefit analysis: higher education

A second example consists of a cost-benefit analysis in higher education, in particular of the costs and benefits of internationalisation in higher education. De Witte and Soncin (2021) assessed in a detailed way the various costs and benefits of international students on national economies, in the Flemish Community of Belgium. The costs and benefits of internationalisation may be traced back to four categories: (i) resource costs borne by institutions (e.g. public spending for education, scholarships, student support); (ii) administrative costs borne by governments (e.g., social costs for health care); (iii) direct economic benefits (e.g., tuition fee, consumptions, income from visitors); and (iv) external effects (e.g., classroom peer effects, soft diplomatic power, displacement of domestic students). Exploiting various sources of micro-data, De Witte and Soncin (2021) apply the outlined framework to monetise the direct effects. They distinguish between costs and benefits during education, and the costs and benefits after graduation. The latter is highly dependent on the stay-rate of international students.

De Witte and Soncin (2021) estimate the net present value to actualise the yearly difference between benefits (good expenditures, private social contributions, taxation on gross salaries and employer contributions) and costs (income support to the working-age population, family services and pensions). The results show that the long-term benefits outweigh the costs, and corresponds to a present value of EUR 4.2 billion. In other words, the results show net positive benefits that exceed costs by a factor ranging between 2.4 (lower bound) and 3.1 (upper bound) times. The results vary highly with the level of education, as the ratio is the lowest for doctoral students (1.2–1.6) and highest for master students (5.1–6.3).

5.2. Evaluation methods in education

CBA and impact evaluation analysis may be seen as complementary. In a sense, evaluation analysis is a preliminary step for a high-quality CBA. While the CBA is used to assess the overall effectiveness of an intervention, impact evaluation analysis is used to study the impact of a given type of education or policy intervention on some outcome variables. Translating these impacts into costs and benefits is one of the tasks of CBA. Often this requires, as noted in the previous section, finding the monetary terms of the costs and benefits ascertained by evaluation analysis.

There may be many outcome variables of interest, depending on the type of intervention. An example discussed in the report is that of remote teaching. Impact evaluation analysis can be used to rigorously assess the impact of remote teaching on the performance of students exposed to this teaching methodology. Ancillary variables may be: the equality of performance of students; the sociability of students exposed to remote teaching; and so on. Impact evaluation analysis can be used to assess the impact of the same treatment – remote teaching – on a number of outcome variables.

The principle of evaluation analysis and the "gold standard" of randomised experiments

Randomised experiments are often presented as the gold standard in evaluation as they allow for the clear identification of a target and a control group (Duflo et al. 2007). The former is a group exposed to the treatment – remote teaching in the above example - while the latter is the group not exposed to the treatment to whom the target group is compared. In principle, the target and control group should be the same individual undergoing the treatment on one occasion and not undergoing the treatment another time. This would be the case for the physical and natural sciences. However, for the social sciences this is impossible, because the same individual cannot be part of the target and control group at the same time, for obvious reasons. This problem is known as the *"missing data problem"*. To overcome this information problem, social scientists resort to quasi-experiments. This implies finding a control group as similar as possible to the target group except for the fact that they did not undergo the treatment. In the above example, to assess the impact of remote teaching on students' performance and other ancillary variables, we should find a group of students who did not undergo remote teaching, but who have exactly the same characteristics as the target group.

Randomised control trials (RCT) have been developed as a way to test innovative policies by randomly selecting a control and treated group among a target population (see example in the box below). The method has been used extensively to assess the impact of technology in education, and in particular its usefulness to deal with the omnipresent academic diversity in classrooms. RCT are particularly useful to assess the impact of new policies at the classroom level, as different treatment arms can be designed to test different aspects of the policy. However, it is not always possible to perform randomised experiments, especially for large scale policies. In other contexts, researchers have relied on *"quasi natural experiments"*, when the implementation of a policy allows the differentiation of a control and a treatment group due to some specific exogenous criteria (such as age, location, some specific allocation rule, etc.).

An example of randomised experiment in education to test the effectiveness of computer-based learning

Using a computer-based learning environment, Iterbeke, De Witte and Schelfhout (2021) studied the effects of adaptive instruction and elaborated feedback on the learning outcomes of secondary school students in a financial education programme. They randomly assigned schools to four conditions based on a crossing of two factors: the type of instruction (uniform or adaptive) and feedback (verification or elaborated). A total of 1,177 students in 32 schools completed the programme in ability groups in the classroom. The results showed that the programme, on average, enhanced the financial knowledge of students by almost half of a standard deviation. No significant changes in students' financial behaviour were found. Despite the promise of adaptive practices to address the individual needs of students, they observed no additional learning gains associated with adaptive instruction and elaborated feedback.

Main evaluation methods

Different casual inference methodologies have been devised to compare a target and a control group. The most representative methodologies are presented below. More precisely, the quasi-experimental methods reviewed here are matching, regression discontinuity designs and difference-in-differences approaches.

a. Matching approach

A matching approach selects for each treated observation a similar non-treated observation, and consequently, constructs an artificial control and treatment group. Each matched treated subject is assumed to be identical in observed and unobserved ways to its non-treated matched counterpart. It is important to clarify that while the matching approach is able to control for bias which is due to observable differences among the target and control group, it provides no guarantee against omitted heterogeneity which cannot be observed or that is not proxied by observed characteristics. Omitted heterogeneity may include motivation in studying, talent or skills that are not measured in the available data bank.

The matching approach has many different declinations. In the last two decades, matching has become an increasingly popular method in economics in general and in education economics in particular, due to its statistical accuracy and effectiveness, especially in the context of cross-sectional data.

Different statistical matching techniques exist to identify the control group in untreated subjects having observable characteristics most similar to the treated subjects. The most common approach is propensity score matching (PSM) (see Caliendo and Kopeinig, 2008, for a practical guidance). Following Angrist and Pischke (2009), the PSM approach allows for the computing of the so-called Average Treatment Effect on the Treated (ATT). The ATT represents the impact of the programme on the treated in the event of undergoing remote teaching as compared to the counterfactual case where the treated themselves did not participate in the programme. Since case two is impossible to observe, we select a control group with the characteristics most similar to those of the target group. The analysis is done in two steps. At step one, we study the characteristics associated with the target group and then we use these characteristics to calculate a propensity score in the control group that allows us to select a sample in all aspects similar to the target group except they did not receive remote teaching, but “live” teaching.

This allows an assessment of the impact of remote teaching on the performance of students and other ancillary variables of interest, including equality of performance within the class.

Example of matching method

Recalling our previous example of remote teaching, if for some reason the group undergoing remote teaching has higher (non-)cognitive skills than the group undergoing in-person teaching, the impact of remote teaching on the outcome variables would be overestimated. In this case, the higher scores of the outcome variables found for the target group may be attributed to the treatment while, instead, they could be associated with heterogeneity between the two compared groups. Matching is done to ensure that the target and control groups only differ in terms of treatment, with other observed characteristics that affect the outcome variable of an individual (e.g. age, educational background of the individuals and their parents, etc.) being equal (see, among others, Angrist, 1998; Angrist and Pischke, 2009; Cerulli, 2015; Sianesi, 2004).

b. Regression discontinuity design (RDD)

RDD is a quasi-experimental method that exploits a discontuinity in the data. The studied population is divided into a treatment and control group according to wether the participants are above or below a given threshold (cuttoff point). Hence, this

method to identify the average treatment effect on the treated (ATT) is used in particular conditions, namely when there is a cut-off or threshold for instance for participation in a programme. De Paola and Scoppa (2014) provide an example of application of this methodology by studying the impact of compensatory courses for undergraduate students at the University of Calabria. Participants in the programme were selected from among the students who sat a placement test to access the university whose score was below a given threshold. Then the performance of these students is followed over time and compared to that of the students who were not admitted to the compensatory course because they had a slightly better score in the placement test. The assumption behind this method is that participants whose score fell just above or just below the threshold were very similar, as they had almost the same score, and were ex-ante comparable. One can therefore consider that the difference in later educational outcomes of students just below and above the cutoffs can be attributed to the effect of the compensatory course. Comparison of the performance of the target group with that of the control group allows an assessment of the so-called local treatment effect of the programme on the treated. The authors find that the compensatory course improved the performance of participants above the level of the students who did not attend, because they had a slightly better score in the placement test. One shortcoming of this methodology is that comparison is essentially between individuals who are below and above the cut-off point identified to enter the programme, so cannot be taken to measure the overall effect on all participants.

Example of a regression discontinuity design

RDD is widely used in studies examining the impact of class size policy on education outcomes. The positive relationship between smaller classes and students' test scores, for example, does not necessarily imply that the smaller classrooms lead to better performance. The reason might be that high-achievers had been allocated to classes of a smaller size whereas low-achievers had studied in larger classes. To test such relationships by true experiments requires random assignment of students to classes of different sizes, which might not be feasible and rarely happens. Therefore, the studies apply a quasi-experimental approach. The cutoff point is defined by the maximum class size imposed in some countries. Konstantopoulos and Shen (2016) apply the method to estimate the impact of class size on mathematics achievement measured by TIMSS for 4th and 8th graders in Cyprus. They use a cap of 30 students per class. Once the threshold is reached, students are allocated to a new class. Therefore, schools with enrolments just above a multiple of the maximum class size (for example 31 students) have smaller average classes (15.5 students) than the size of the average class (29 students) in schools with enrolments just below it (29 students). The assigned class size is calculated on the basis of the class size cap and school enrolment. This allows for an empirical estimation of its causal effect on student performance around the cutoff points (± 5 students) since the class size is released from the influence of other factors which might affect it. The results from the RDD approach indicate that class size does not affect mathematics performance. However, the alternative estimation provided by the authors shows a beneficial effect of smaller classes in the 4th grade. A main drawback of RDD is the assumption that individuals do not have precise control over the assignment variable so each one would have almost the same probability of receiving the treatment or being denied the treatment (Lee and Lemieux, 2010). In the case of class size, it is assumed that schools do not manipulate enrolment or, for example, more educated parents do not intentionally select schools with smaller classes.

c. Difference-in-differences (DID)

The difference-in-differences method is different from the previous ones in that it identifies the general effect of a treatment comparing individuals in an area where the treatment has happened with another where the treatment did not happen. While the matching approach provides a direct and individual-level performance of a programme, instead the difference-in-differences (DID) approach identifies the overall impact of the programme on a given outcome variable at the aggregate level. The DID methodology requires identifying a time before and after the policy and two groups/areas - the treated and control - to be compared over the same period of time, that is before and after the policy implementation. This is why it is called DID method, because it compares the post/pre-treatment levels of the outcome variables in the two groups/ areas which are compared. Imagine that a training programme is implemented in one region, but not in the nearby region at a given point in time. With DID we can compare the change in employment or unemployment in the two regions after and before the treatment to see whether the regions which experienced the treatment had a larger increase in the outcome variable.

An important assumption of the model is the so-called *"common trend hypothesis",* which assumes that the treated and control groups would have evolved similarly if the policy had not been implemented. Indeed, this assumption is needed for the evolution of the control group to constitute a good counterfactual for what would have happened in the treated group in absence of the policy. In the example above, when comparing treated and control regions, one need to assume that they had the same (macroeconomic) trends over the period when the policy was implemented. Imagine that the region where the programme was not implemented experienced a larger increase in GDP, then in this case, the DID approach would fail to catch the positive impact of the training programme on the outcome variables not because the programme was ineffective, but because the nearby region experienced a much larger increase in GDP. The condition for the DID method to work properly is that the two regions experience the same macroeconomic trends, over the period considered.

Example of difference-in-differences

The DID methodology has been widely used not only for the evaluation of training programmes, but also for education policy, as the following example shows for modular education. Modular education refers to the division of conventional courses into smaller components or modules. Each module enables students to obtain a partial certificate that can be combined into a qualification. Mazrekaj and De Witte (2019) evaluate whether modular education, which is widely used in secondary and tertiary education, has been effective in reducing early school leaving (ESL).

The study exploits a policy change in the Flemish Community of Belgium, which recently introduced modular education for some programmes. Using a difference-in-differences framework with diverse adoption dates per school, the results indicate that modular education may significantly reduce school dropout in vocational education by 2.5 percentage points (from a baseline dropout rate of 28%), with the largest effects on foreign born students. Therefore, modular education is likely to be an effective policy to tackle school dropout and reduce the gap in test scores for disadvantaged students. Additionally, students enrolled in modular education are more likely to be employed and to incur higher earnings on the labour market. The mechanisms that may explain the positive impact of modular education on diploma attainment are increased flexibility in choice of modules, partial certification and goal setting.

Choice of method

The availability of several methods offers the possibility of adapting the evaluation in order to choose the most appropriate technique in a given context, and given the available data.

Overall, although each approach has some shortcomings and limitations, causal inference methods have greatly improved our understanding of the impact of a given treatment on educational outcomes. Often, these different approaches are used in combination as robustness exercise.

Quantitative evaluations should also be complemented by qualitative evaluations in a multidisciplinary approach. For example, qualitative studies are necessary to better understand the context in which policies are implemented, and help define the aspects to be measured and evaluated. Qualitative approaches also allow us to go beyond impact evaluations and analyse the process of implementation of a policy by studying how the different actors participate in the implementation of a policy. These analyses are crucial to better understand the reasons why a policy might be supported and successfully implemented and the mechanisms that may explain why the effectiveness of a given policy might vary across contexts.

Public policy analysis has evolved tremendously over the years. We cannot consider public policy making an act of causal social engineering. It is important to widen the type of knowledge and the type of methods that are considered legitimate. Many existing techniques used to measure stimuli effects are inadequate as a basis for inference under new or dynamic contexts (Cartwright & Hardie, 2012; Hammersley, 2013) as well as in complex policy and practice environments (Nelson & Campbell, 2019). We cannot transfer an effective policy instrument across cultural borders or across time and expect it to work. Furthermore, it is only in very rare instances – often the irrelevant ones – that it is possible to make clear-cut causal conclusions of effects of policy instruments because we can almost never isolate them from the relational and cultural contexts they appear in. Education and training deal with dynamic-adaptive systems – such as humans or societies – which implies that predefined performance indicators at individual or system levels are rarely meaningful instruments to capture the quality impact of investments made.

However, absence of causal mechanisms does not equal absence of systematic rigorous and transparent methods. Qualitative policy analysis, fx, is also systematic and rigorous. And often-times the methods that allow for adjustment, formative evaluation and context-sensitive implementation are the methods that are the most meaningful. Therefore, also in the evaluative phase, there is a need for developmental evaluation or principles-based evaluation that combine rigorous systematic methods with context-sensitivity and flexibility in order to contribute meaningfully with useful knowledge.

Methodical development is needed to provide richer, more context-sensitive knowledge about the relative outcome of different education and training policy initiatives (Bloch et al. 2020). We need to combine a variety of evaluation and assessment instruments including quantitative and qualitative methods to ‘trace’ pathways (Budtz Pedersen et al., 2020) to quality and training to provide policy-makers and education institutions with meaningful added value.

Overall, a multiplicity of concurrent approaches is key to ensure the quality of evaluation analysis as well as to increase the transparency of the overall evaluation processes.

By developing, promoting and implementing rigorous and comprehensive evaluations, educational and training systems will be better equipped to choose from among the

most (cost-)effective policies, and to design innovative policies. This will help develop effective, resilient and equitable policies that promote quality education and training in each EU Member State.

5.3. Practical implementation

The evaluation of educational investments involves a series of key steps with specific challenges for implementation. Cellini and Key (2015) identify key steps for the implementation of cost-benefit analysis (CBA) or cost-effectivenness analysis (CEA):

1. Set the framework for the analysis
2. Decide whose costs and benefits should be recognised
3. Identify and categorise costs and benefits
4. Project costs and benefits over the life of the programme, if applicable
5. Monetise (place a value on) costs
6. Quantify benefits in terms of units of effectiveness (for CEA) or monetise benefits (for CBA)
7. Discount costs and benefits to obtain present values
8. Compute a cost-effectiveness ratio (for CEA) or net present value (for CBA)
9. Perform sensitivity analysis
10. Make a recommendation where appropriate

Since we already discussed technical aspects of the evaluation and the cost-benefit analysis, we want to discuss here some practical choices to be made at key stages of the evaluation process.

Which policies to evaluate?

Before setting the framework for analysis, policymakers might want to have some guidance from existing evidence on promising policies. Existing reports are useful, but it is important for policymakers to have access to the most recent updated information on educational investiments that work in other contexts. This necessitates the development of a specific taskforce to identify, read, summarise and classify existing studies, and make the results widely availble. Some inspiring inititatives are the works made by the Education Endowment Foundation, based in the UK, or "*What works*" in the US, which are available on specific websites.[98] The development of such platforms with a more European-based approach could be very useful at the EU-level. New initiatives also often come from local educational authorities, or non-profit organisations, who develop local solution to problems in the field. Top-down approaches can include the partnership between local institutions, national ministries, and academic experts to implement innovative policy experiments that can be rigorously evaluated. An example of such approach is the *"Fonds d'experimentation pour la jeunesse"* in France, which finances experimental programmes to favour educational success and equality of opportunities through specific calls for tender.

Setting the framework for evaluation

Once the policy to be evaluated has been clearly identified, it is important to set the framework for the analysis. This implies to not only describe and define precisely the policy to be evaluated, but also to define the baseline comparison group. In other

[98] https://educationendowmentfoundation.org.uk/ and https://ies.ed.gov/ncee/WWC

words, as put by Cellini and Key (2015), *"(you need to specify) what you want to know. Are you evaluating one programme or comparing two or more? Does the programme have multiple objectives or just one major focus?"*. It is also important to decide whether cost-benefit analysis (which requires more data to monetise benefits) can be implemented or whether one aims to perform a cost-effectiveness analysis.

Data requirements

Performing CBA and CEA necessitates to gather data on costs and benefits. This implies a specific investment to develop a data infrastructure to define indicators and collect data to construct them.

Different types of data are needed:

- **Detailed and up-to-date data on costs**: this implies to gather specific accounting data on educational systems, such as information on teacher's costs, student's teacher ration, staff costs, costs of construction of educational buildings, costs of equipment and maintenance, etc.
- **Data on benefits**: to evaluate the impact of educational policies, it is very important to define the outcomes to be measured (cognitive/non-cognitive achievements, equity measures, labour market outcomes, etc.) and organise the data collection in a consistent way overtime. For experimental randomised evaluations, which are usually conducted on relatively small samples, specific data collection efforts (with specific survey) can be implemented.
- **Longitudinal data**: to measure the countrywide impact of educational policies when they are implemented at a large scale, educational institutions need to collect data on the evolution of pupils' outcomes overtime on large individual samples. This implies to develop surveys on cognitive and non-cognitive outcomes that can be administered at a large scale, with stable indicators that can be compared overtime. It is also very important to follow the evolution of the same pupils' cohorts overtime to be able to assess educational progress along the way. The development and the storage of such datasets, along with the implementation of secure data access procedures preserving the anonymity of children, will considerably lower the costs of further impact evaluations, which will be able to exploit these existing datasets[99].

Implementation of the evaluation procedure

How to implement the evaluation procedure and ensure its quality? When preparing an evaluation, it is important to determine ex-ante by whom and how it will be evaluated and involve the evaluation team early in the process. Indeed, coordination between all parties in the educational system and the evaluation team is necessary to ensure a good understanding of the challenges of the evaluation and overcome them.

The methods for evaluation that have been described above necessitate specific statistical skills and are usually applied by researchers and scholars in academic institutions. Involving academic teams in the evaluation helps to ensure that the method appropriately chosen for the case at hand and the evaluation is done along

[99] It is important to emphasize the usefulness of testing pupils at key stages of the education process in order to inform educational decision making. As emphasized by Bergbauer, Hanushek, Woessmann (2021), being able to compare and follow students' progress overtime is very useful, independently of the type of accountability measures put in place in each educational system to monitor the different actors. While one may not want to use standardized tests scores may as a measure the performance of specific teachers or schools, having comparable information on student's progress across schools and cohorts help the decision process in other ways than accountability, for programme evaluation and policy formulation.

rigorous academic standards. The choice of academic institutions through public tenders also ensures that research is done independently from the institution at stake. Moreover, it is also important to adopt a plurality of approaches, as each method can have its own limits. In particular, while quantitative approaches can help estimate the overall effect of the policy, qualitative approaches help understand the process and mechanism at play.

Another important requirement to ensure the quality of the evaluation is the commitment to publish the methodology and the results of the evaluation. Publication of the results in academic journals guarantees that the evaluation has been performed according to the highest academic standards. More generally, it is important to make the results available for public debate (Desplatz & Ferracci, 2016) to allow for a wide review of the results.

6. Conclusions

The review of the topics conducted for this report allowed us to identify many **promising education policies that nevertheless deserve further experimentation at EU Member State level**. Experimentation and evaluation are key steps in the design and successful development of policy interventions that are adapted to each specific local, regional or national context.

From a methodological standpoint, the review revealed that **a large body of robust evidence comes from the US and UK, and much less so from EU Member States**. Moreover, the number of evaluations that provide detailed cost-benefit analysis is even more limited.

There is a need for development of the expertise for the evaluation and dissemination of findings at EU level, which could support the design of effective education policies in each Member State. The work done by this group shows the importance of having expertise on the evaluation of education policies within each country.

The experts believe that a culture of evaluation should build on four pillars:

1. **Experimentation.** In order to evaluate the efficiency and effectiveness of education policies, it is important to develop more pilot experiences with rigorous evaluations to obtain causal evidence.
2. **Use of appropriate evaluation methods**. Causal evaluation involves the use of appropriate quantitative methods (randomised control trials, quasi experiments, etc.). Quantitative evaluation can be combined with qualitative analysis to provide a comprehensive analysis of the process of policy implementation.
3. **Development of data collection.** Evaluation requires thinking about the outcomes to be measured (cognitive/non-cognitive outcomes, equity measures, labour market outcomes, etc.). The organisation of a data infrastructure that allows the collection of data on such outcome measures and consent to follow the achievements of cohorts of students over time would allow the possibility of studying the medium and long-term beneficial effects of educational policies.
4. **Assessment of costs and benefits.** Education policies are investments with current costs and long-term benefits. It is therefore necessary to perform cost-benefit analysis of education policies to assess the efficiency of such interventions and choose among different policies to promote sustainable public finances. This also requires the collection of detailed data on costs.

There are gains to be expected from gathering expertise and evidence on policy evaluation at EU level. So we recommend that **the European Commission should support this objective though the following actions**:

- **Promoting the development of expertise on evaluation methods among policy makers** (both causal quantitative analyses and qualitative studies of the process of policy implementation).
- **Disseminating knowledge** about rigorously evaluated policies to develop and share best practice.
- **Making available EU funding for policy experiments** for the evaluation of the development of innovative education policies through EU programmes such as Horizon Europe.

Appendix (bibliography)

Teachers and trainers

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