Effective School Management in the Twin Transition –

Evolution of Teachers Working Time due to the Digital and Green Transitions –

Education Employers Capacity Building Project

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RESEARCH REPORT

Twin time (Part II)

Synchronising Clocks: Managing Educational Time in the Twin Transition

Abstract

This report examines the effects of the twin transition—encompassing both digital and green transitions—on the management of teachers' time in schools across the European Union. The twin transition presents significant challenges for educators, including the slow implementation of new technologies and sustainable practices, conflicting objectives, and the need for substantial skill development. The analysis highlights the importance of strategic time management to balance instructional demands, professional development, and personal well-being, thereby enabling teachers to effectively navigate the complex landscape of digital and environmental education.

CONTENTS

GLOSSARY

ACTECIM	Local players for education in global citizenship
AEFE	Agence de l'enseignement français à l'étranger
AI	artificial intelligence
CEDEFOP	European Centre for the Development of Vocational Training
CEFR	Common European Framework of Reference for languages
CO2	carbon dioxide
Council	Council of the European Union
COVID 19	Coronavirus disease 2019
CPD	Continuing professional development
CT	Computational Thinking
DEAP	Digital Education Action Plan
DELTA	Digital Education: Learning, Teaching and Assessment
DG EAC	Directorate-General of Education, Youth, Sport and Culture
EEA	European Education Area
EC	European Commission
ECTS	European Credit Transfer and Accumulation System
EDEH	European Digital Education Hub
EDUSTA	Academy for Sustainable Future Educators
EFEE	Europen Federation of Education Employers
EES	Education for environmental sustainability
EITA	European Innovative Teaching Award
ENEE	European Expert Network on Economics of Education
EP	European Parliament

ERASMUS	European Action Scheme for the Mobility of University Students
ESD	Education for sustainable development
ESF	European Social Fund
ESMTT	Effective school management in the twin transition
ESSIE2	European Survey of Schools: ICT in Education
ET2020	Education and Training 2020
ETI	Energy Transition Index
EU	European Union
EUCYS	European Union Contest for Young Scientists
GAFAM	Google, Apple, Facebook, Amazon, Microsoft
GEP	Greening Education Partnership
ICT	Information and Communication Technologies
ISCED	International Standard Classification of Education
IT	Information Technology
ITE	Initial Teacher Education
MOOC	Massive open online course
MS	Member States of the European Union
NGEU	Next Generation EU
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
OHTE	Observatory on history teaching in Europe
PISA	Programme for International Student Assessment
PLA	Peer learning activity
RRF	Recovery and Resilience Facility

SAP	Sustainability Accelerator Program
SDG	Sustainable Development Goal
SELFIE	Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies
SOCPL	Social Prerogative and Specific Competencies Lines
STEM	Science, Technology, Engineering, and Mathematics
TAP-TS	Teaching and Learning for Sustainability
TET-SAT	Technology enhanced teaching self- assessment tool
TNC	Transnational companies
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WHO	World Health Organisation
WSA	Whole School Approach

EXECUTIVE SUMMARY

Challenges of teacher work hours amid digital and green transition

The question of **managing the work hours of teachers** is one of the paradoxes of contemporary salary policies: while it is the subject of numerous discussions in the media, meetings, and books, to the point of becoming a political issue, education representing a substantial portion of public expenses, it has not always been managed as with other professions. The actual working hours of teachers remain poorly understood: its content, various aspects, volume, and nature, which have undergone profound changes in recent years, have significantly evolved. This impression has been reinforced by the fact that some occupations are facing tougher digital and green challenges than others: many employees spend more time than teachers behind their computers; digitisation is threatening more other service jobs; some professions are more exposed to climate change.

In reality, in the midst of the twin transition, teachers are facing increased pressure from concerned parents who are keen on their children's professional success. This is partly the result of a greater delegation of responsibilities to schools, including the implementation of key disciplines and values, thereby reducing the time available for the twin transition. Despite the constant number of teaching hours, teachers are now tasked with **additional responsibilities by their administration.** These include, among other things, **personalising teaching to cater to each student's needs (including those with dyslexia), accommodating more students, combating radicalisation, teaching sustainable development, and integrating new technologies**. The subjects taught in schools have also diversified. For instance, history, a subject that requires considerable time, has been identified in a recent European survey as a subject where the primary hindrance to quality teaching is the insufficient time allocated to the curriculum[1]. Teachers are finding it challenging to manage the intensity of their work hours while addressing these myriad challenges.

Recent surveys confirm that the job of headteacher, exposed to numerous demands, and, to a lesser extent, that of teacher, are stressful because of the workload[2]. High workloads and long working hours have been identified as one of the main reasons for teachers leaving the profession[3]. The latter have accepted the multiplication of these challenges, but the accumulation of them, and in particular the lack of recognition and reward for the hours worked, is one of the many causes, though not the only one of a certain exhaustion and dissatisfaction. Currently, a vast majority of EU Member States (21 out of 27) are experiencing a shortage of teachers[4], which is likely to have a greater impact on primary

[1] 58% of respondents to the TES 2023 survey, including 1,772 history teachers in primary and especially secondary education, from 9 EU Member States.
[2] CEDEFOP (2022). Setting Europe on course for a human digital transition: new evidence from Cedefop's second European skills and jobs survey. Luxembourg: Publications Office. Cedefop reference series; No 123
[3] European Commission, Directorate-General for Education, Youth, Sport and Culture, (2023). Education and training monitor 2023: comparative report, Publications Office of the European Union.
[4] European Commission, European Education and Culture Executive Agency, Motiejūnaitė-Schulmeister, A., De Coster, I., Davydovskaia, O.et al., Teachers in Europe – Careers, development and well-being, Birch, P.(editor), Publications Office of the European Union, 2021, https://data.europa.eu/doi/10.2797/997402

education by 2030[5]. Even in Germany, despite demographic decline and above-average salaries, secondary education, especially specialised secondary education, is expected to face severe shortages[6].

Methodology

This research project is part of a call for projects from the Social Prerogative and Specific Competencies Lines (SOCPL), a financial programme by the European Commission, offering €43.9 million in 2020, to bolster European social dialogue as per Articles 154-155 TFEU. It funds initiatives by European social partners to enhance dialogue, develop industrial relations expertise, and facilitate joint actions, excluding national-level capacity-building, which is supported through other funds like ESF/ESF+. Additionally, SOCPL supports training, information sharing, and transnational exchanges of best practices for workers' organisations and relevant company-level dialogue activities.

In February 2021, when it was drawn up, this research-based project comprised four main events, including three peer learning activities and a final conference, aimed at enhancing the understanding of how the concept of teachers' working time had evolved due to the twin transition (digital and green transformations). The project, which exclusively engaged education employers, sought to strengthen their role in social dialogue by equipping them with insights into the management of teachers' working time across Europe. The focus was on preventing teacher overload while ensuring they had adequate time and clear guidelines to impart essential digital and green skills. By identifying best practices and gaining a deeper understanding of teachers' needs, the project aimed to better prepare education employers for discussions with trade unions on this critical issue at both national and European levels.

In line with initial plans, the project began with a survey designed by the expert researcher, with the support of an advisory committee, targeting EFEE members and affiliated schools, to map existing teachers' working time management systems across Europe. This was followed by three peer learning activities held in Ireland (May 2023), Cyprus (October 2023), and Slovenia (April 2024), which showcased good practices and explored regional challenges in managing teachers' working time. The final conference in Brussels (November 2024) will disseminate the findings of the project, along with policy recommendations and guidelines developed by the expert researcher. The research addressed key questions regarding the actual versus perceived working hours of teachers, the evolution of working time concepts during the twin transition, and strategies for more efficient time management in primary and secondary education. The project provided essential data on teachers' working time, addressing discrepancies between statutory and self-perceived hours, contributing to the restructuring of this concept to reduce teacher overload, and enhancing the profession's attractiveness.

[5] World Economic Forum, Future of Jobs Report, 2023.
[6] D. Zorn, « Weniger Geburten, mehr Lehrkräfte », Bertelsmann Stiftung, 2024.

This research fills a gap in both data and method. There is a lack of consistency in data on teachers' time: while the OECD reduces school hours to 60 minutes to allow comparisons, the hours measured may be minimums, averages or maximums. For example, for the Flemish Community of Belgium, school time is reported as a minimum at primary level and as a weighted average at secondary level. Many studies on education and teachers' time do not help much to discern truth, as these sources are affected by certain biases, some of which are difficult to circumvent. They are often based on self-assessment and personal views. It is sometimes difficult to get an idea of the world of work. Surveys - like the one presented at the 1st PLA in Naas - often end up revealing more about the psychology of the employees and respondents than about the reality of working conditions. The Belgian case illustrates the contradictory relationship that employees have with their work: on the one hand, according to some surveys, they claim to be among the most satisfied with their own work and their professional situation[7], while on the other, statistics show a very high number of what they themselves consider to be professional "burn-outs" in recent years. Methodological problems may also lie in defining the educational concepts used by those surveyed/researched. Because the concept of time is so subjective, even the most reliable sources are not always easy to use. It remains very difficult to explain certain results in terms of teachers' management of teaching time, such as the fact that in the OECD's Talis 2018 survey, Japanese teachers were the ones who complained most about wasting time on maintaining order in the classroom, which is very counterintuitive when compared with the evidence of discipline problems in primary/secondary education elsewhere, particularly in the European Union (EU). The same is true for a number of other concepts. One of the central questions of the twin transition is what constitutes basic (Individuals with 'basic' or 'above basic' digital skills in each of the following five dimensions: information, and data literacy, communication and collaboration, problem solving, digital content creation and safety) digital skills: it is not logical to note that, according to Eurostat figures for 2021, teachers would be better equipped with basic IT skills (78.8%) than ICT professionals (76.4%). This is undoubtedly due to the fact that they do not have the same definition and the same level of requirements for the self-assessment of their skills. These perceptions often need to be put into perspective.

This project was initially concerned with a strict **concept of time**, as assigned in the research context. Time is a fairly general concept, but it has several essential components.

- First, time is a measure, a quantity that we try to capture and that digitisation tries to fix, even as it flees and escapes. Time is a concept that is increasingly measured for accounting purposes. There is a certain contradiction between the time it takes to learn, the mistakes that are necessary but waste time, and the imperative of profitability of a time that is not infinite, either in financial terms or in terms of psychological and moral effort.

[7] SD Work survey 2023 for 16011 employees.

- Secondly, time raises the problem of the perception of time. It is essential to reconcile several points of view, since the same lesson is perceived differently by those involved (students, teachers, lecturers), by external professionals (school directors, inspectors) and by the parents' community.
- Finally, time is also a question of scale. Hence the need to consider the lesson, the teaching sequence, the weekly timetable, the monthly or fortnightly activities, the quarterly, six-monthly and annual reviews, and the projects over several years.

To counterbalance the reliance on specific testimonies, the ESMTT research project has sought to broaden both methodologically, by diversifying sources, and geographically. The project is based primarily on the collection of sources through a systematic search for the most relevant and recent sources on management, digital transition, green transition and working time. This is not an exhaustive list, but already a very substantial one of the resources available on the subject[8].

To help resolving this paradox, we need more reliable data based on a mix between

- More than 250 references (**reports, studies, surveys, newspaper articles…)**
- around twenty structured and informal interviews with civil servants, experts, school heads and teachers
- and local observations **(3 peer learning activities (in Ireland in May 2023; in Cyprus in October 2023; in Slovenia in April 2024) and a final conference (in Brussels in November 2024))**.

Picture 1. Introduction to the research project, made at the Education and Training Boards Ireland (ETBI), Naas (IE), 24th May 2023

Source: Doodt Media (2023)

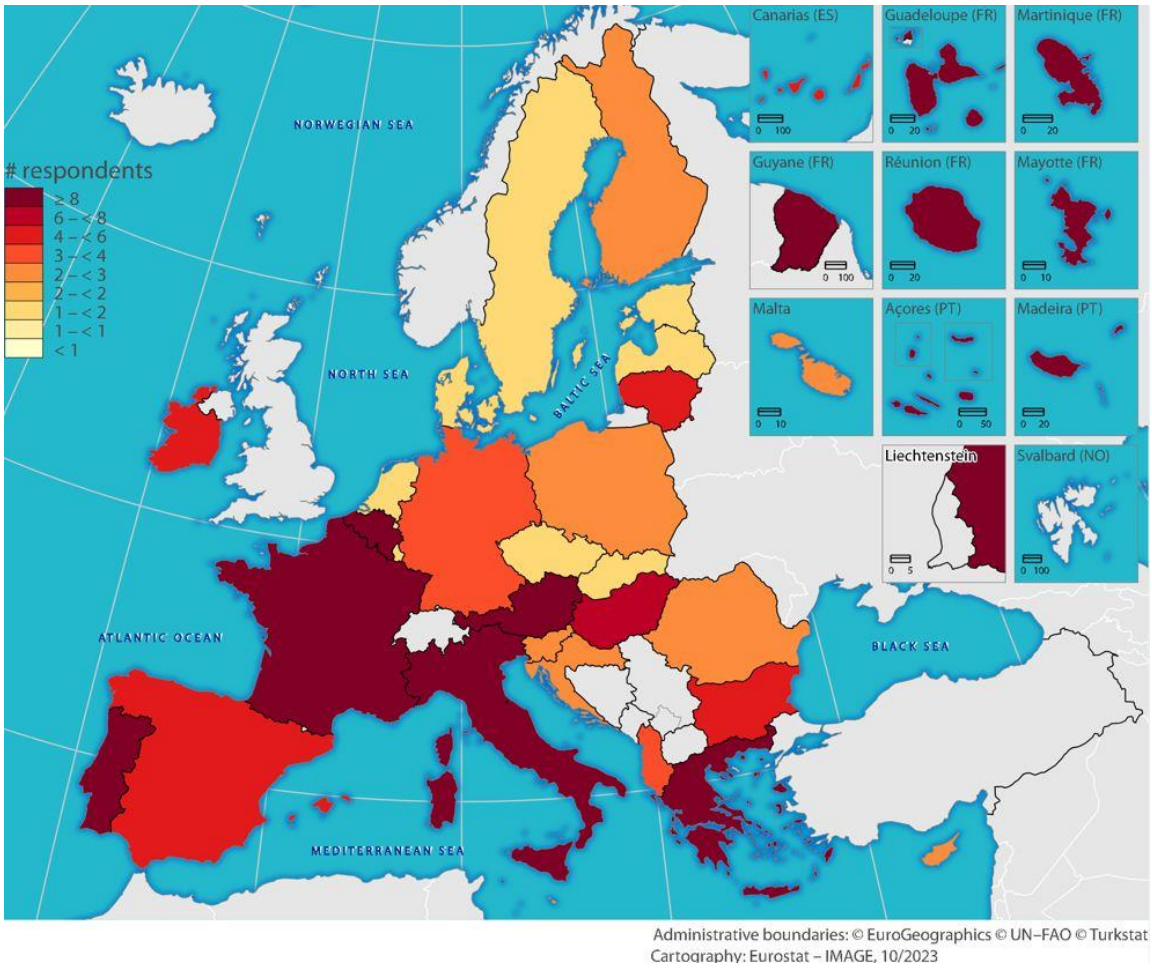
Only a precise quantification of both instructional and leisure time can enable its effective management and the successful implementation of digital and green transition policies. Originally, one of the aims of this project was precisely to

[8] See Annex "References"

gather this information through 3 PLAs (peer learning activities), multiple interviews, participation in several international conferences on education, and specific searches in recent publications on the subject. Despite the difficulty of gathering numerous independent testimonies, given the scope of the project, the background notes and appendices give a flavour of the up to 3,000 establishments surveyed for this purpose.

The purpose of this report was to broaden the scope of research beyond the conventional boundaries of management, working hours, and transitions. Specifically, it aimed to encompass all 27 EU Member States.

Map 1. Map of respondents to the EFEE 2023 European survey on working time management as part of the twin transition (2023)



Source: ESMTT survey (2023)

Both the survey and the study include at least one illustrative example from each state. The report intentionally emphasises a distinctly European perspective, aspects such as the Green Deal, international collaborations, and civic values. In contrast to existing bibliographies, this report drew upon foreign studies—particularly those from Anglo-Saxon, Indian, and Chinese contexts—for comparative analysis.

This report should therefore serve several purposes:

- contribute to scientific research by describing the implementation of this transition and its consequences for the management of teachers' working time;
- provide a repertoire of various examples of inspiring good practices in the context of the open method of coordination;
- and help guide managers by providing some concrete and directly applicable recommendations.

1. BACKGROUND. RECENT DEVELOPMENT ON TEACHERS' TIME

KEY FINDINGS

The concurrent transition towards digitalisation and sustainability in education is a crucial step in adapting teaching practices and preparing students for future job markets. Educators are confronted with considerable challenges, including heightened bureaucratic pressures and performance targets, which have the potential to negatively impact their commitment and well-being. A considerable number of teachers are acquiring digital and green skills as a matter of necessity, rather than as a result of genuine interest.

A widening skills gap is evident in the labour market, particularly in the digital sector, where a significant proportion of the adult population lacks basic digital skills. The demand for specialised skills in fields such as information technology and green jobs is growing, necessitating changes in educational pathways to better prepare students for these careers.

The twin transition in education is impeded by a dearth of resources, including insufficient equipment and inadequate internet access, which constrains digital integration. Overburdened educators are unable to meet the new demands placed upon them, while financial constraints result in overcrowded classrooms. A piecemeal approach across regions gives rise to disparities in quality, while resistance from some educators, coupled with the burden of bureaucratic pressures, serves to further complicate progress. Furthermore, the persistent digital divide serves to exacerbate existing inequalities, thereby impeding the effective implementation of both digital and green transitions.

It is of the utmost importance to integrate digital and sustainable development into educational curricula in order to equip students with the necessary skills to thrive in a competitive global economy.

Today's **management** of educational establishments has left the family domain to take its inspiration from the professional models of the business world, borrowing its vocabulary. "**Managing" seeks to produce predictability and order**, whereas "leading" seeks to produce organisational change. This is particularly the case in large schools, as management becomes increasingly

important as an organisation grows in size and complexity[9]. The management of working time has frequently prioritised an organisational logic over a hierarchical logic. This has sometimes led to insufficient cooperation.

The "twin transition" is a recent term, which is used in the world of business and international institutions to designate the successful completion, more or less synchronously, of the twin digital and green transitions.

Of the two transitions, digitalisation is undoubtedly the best known. **Digitalisation** can be defined as

> *"the ongoing integration of digital technologies and digitised data across the economy and society…Work, its content, its organisation and design, its regulation and protection, are all undergoing change.* ***This also often brings a blurring of boundaries between different dimensions of work and between work and non-work activity****"*[10]

The concept of a green transition has evolved to encompass a broader range of considerations, including an emphasis on environmental, economic, and social dimensions.

1.1. The management of the twin transition, an economic concept transposed to the world of education

1.1.1 The twin transition, a concept borrowed from the business sector

The vast majority of teacher studies just focus on teachers alone, as the profession is specific and difficult to compare to others, especially in terms of working time. It is essential to adopt a more comprehensive approach to analysing the implications of the twin transition in order to gain a deeper understanding of the specific challenges facing teachers in terms of time management.

The "twin transition" and its implementation apply first to the business sector, and a significant part of the twin transition has already taken place. Employees use more **digital technologies**, **defined here mainly as the new artefacts, tools and applications to treat information, such as hardware (robotics, sensors) and software (internet of things, clouds, big data, AI, augmented reality) services[11], but also the technological productions and the social interactions**. For instance, workers spend 57 percent of their working time "communicating". That is two working days obliterated. The heaviest email users (top 25%) spend 8.8 hours a week on email, and the heaviest meeting users (top 25%) spend 7.5 hours a week in meetings[12]. In comparison, teachers have hitherto spent less time on these tasks, but are also affected by these macrostructural trends, adding to their teaching hours.

As to digitisation, companies have made huge productivity gains. Higher degrees of digitalisation increase managers' propensities to allow employees to work

[9] Kotter, J. P. (1990) quoted from Yukl (2013). See Bunescu (2023).
[10] Eurofund, European Foundation for the Improvement of Living and Working Conditions (2023); S. Brennen and D. Kreiss, "Digitalization", in K. Bruhn Jensen, *The international encyclopedia of communication theory and philosophy,* Chichester, Wiley, 2016.
[11] Selwyn (2021)
[12] According to a study based on analysis of "intentional actions" within the Microsoft 365 ecosystem, *2023 Work trend index. Will AI fix work,* 2023 https://assets.ctfassets.net/y8fb0rhks3b3/5eyZc6gDu1bzftdY6w3ZVV/1dad94a24aae170d5954374fb1719092/WTI_Will_AI_Fix_Work_050923.pdf

autonomously[13]. The resultant increases in self-leadership and flexibility have been in turn linked to higher worker motivation, engagement, and productivity[14]. Finally, technology can enable the analysis of data to improve work organisation and workflow[15].

The JRC (Joint Research Centre) has identified **several challenges** for the implementation of the twin transition in general, covering **social, technological, environmental and economic aspects**. On the social side, these include tackling energy poverty, ensuring equitable green subsidies, promoting environmental urgency, reconciling digitalisation and privacy, and overcoming resistance to change. Technological challenges include bridging the digital divide, promoting innovation in rural areas and among SMEs, managing obsolete technologies and minimising the environmental impact of digital solutions. Environmental challenges include managing the environmental footprint of digital technologies, ensuring equipment reliability, reducing carbon emissions while maintaining economic viability, and creating adequate infrastructure. Economically, it is a matter of removing barriers to market entry for small players, supporting adaptation to new technologies, managing investment costs and ensuring fair allocation of public resources. Addressing these challenges requires a holistic approach that fosters innovation and social acceptance[16].

To overcome the difficulties encountered, a number of inspiring solutions have been identified. Scientific works focus on the drivers that influence twin transition and its economic effects, such as sensing and learning skills, and the development of these skills could enable businesses to capitalise on the potential of digital transformation [17]. There is nothing mechanical about this twin transition, which is a matter of management.

> *"A successful twin transition requires dedicated attention and efforts on three levels: Envisioning the transformation at the strategic level, enabling the organization to execute it, and engaging and empowering people of the organization to contribute"*[18]

To assist with the implementation of the twin transition, three distinct strategies for managers utilising digital capabilities have been identified in the business sector: to measure (e.g. observing user habits), to optimise (e.g. improving the timetable), and to reinvent (e.g. online business). There are two concrete ways in which both components of the twin transitions are aligned: first, to reduce energy consumption, data volumes and associated emissions, and to make the use of

[13] Eurofound and Cedefop, *European Company Survey 2019: Workplace practices unlocking employee potential*, Publications Office of the European Union, Luxembourg, 2020; Eurofound, Digitisation in the workplace. Publications Office of the European Union, Luxembourg, 2021, https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef21001en.pdf

[14] T. Galanti, G. Guidett, E. Mazzei, S. Zappalà, F. Toscano, "Work from home during the COVID-19 outbreak: The impact on employees' remote work productivity, engagement, and stress", *Journal of occupational and environmental medicine*, 63(7), e426, 2021.

[15] Eurofound, The digital age: Implications of automation, digitisation and platforms for work and employment, Publications Office of the European Union, Luxembourg, 2021
https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef21007en.pdf

[16] Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M. and Scapolo, F., Towards a green and digital future, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/977331, JRC129319

[17] M. Matarazzo et alii, "Digital Transformation and Customer Value Creation in Made in Italy SMEs: A Dynamic Capabilities Perspective". J. Bus. Res. 2021, 123, 642–656, mentioned by S. Korucuk, "Assessing Green Approaches and Digital Marketing Strategies for Twin Transition via Fermatean Fuzzy SWARA-COPRAS", *Axioms*, 2022, 11, 709.

[18] The Conference Board, Digital for Green Conference, 2023

digital technology itself more environmentally friendly. Secondly, to use digital technology to develop green computing technologies, notably by improving infrastructure. These strategies can serve as a pioneering model for education managers

The impact of the twin transition goes beyond these technical specialties. As far as digital transition is concerned, EU social partners have identified **four impacted areas**: work organisation; work content & skills; working conditions and work relations[19]. A majority of digital jobs are affected by digitalisation; to a lesser, but ever greater extent, the green transition is expected to affect 35% to 40% of all jobs. The social partners have provided a framework for this request, particularly in terms of digital technology. The cross-sectoral social agreements emphasise the need for adjustments in the educational systems to better address the new challenges of digitalisation. Two key cross-sectoral social agreements have been signed on the issue of digitalisation: **a framework agreement on telework (2002) and on digitalisation (2022)**. The latter addresses 4 key challenges: the training and up-skilling of the workforce ii) exploring modalities of connecting and disconnecting, building respect for rules governing working time (including teleworking) and preventing isolation at work; iii) guaranteeing that humans are in control of the development and applications of artificial intelligence (AI); and iv) fostering the respect of human dignity with regard to worker surveillance, including the handling of worker-related data and the right to privacy[20]. Where possible, this training must take place during working hours – otherwise, appropriate compensation must be arranged. The organisation objectives must be arranged so that their achievement does not require out of hours connection. Employers and workers must be provided with guidance on respecting working time rules, the risks of being overly connected, and how to properly use digital tools. A no-blame company culture should be supported to prevent retribution against workers who are not available outside their working hours. Ensuring AI systems are deployed in ways that improve human involvement and capacities at work. Ensuring that workers' representatives are able to address issues related to data protection and surveillance. However, there is no such cross-industry social agreement on the green transition at EU level

This twin transition has manifold implications for the labour market, necessitating **new skills** that have yet to be fulfilled, thereby widening the skills gap. Europe's needs are particularly great in the digital sector, with a large number of jobs on the line, compared with green jobs. In the digital domain, half of the adult population needs more skills, as it is unable to perform nearly 90% of jobs that require basic digital skills[21]. Certain new professions demand even more specific skills. This is particularly evident in the context of Information Technology (IT) professions, such as IT specialists, data analysts, network managers, and cybersecurity managers, as well as in the field of energy transition involving engineers, chemists, and electricians. The EU has a great need for IT specialists

[19]European Social Partners Framework Agreement on Digitalisation, https://www.etuc.org/system/files/document/file2020-06/Final%2022%2006%2020_Agreement%20on%20Digitalisation%202020.pdf

[20] J. Bednorz et alii, *Unionisation and the twin transition, Good practices in collective action and employee involvement*, EPRS, September 2022.

[21] CEDEFOP, ESJS, 2021

(twenty million by 2030). This is already an issue today: In 2018, around 34% of eighth graders were rated as underperforming in digital skills[22]. By 2030, 6.2 million new STEM jobs are expected to go unfilled worldwide and only 2% of graduates will have the skills to fill them. At EU level, eleven million new green jobs could be created. One million of these would be in the bioeconomy. Hence, the significance of existing academic pathways, series, and options that guide students towards a variety of future-oriented professions, including those in information technology and the energy transition sector, and the crucial need for the training of specialised teachers.

In this way, the business world has gradually been passing on training requests to the players involved and insisting that the **training be provided upstream by the education sectors**, without the employer having to pay. As a consequence, **the education job market itself is more affected** by the digitisation of processes through AI-related technologies, cloud computing and communication of digital information and by the green transition.

1.1.2 The peculiarities of the implementation of the twin transition at school

The twin transition has already impacted many school heads, in particular in the way they deal with teachers' time. The teaching profession displays a distinctive set of historical and contemporary characteristics that present a challenge to the straightforward transposition of the entrepreneurial economic model, let alone the economic philosophy that underlies the twin transition in other sectors. Administrative adjustments, like the setting of performance benchmarks or the growing demands on workload, might be gradually affecting teachers' commitment. When educational institutions emphasise management practices, it can occasionally lead to a decline in morale and motivation[23]. Besides, algorithmic management changes the temporality[24] of work and can degrade workers' well-being. Moreover, digitalisation tends to fragment. Some OECD educational time international studies, in search for more efficiency, try to determine the share of real teaching within an hour. The capacity of a teacher to keep order is still considered as an individual skill. This proves to be all the harder with the green transition. Teaching is not just about delivering a content but about educating, especially for sustainable development and the results depend more on time spent by the entire community.

Teachers have also been affected by the twin transition. By its very nature, the education sector is not the most exposed to the twin transition, namely initial and general education – with the notable exception of technical and vocational training[25]. The key players in the system have developed their digital and green

[22] J. Ainley et alii, Preparing for Life in a Digital World: International Computer and Information Literacy Study 2018 International Report, Amsterdam: IEA, 2019.
[23] as shown in England and Wales, for instance, by B. Skinner, G. Leavey & D. Rothi, "Managerialism and teacher professional identity: impact on well-being among teachers in the UK", *Educational Review*, January 2019, mentioned by P. Kelly, Teacher recruitment, retention and motivation in Europe, European Education Policy Network, 2018.
[24] Piasna, Agnieszka, Algorithms of Time: How Algorithmic Management Changes the Temporalities of Work and Prospects for Working Time Reduction (2023). Cambridge Journal of Economics (forthcoming), Available at SSRN: https://ssrn.com/abstract=4361557
[25] R. Arnold et alii, *Twin Skills for the Twin Transition: Defining Green & Digital Skills and Jobs*, 2023, AE4RIA, ATHENA Research Centre, Sustainable Development Unit.

skills out of necessity rather than conviction. Most teachers feel less threatened by digitalisation than other professions. The possibility of implementing green or digital projects with younger generations can be stimulating and enriching for teachers, yet the prospects of a direct impact from this implementation remain distant. Teachers, for instance, have not benefited from the immediate advantages of teleworking, particularly since 2020, when homeworking was introduced as an additional, rather than a replacement, for their usual teaching hours.

In education and training, the digital transition refers to the process of transforming systems towards digital learning (access, content, pedagogical methods, infrastructures and technologies, management, monitoring and assessment of learners). Digital transformation in education and training enhances learning by expanding resources and making education more accessible through mobile devices and web applications. It allows for effective online course management and learner progress monitoring. However, this shift demands innovation in teaching methods, high-quality and user-friendly content, secure platforms, adequate infrastructure, and comprehensive digital capacity planning to ensure privacy, connectivity, and the necessary digital tools are in place[26]. In terms of continuous training and promotion of knowledge, the digitisation of education, although not a novel concept, has experienced a significant acceleration, particularly in the wake of the COVID-19 pandemic[27]. Technological innovations such as smart devices, the Internet of Things (IoT), artificial intelligence (AI), augmented reality (AR), virtual reality (VR)[28], blockchain have sparked much discussion about their role in teaching and learning. Given the increasingly complex and competitive educational context, including digital and green skills, **teachers' skills are now much more numerous and diverse** than in the past.

Unfortunately, the profession has not gained in prestige over time. In some respects, it has even lost recognition, as seen in salaries, where teachers earn around 11% less than in comparable roles, as recalled at the 3rd PLA in Ljubljana. The upscaling of skills has not translated into improved well-being at work, creating an impression of overload. Ultimately, those most skilled in a particular area, such as mathematics teachers with computer skills, may seek professions where these same competencies are much more highly valued (in roles involving planning, analysis, evaluation, and communication), whereas they are not always appropriately utilised in the school environment. As the profession broadens, teachers are taking on diverse tasks, which may result in a shift from mastery in specific areas to a more well-rounded, yet generalised, set of skills. One of the challenges for the school is to make the twin transition an added value not only for the educational institution but also for the teaching profession. **Far from**

[26] Cedefop (2024). Terminology of European education and training policy. Luxembourg: Publications Office. Cedefop reference series; No 124. http://dx.doi.org/10.2801/991753

[27] M. Mandelli et alii, "The Socio-Ecological Dimension of the EU Recovery", *Eurosocial collection*, #24, 2021.

[28] Gaol, F. L., & Prasolova-Førland, E. (2022). Special section editorial: The frontiers of augmented and mixed reality in all levels of education. Education and Information Technologies, 27(1), 611-623.

complicating matters, the twin transition could actually provide the tools and strategies needed to resolve their challenges.

1.2. Building coherence between the climate and digital agendas of the Member States

1.2.1. What Sets the EU Apart: A brief Comparative Analysis of the Twin Transition

Over the past four decades, global education systems have experienced significant transformations in the digital and sustainable realms. While the EU has not excelled in the digital domain, with the Lisbon Strategy in particular a relative failure and only a few Member States at the forefront, it has made notable progress in climate policy. During the 1990s and 2000s, European climate ambitions served as a key comparative advantage and a distinctive feature of the Union's policies, before being reaffirmed through the Green Deal.

Nevertheless, these endeavours, which extend beyond mere communication, must not obscure the existence of ambitious global policies developed in this domain at the global level. The UN has long been at the vanguard of the implementation of ambitious policies. Despite the numerous challenges, particularly in terms of financial resources in developing countries and also in terms of culture and political choice, there is a global awareness among governments of the necessity to implement policies for digital development and sustainable development. The participants in the various networks of UNESCO programme schools demonstrate a remarkable diversity of initiative. The PLA in Larnaca shed light on the multifaceted nature of initiatives at Salwan School in Delhi (India). By drawing upon an analysis of local data, the school has initiated a series of long-term projects, thereby reinforcing its ties with local stakeholders, including hospitals, from a social standpoint. Teachers have demanding schedules. They have participated in ongoing training programmes to enhance their digital skills. Additionally, environmental education encompasses tangible initiatives, such as river cleanup campaigns and anti-plastic measures, particularly focused on raising awareness about the impact of plastics on marine ecosystems[29].

This prompts the question of what distinguishes these policies at European level. Several features merit particular attention.

- First, there are older school traditions.
- Secondly, there are more developed cooperation programmes, such as Erasmus and twinning.
- Thirdly, there is the geographical specificity of the European area as a framework for reflection and action.
    - Fourthly, there is a desire to combine the ecological and digital transitions in a more closely integrated manner, in a sober, ethical and responsible way.

[29] Interview with Rashi Oberoi, Head of Primary Salwan Public School, Larnaca, 16 October 2023

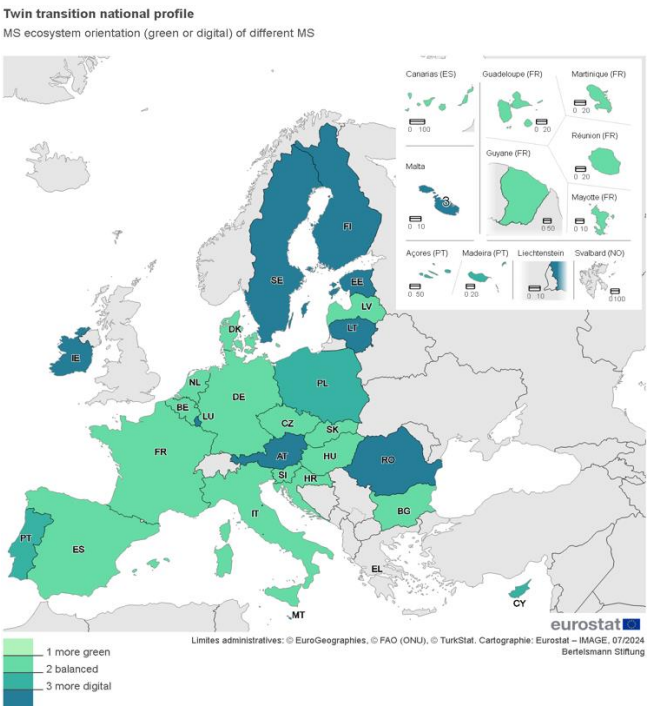
1.2.2 An uneven and dispersed implementation in the Member States of the EU

The question therefore arises as to the extent to which the twin transition applies to education and training. The world of education is affected in two ways, not only because it has to pass on the skills of the future, but also because teachers themselves are affected, as are other sectors.

Since education remains largely a national competence, responsibility for implementing the twin transition lies with the Member States. The twin transition has been addressed predominantly in a fragmented manner. In recent years, **digitalisation** has been the field that has advanced most rapidly and conspicuously in the EU's classrooms. Consequently, in Germany, for instance, educators deem it to be the dimension that has undergone the most significant transformation, surpassing all others[30]. Following the issue of chronic understaffing, digitalisation is regarded as an essential prerequisite for academic success, particularly within high schools and vocational institutes. This is less the case of the green transition.

Regionally, the dynamics present a contrasting scenario: the green transition is more likely to be driven by the regions. In recent years, studies on the twin transition have advocated for a differentiated regional approach to European regions, revealing that the educational environment varies in its capacity to implement specific aspects.

Map 2. Twin transition national profile



Source: Bertelsmann Stiftung (2024, simplified)[31]

[30] 70% of teachers consider that digitalization is the most developed field at school. Robert Bosch Foundation, *German Schoolbarometer*, November 2022.

[31] J. Bachtrölger-Unger et alii, *Technological capabilities and the twin transition in Europe. Opportunities for regional collaboration and economic cohesion*, Bertelsmann Stiftung, 2023.

The predominance of the green dimension of the transition in some regions can have different interpretations: either the difference may be the result of a significant prioritisation of investments in the green sector, which has been promoted by many regions, or by underinvestment in the digital sector. Schools operate in different and unbalanced environments, a context in which schools must fit in. A number of surveys, including the ESMTT survey, highlight a contrast between countries in the Mediterranean and those in the Baltic region. Southern countries tend to prioritise sustainability, while some northern countries place greater emphasis on the digital aspects of the transition.

In response to the COVID-19 pandemic, an effort has been made by the 27 Member States, and the national Recovery and Resilience Facility (RRF) plans allocated a significant portion of funds towards the twin transition, exceeding the recommendations set forth by the European Commission (EC). The distribution of these funds was tilted towards the green transition (40%) and digital transformation (26%), primarily for the private sector. However, the implementation of these ambitious plans has been hampered by several factors, including sometimes a dearth of sufficient project proposals[32]. At the regional level, there is a disparity in the readiness of the territories of the EU to fully embrace the twin transition in the central and western regions of the EU[33]. Some regions are well-prepared to support these initiatives, whereas others have lagged behind, demanding targeted intervention and tailored guidance. Among the diverse projects under the twin transition, education has received a disproportionately small allocation of funds for green transition investments, despite its crucial role in fostering environmental awareness and promoting sustainable practices. Conversely, education ranks second for digital transition investments, reflecting the recognition of its importance in shaping the digital future. However, the allocation of funds for schools remains inadequate and unbalanced, necessitating a more equitable distribution to ensure that all educational institutions have the resources they need to effectively integrate digital technologies and contribute to the twin transition. A notable exception is the Swedish government, which has demonstrated a commitment to a more integrated approach till 2023[34]. This should be an example of a strategic approach to digital education and skills, which will require coordination across government and the engagement of a wide range of stakeholders.

However, public spending has continued to be limited and green and sustainable school projects cannot depend solely on national or regional public funding. Even in the United States, spending in education technology (hardware, software, technology enabled service) represent only 3.6% of education spending compared to others (labour, physical equipment, real estate…)[35]. If European schools want to fund their twin projects, it seems that it must seek funding by strengthening

[32] B. Julien-Vauzelle, « Plan de relance : 10 points sur les progrès de NextGenerationEU », *Le Grand Continent*, 25 octobre 2023
[33] F. Cappellano et alii, "Are EU regions ready to tackle climate change?" - *JRC Working Papers on Territorial Modelling and Analysis*, No. 10/2023, European Commission, Seville, 2023, JRC135523.
[34] E. Verdolini, Interlinkages between the just ecological transition and the digital transformation, ETUI working paper, 2023, p.7.
[35] HolonIQ, quoted by Pictet Wealth Management

ties with businesses, as in some European regions (Ireland), which is sometimes discussed for pedagogical and ethical reasons.

1.2.3 The support of the twin transition by the EU in the new European Education Area

Because of its technical nature, the term "twin transition" may seem to be specific to Brussels and the EU, or even to the developed countries that have the means and the will to implement it in schools and on the labour market. A global overview shows that this is not the case. Despite economic disparities, many countries around the world have also recently taken the step to implement digital and sustainable development policies, even with limited resources. The governments have become aware that these are cross-cutting issues that are essential in a globalised and competitive economy, and many schools can identify with the modernity and playfulness of the digital age, or the beauty and unsurpassed understanding of our relationship with nature. At international conferences, these themes have become must-haves for educational curricula. Many international institutions have recently underlined the importance of the twin transition and some of them have played a key role in promoting and harmonising these policies around the world. Governments have introduced curricula that take this into account by developing documents and setting up school networks. On the one hand, for more than thirty years, the UN has seen education as a driving force for change. On the other hand, from 2005 to 2014, its education arm, UNESCO, led a United Nations Decade of Education for Sustainable Development, producing a number of texts that emphasised the importance of interdisciplinarity, among other things. In **2015**, the UN has set clear targets for green projects through the development of the **Sustainable Development Goals (SDG)**, which sets out the objectives of the organisation in terms of quality education and includes sub-sections on digital technology. At UNESCO, the 175 members of the Global Education Coalition (GEC) constitute a dynamic global platform for multi-stakeholder cooperation facilitating the transformation of education in order to achieve digital transformation and sustainable progress. A number of global and local players have a stake in these transition policies. These objectives are ambitious and often remain a distant goal for many of those involved in education. Furthermore, their implementation is slow and incomplete at the local level, as assessed by UNESCO. Only 17% of the measurable targets for the SDGs are on track to be achieved by the end of this decade[36]. It is notable that developing and emerging countries have set an example in the **concrete, action-oriented** dimension of sustainable education. This is particularly evident in Latin America (Peru, Mexico, Costa Rica, Colombia), where there is a strong commitment to developing a culture of action and involvement[37]. These efforts are global, which is why EFEE has included the Indian Salwan State Primary School in the research project at the PLA, which took place in October 2023 in Larnaca. The project highlighted the type of initiatives taken by a network of schools in Delhi, with a particular focus on the diversity and social and community nature of this teaching.

[36] United Nations Department of Economic and Social Affairs (2024), The Sustainable Development Goals Report 2024, United Nations
[37] OECD (2016-2024), Education at a glance, Paris, Éditions OECD.

While there is a generalisation of the implementation of the green transition in educational policies at the global scale, **the EU has a specific approach** to this issue in terms of policy, philosophy (an approach that is concerned with preserving digital rights), will (to remain a leader in environmental matters), instruments (the habit of cooperation between Member States, specific programmes and funding) and territories (particularly affected by global warming). Officially, in the EU, these transitions are not new and have been gradually recognised since the 1980s, but due to numerous obstacles, their recognition and the implementation of appropriate policies are much more recent. The digital and green transition – the **'twin transition'** – has taken its place at the top of the EU political agenda, especially since the launch of the European Green Deal in 2019. The EC has shown its commitment that the digital and green transformation has to go hand-in-hand'[38]. "Green" and "digital" appear more together in policy documents, to characterise the twin transitions which "hold the key to Europe's future resilience and prosperity". Early 2020, the EU Commission added that this twin transition should be "just"[39], leaving no one behind, a dimension which is assessed through the Just Transition Mechanism of the 2020 Sustainable Europe Investment Plan. The notion of justice is understood here in fairly broad terms, recalling the social dimension of sustainable development. In March 2021, 84 European companies signed a declaration to support the EU's digital and green transformation, based on the conclusions of the December 2020 EU Council, committing to invest in greener digital technologies, develop environmental impact assessment tools and create sector-specific green transformation guidelines.

To implement these transitions and to remedy skills shortages in the EU, the EC has been encouraging the acquisition of new competences for a long time now, setting itself precise quantitative targets in terms of skills. In 2016, its communication 'Improving and Modernising Education' promised to intensify work on identifying challenges and implementing best practices for digital education and the **EU Skills Agenda** was published, presenting twelve actions for redefining the key competences for lifelong learning. Action 6 presents concrete actions to support the acquisition of skills for the green transition, including digital and green skills. It aims at improving the digital skills of the wider population, not just IT professionals. On 1st July 2020, the EC launched the European Skills Agenda for sustainable competitiveness, social fairness and resilience, adding new, more sustainable dimensions[40]. In November 2020, it launched the **EU Pact for skills**. To achieve the EU's objectives, the EC has adopted several initiatives: identifying and addressing (re-/up-)skilling and (re-)training needs stemming from new, green or digital products, services or technologies; fostering social acceptance and/or behavioural changes for more sustainable modes of transport; investing in education and training, enhancing skills and equipping students for new digital

[38] F. Borgonovi et al. (2022), "The environmental sustainability competence toolbox: From leaving a better planet for our children to leaving better children for our planet", *Documents de travail de l'OCDE sur les questions sociales, l'emploi et les migrations*, n° 275, Éditions OCDE, Paris

[39] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A strong social Europe for just transitions, COM (2020) 14 final, 14 January 2020; European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, A new industrial strategy for Europe, COM (2020) 102 final.

[40] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM (2020) 274 final.

and green jobs; raising awareness of the opportunities and challenges related to the digital and green transitions… 2023 has been declared the European year of skills. In April 2023, the EC adopted two proposals for a EU Council Recommendation, with the aim to support MS and the education and training sector in providing high-quality, inclusive and accessible digital education and training to develop the digital skills of European citizens. In November 2023, the EU Council adopted the two recommendations aiming to guide and support EU countries in providing high-quality, inclusive and accessible digital education and training, and in developing the digital skills of all European citizens.

The **EEA (European Education Area)**, which is to be achieved by 2025, promotes cooperation between the EU MS to improve access to high quality education for all across the EU. In 2020, the EC communication has proposed forty actions. The EU Council has already adopted 2 recommendations and other transversal actions to support policy reform and cooperation between education and training institutions have been launched in 2021-2022, such as the **European Innovative Teaching Award**, an annual award to showcase innovative teaching practices in line with EEA priorities (2021: distance and blended learning; 2022: promoting creativity and sustainability): 104 projects in 31 Erasmus+ countries have been awarded in 2021; 98 projects in 29 Erasmus+ in 2022; 93 in 32 Erasmus+ countries in 2023. The **Erasmus+ Teacher Academies** initiative was launched in February 2022, with the announcement of 11 academies selected in the first round.

Overall, the preliminary results of these policies are mixed. In terms of the digital transition, the EU lags behind. The EEC/EU has been eager to incorporate new technologies into education for nearly half a century. This process was reinforced through the eLearning programme, which has not fundamentally changed since 2001, focusing on infrastructure, training, content, and networks. However, the bursting of the internet bubble, the big bang of enlargement, the fragmentation of initiatives, and the subprime crisis have weakened the ambitious goals of the Lisbon Strategy. In alignment with the Lisbon strategy, the 2010 digital agenda for Europe emphasised the critical role of ICTs in achieving EU objectives. The subsequent 2020 strategy aimed to shape Europe's digital future by focusing on technologies that fostered societal benefits, economic competitiveness, and democratic openness. Building upon this foundation, the 2021 digital compass for 2030 outlined the EU's digital goals for the decade ahead. Based on the open method of coordination, the Digital Compass 2030 and the 2030: Towards the Digital Decade Policy Programme (2022) set non-binding targets for the digital transition. A key target is ensuring that by 2030, at least 80% of adults possess basic digital skills. These skills encompass proficiency in five core areas: information and data literacy (e.g., online research), communication (e.g., email correspondence), digital content creation (e.g., coding), safety (e.g., safeguarding personal data), and problem-solving (e.g., software installation).

The implementation of digitalisation in schools has been progressing very slowly. The EU has identified the broad notion of digital competence as a key competence for lifelong learning since 2006. The 2019 Eurydice report on digital

education in primary and general secondary schools in Europe concludes that digital competences across Europe are consistently defined as key competences[41].However, based on research, statistics and reports, the Education and Training Monitor 2019 concludes that while progress has been made in the integration and effective use of digital technologies in primary and secondary schools, there is a need to mobilise education staff and stakeholders to embrace digital technologies in education. In the majority of Member States (two out of three), digital literacy is considered to be an essential skill that teachers are expected to have. Teachers also report that learning how to use ICT (Information and Communication Technologies) in the classroom remains one of their greatest needs. Digital gaps persist despite significant investment in equipment and infrastructure[42].

In 2018, the EC adopted a flagship initiative, the **2018-2020 Digital Education Action Plan (DEAP)**, to place digital education centre stage, setting out "how education and training systems can make better use of innovation and digital technology and support the development of relevant digital competences, needed for life and work, in an age of rapid digital change"[43]. In the context of the **EU cooperation in education and training (ET 2020)**, the working group 'Digital Education: Learning, Teaching and Assessment' (DELTA) has been set up to examine the use of digital technologies and the development of digital competences for teachers and learners. The DEAP also supports the Commission's "A Europe fit for the digital age" priority and contributes to the **Next Generation EU (NGEU)** recovery instrument. As a result of the COVID-19 pandemic and the associated 'great lockdown', from early March 2020 education and training institutions in all sectors were closed (prohibited from delivering face-to-face courses) and institutions made a 'shift' to digital learning as a safeguard to ensure that learning continues in some form[44]. "The COVID-19 crisis has brought greater awareness of the need to improve the use of technology in education and training; to adapt pedagogies and develop digital skills"

The **2021-2027 DEAP**, adopted in September 2020, calls for high-quality, inclusive and accessible digital education supported by reinforced cooperation and exchange at EU level. The two strategic priorities set out in the plan are the development of a high-performing digital education ecosystem and the strengthening of citizens' digital skills and competences. Implementation of each of these actions is already on track or completed. For instance, the EU Council adopted in November 2021 its recommendation on Blended learning approaches for high-quality and inclusive primary and secondary education[45], that urges the MS to establish "strong school teams through collaborative learning, networks, collaboration projects, and communities of practice", to develop "guidance on new

[41] S. Broek & B.J. Buiskool, Research for CULT Committee – Shaping digital education policy, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels, 2020.
[42] European Commission, Directorate-General for Education, Youth, Sport and Culture, Education and training monitor 2019, Publications Office, 2019, https://data.europa.eu/doi/10.2766/442033
[43] Broek, S & Buiskool, B-J 2020, Research for CULT Committee – Shaping digital education policy, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels
[44] Broek, S & Buiskool, B-J 2020, Research for CULT Committee – Shaping digital education policy, European Parliament, Policy Department for Structural and Cohesion Policies, Brussels
[45] Council Recommendation of 29 November 2021 on blended learning approaches for high-quality and inclusive primary and secondary education 2021/C 504/03

approaches to assessment and final examinations, including online" and to encourage "educational staff to participate in exploratory projects and research", and the Commission published ethical guidelines on the use of artificial intelligence and data in teaching and learning for educators in October 2022. In 2022, the EC started a Structured Dialogue on digital education and skills. On 18 April 2023, the EC adopted two proposals for a EU Council recommendation, on the enabling factors for digital education and on improving the provision of digital skills in education and training. It will be necessary to identify other factors which may have slowed down the process. More specifically, the European Institute of Innovation and Technology has launched Girls go circular[46] to engage around 10,000 girls in STEM and ICT activities.

Conversely, in terms of the green transition, the EU was so far in advance for the green transition compared to Asia and America. The EU **Green Deal**'s overarching goal is to make the EU the first climate neutral continent by 2050. The COVID-19 pandemic acted as an accelerator. In 2021, the European Climate Law made this target legally binding. Attention to 'green recovery' has led to a new EU strategy for member countries' post-pandemic education systems[47]. To this end, the EC has utilised funds connected to the Green Deal and the SDGs and committed itself to launching a EU Council Recommendation on *Learning for the green transition and sustainable development*[48] that urges the MS

- to *"support and enhance teaching and learning for the green transition and sustainable development by providing infrastructure, digital tools and resources and supporting educators' digital competences"*,
- to *"support educators, including by providing the necessary time and space, in adopting pedagogies that enhance teaching and learning for the green transition and sustainable development in interdisciplinary ways and develop the socio-emotional aspects of learning, so that all learners can become agents of change and learn to reflect and act, both individually and collectively, locally and globally, for a more sustainable world."*

In March 2023, the EU Council invited Member States, inter alia, to involve education and training providers in jointly identifying re-skilling and up-skilling needs for the green transition, including public-private cooperation. To engage the community at EU level, an **Education for climate coalition** has been set up, the European participatory community to support teaching and learning for the green transition and sustainable development, mobilising 4,400 members.

In a broader sense, sustainable development has also been promoted by the beginnings of a more European social policy with the social pillars of economic development. The European Parliament (EP), the EU Council and the Commission proclaimed the **European Pillar of Social Rights** in 2017 at the Gothenburg Summit, which sets out twenty key principles, some relating to education:

[46] Website https://eit-girlsgocircular.eu/
[47] Grek, S., & Landri, P. (2021). Editorial: Education in Europe and the Covid-19 pandemic. European Educational Research Journal, 20(4), 393–402. https://doi.org/10.1177/14749041211024781
[48] Council Recommendation of 16 June 2022 on learning for the green transition and sustainable development 2022/C 243/01 (Text with EEA relevance)

> *"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"*

More recently, however, at the end of the health crisis and against a backdrop of heightened geopolitical tensions, the most anti-environmental directorates of the EC have taken the lead, the majority of MS have put the brakes on, and the European Parliament has allowed itself to be dominated by hostile parties, sometimes financed by foreign lobbies deliberately hostile to the Green Deal, as recently revealed by an international journalistic consortium. The setbacks to the nature restoration project, the indefinite delay of chemicals regulation reform, the decade-long reauthorisation of glyphosate, the adoption of packaging regulations with several exemptions, and the rejection of the SUR regulation, alongside the diminishing green momentum in the European Parliament and the Commission's adjustments to the greening of the CAP in response to farmers' protests in 2024, collectively signal a **significant shift. The green part of the twin transition is under threat**, as a recent report by the Climate Observatory reveals that the EU has only met around 15% of 124 sustainable transition indicators. In the face of these challenges and setbacks, the twin transitions need to prove their worth more than ever. This starts in schools.

For an extended period, EU's educational and cultural diplomacy was largely shaped by the influence of individual Member States. These institutions continue to maintain extensive networks, with 580 establishments in 139 countries for the AEFE. These networks implement national or local programmes, including the twin transition. However, their influence is somewhat challenged by the emergence of these new dimensions and new educational players from outside Europe who are becoming involved in the field of transition. In addition to traditional teaching, they sometimes propose more innovative approaches. This is exemplified by the educational programmes defended before UNESCO by the Chinese TNC Huawei, which are making a point of implementing the transitions. The 'Technology-enabled Open Schools for All' (TeOSS) project, in partnership with UNESCO, has the objective of building resilient education systems in Ethiopia and Egypt. This will be achieved by integrating technology into learning, training teachers and students in digital tools, and developing ICT infrastructures and competencies to ensure educational continuity during crises like the current pandemic. As we can see, there is still a long way to go for European ministries and companies to promote a model that is attractive and exemplary, not only in the EU, but throughout the world.

1.3. The need for a diagnosis of the obstacles to implementing the twin transition

The 3rd PLA in Ljubljana confirmed the limits and obstacles that explain why implementation, which began a long time ago, has often been **slowed down**. The **twin transition**, which encompasses both the digital and green transitions, has encountered considerable delays despite having commenced in the 1980s and 1990s. Teachers are already tasked with an extensive workload due to the

numerous responsibilities inherent to their role[49]. The twin transition has further compounded this challenge by introducing an extensive list of new educational objectives and missions. Many teachers have struggled to keep up with the demands of the twin transition due to a lack of time and resources. From this perspective, the implementation of the digital transition has not automatically saved time.

1.3.1 The obstacles to the adoption of digital technologies

The implementation of the twin transition is confronted with **a number of obstacles, with digitalisation representing a particularly significant challenge. One significant challenge is the lack of adequate equipment**, including insufficient computers, tablets, laptops, internet-connected devices, interactive whiteboards, and internet bandwidth[50]. The sharing of equipment, slow connections, and limited internet access result in time wastage for teachers. While basic equipment has improved, the digital divide persists, rendering the "digital classroom" a distant reality for many schools. The high cost of digitalisation, including equipment and software licenses, represents a substantial obstacle, particularly for schools with limited resources.

Moreover, the financial burden of digitalisation may have resulted in a reduction of personnel, leading to overcrowded classrooms and the inability to utilise digital tools effectively. In many cases, the basic equipment provided is insufficient, and specific items, such as digital whiteboards and digital cameras, are lacking. Notwithstanding the significance of internet access, a considerable number of educational schools within the EU are deficient in high-speed connectivity. Furthermore, the responsibility for the management of computer **maintenance**, connections and software issues is frequently placed on teachers, which serves to increase their workload[51].

In addition to equipment constraints, **pedagogical obstacles** represent a significant challenge to the effective integration of digital technologies into educational settings. Despite the pervasive integration of information technologies, empirical evidence substantiating their educational benefits remains scarce[52]. Although some studies indicate a positive correlation between technology use and student achievement, the documented effect sizes are typically modest to moderate, underscoring the necessity for a more nuanced comprehension of technology's influence on learning outcomes[53].

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[49] Naylor, C (2021), Teacher Workload and stress: An international perspective on human costs and systematic failure, BCTF Research, September 2001; UNSA, Baromètre des métiers 2023

[50] Eighteen students on average at European level per computer at ISCED 1; 7 and 8 students per computer at ISCED levels 2 and 3, respectively. Fifty-six students in Europe share one interactive whiteboard at ISCED 1, 109 students at ISCED level 2, 166 at ISCED 3 cf Deloitte/IPSOS (for the European Commission), *2nd Survey of Schools: ICT in Education*, 2019.

[51] J. Rossing, W.M. Miller, A.K. Cecil, S.E. Stamper, "iLearning: The Future of Higher Education? Student Perceptions on Learning with Mobile Tablets", *Journal of the Scholarship of Teaching and Learning*, 1, 2012, 1-26. See, for instance, in Sweden, Sveriges Lärare (2024), Lärarledd digitalisering, https://lararpdf.tmkontor.se/sv/sveriges-larare/trycksaker/sveriges-larare/undersokningar/lararledd-digitalisering-pdf.html

[52] Facer, K., & Selwyn, N. (2021). *Digital Technology and the Futures of Education: Towards 'Non-Stupid' Optimism.* UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000377071

[53] Giannoutsou, N.& alii, *Unpacking the impact of digital technologies in Education*, Publications Office of the European Union, Luxembourg, 2024,doi:10.2760/214675, JRC132998

At times, the advent of digitalisation has been demonstrated to exert sometimes a **detrimental influence** on the processes of teaching and learning. A reduction in the time spent reading by teachers may potentially impact the reading habits of their students[54]. Furthermore, students have lost the practice of taking notes, instead relying on PowerPoint summaries. As evidenced by the PISA 2022 survey, the utilisation of digital devices, particularly smartphones, has the potential to act as a source of distraction within the classroom setting. Although technology can facilitate interactive learning, excessive reliance on digital tools may impede students' digital literacy and ultimately diminish their educational outcomes.

Furthermore, the integration of digital technologies gives rise to concerns pertaining to values and ethics[55]. The process of digitalisation has been perceived as a factor that creates a sense of urgency, resulting in heightened expectations of availability for teachers. The utilisation of digital technologies, including **email** and social media platforms, can result in an imbalance in work schedules, with educators frequently feeling compelled to respond to electronic communications outside of their contracted working hours[56].

The **adoption of digital technologies has also resulted in a merging of boundaries between work and personal life, with teachers facing challenges in maintaining a healthy work-life balance**. Resistance to the use of digital technologies can be attributed to various factors, including personal attitudes, concerns about the digital world, and a precautionary principle. While the generational factor is not a primary driver of resistance, the rapid transition towards all-digital technology during the COVID-19 pandemic has given rise to concerns and intensified opposition from teachers[57].

Moreover, the widespread adoption of AI in education, without sufficient empirical evidence supporting its benefits, could risk **undermining the unique contributions that educators** bring to the learning process[58]. The advent of **AI tools**, such as chatbots (Tutor.ai; Poe.com), has the potential to supplant the role of teachers in the eyes of learners, thereby prompting a re-evaluation of the function of educators in a digitalised world. The rapid pace of technological change, coupled with the constant need for updates, creates a sense of pressure and uncertainty for teachers, who may perceive schools as perpetually lagging behind in terms of technological advancement.

1.3.2. The obstacles to the adoption of sustainability

The implementation of the green transition in schools is confronted with a number of obstacles, which can be classified into three categories as well:

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[54] Applegate, A. J., & Applegate, M. D. (2004). The Peter Effect: Reading Habits and Attitudes of Preservice Teachers. *The Reading Teacher*, *57*(6), 554–563. http://www.jstor.org/stable/20205399

[55] Deloitte/IPSOS (for the European Commission), *2nd Survey of Schools: I CT in Education*, 2019.

[56] Piasna, A. (2023), Algorithms of Time: How Algorithmic Management Changes the Temporalities of Work and Prospects for Working Time Reduction . Cambridge Journal of Economics (forthcoming), Available at SSRN: https://ssrn.com/abstract=4361557 The average full-time worker in America amounts to 2.6 hours per day according to Matt Plummer, "How to spend way less time on email every day", *Harvard Business Review*, 22 January 2019.

[57] König, J., Jäger-Biela, D. J., & Glutsch, N. (2020). Adapting to online teaching during COVID-19 school closure: teacher education and teacher competence effects among early career teachers in Germany. European Journal of Teacher Education, 43(4), 608-622

[58] Miao, F; Holmes, W; (2021) Artificial Intelligence and Education. Guidance for Policy-makers. United Nations Educational, Scientific and Cultural Organization (UNESCO): Paris, France

technical, pedagogical and value-based. The lack of resources represents a significant technical obstacle, with many schools lacking both the financial and the expert capacity to move from theoretical principles to practical application[59]. To illustrate, a considerable proportion of classrooms remain without the most basic recycling bins, which serves to exemplify the material obstacles that impede the green transition.

A further significant challenge is the lack of time available. Teachers are already overburdened, tasked with managing a multitude of responsibilities and a curriculum that is extensive in scope[60]. This makes it challenging for them to allocate sufficient time to environmental education, resulting in a reliance on pre-made teaching materials and a tendency to limit the scope of EES to theoretical concepts[61]. Furthermore, the green transition, with initiatives such as Fridays for Future, has the effect of **obfuscating the distinctions between formal, non-formal, and informal education**. This has resulted in an expectation for teachers to extend their work beyond the classroom into the broader community.

The transition to a more environmentally-conscious approach to business is further complicated by the presence of **value-based obstacles and controversies**. Some teachers and school administrators are reluctant to embrace the transition due to a lack of personal conviction regarding the urgency of environmental issues or due to the prioritisation of alternative educational objectives[62]. Furthermore, there is a paucity of consensus regarding the environmental impact of different energy sources and practices, which in turn results in a dearth of definitive guidance for educators. Furthermore, the green transition is a topic of frequent debate within the educational community[63]. While some proponents of environmentalism advocate for the integration of active student involvement in environmental values, others maintain the importance of maintaining a neutral stance in the classroom. The subject of sustainability is frequently regarded as more contentious than that of digital transformation, with a divergence of opinion regarding the most appropriate means of addressing

[59] Economic Commission for Europe Committee on Environmental Policy , United Nations Economic Commission for Europe Steering Committee on Education for Sustainable Development, "Implementation of the United Nations Economic Commission for Europe Strategy for Education for Sustainable Development: summary of outcomes of the progress report on the fourth phase of implementation", Information paper no. 2, "Learning from each other: achievements, challenges and ways forward", Geneva, 19-20 (am) October 2020

[60] European Commission, Directorate-General for Education, Youth, Sport and Culture, Tasiopoulou, E., Billon, N., Finlayson, A.et al., *Education for environmental sustainability – Policies and approaches in European Union Member States: final report*, Tasiopoulou, E.(editor), Billon, N.(editor), Finlayson, A.(editor), Siarova, H.(editor), Pribuišis, K.(editor), Gras-Velazquez, A.(editor), Mulvik, I.(editor), Bajorinaitė, M.(editor), Sabaliauskas, E.(editor), Fronza, V.(editor), Vežikauskaitė, J.(editor), Disterheft, A.(editor), Publications Office of the European Union, 2022. Cf also EDEH's 2024 short intern survey on sustainability. "Education for environmental sustainability can be understood as education that makes students aware of, sensitive to, and knowledgeable about the environment and its interconnectedness to social and economic systems, while encouraging them to develop attitudes of concern and motivation, as well as practical, complex systems and critical thinking skills to identify and solve environmental problems. Education for environmental sustainability is closely related to […] the broader concept of education for sustainable development (ESD)". See also ETUCE (2022), Education For Social Change: The Role of Education Trade Unions in Addressing Sustainable Environmental Development. See alsoTerälahti primary school, Tampere, and A Geroskipou Elementary School in Cyprus, in Mathie, R.G., and A.E.J. Wals (2022), 'Whole School Approaches to Sustainability: Exemplary Practices from around the World.', Wageningen University

[61] Dunlop, L., Rushton, E. A., Atkinson, L., Ayre, J., Bullivant, A., Essex, J., Price, L., Smith, A., Summer, M., Stubbs, J. E., Diepen, M. T. V., & Wood, L. (2022). Teacher and youth priorities for education for environmental sustainability: A co-created manifesto. British Educational Research Journal, 48(5), 952–973.

[62] European Commission, Directorate-General for Education, Youth, Sport and Culture, Tasiopoulou, E., Billon, N., Finlayson, A.et al., Education for environmental sustainability – Policies and approaches in European Union Member States: final report, Tasiopoulou, E.(editor), Billon, N.(editor), Finlayson, A.(editor), Siarova, H.(editor), Pribuišis, K.(editor), Gras-Velazquez, A.(editor), Mulvik, I.(editor), Bajorinaitė, M.(editor), Sabaliauskas, E.(editor), Fronza, V.(editor), Vežikauskaitė, J.(editor), Disterheft, A.(editor), Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2766/391

[63] C.H. Chang et alii (2020), *Issues in teaching and learning of education for sustainability. Theory into practice*, London, Routledge

urgent environmental concerns. This divergence of opinion can give rise to uncertainty and render consensus on the optimal approach elusive.

The ESMTT survey revealed that a significant proportion of respondents associated the twin transition mainly with sustainable development, with a particular emphasis on its green dimension in comparison to its digital counterpart. The survey also indicated that, while digitisation has the potential to result in a reduction in paper usage and energy consumption, the environmental benefits of these devices are frequently eclipsed by their energy demands. **The reliance on resource consumption for production and usage renders digitisation itself inherently unsustainable**, particularly due to its reliance on distant supply chains[64]. Moreover, digital customisation is at odds with the collaborative goals of the green transition. The process of digitisation has the potential to create a sense of isolation within digital environments, which may in turn impede the capacity for genuine, face-to-face interactions and connections with the natural world[65]. In conclusion, the twin transition requires meticulous consideration of its environmental impact, acknowledging the contradictions between its goals and fostering a balance between digital advancement and ecological responsibility.

- **It is evident that barriers are not merely individual behaviours; rather, they encompass a multitude of interrelated factors. As it is impractical to address all of these factors simultaneously, it may be beneficial to develop a concise self-assessment instrument[66]. By identifying the most salient factors within a given context, a school can gain insight into the underlying causes of potential barriers to transition.**

1.4. Defining the future skills needed to implement the twin transition

The **necessity for skills pertinent to a digital and green future** is shaped by a swiftly evolving employment context, particularly within the digital and environmental domains. The acquisition of digital skills is no longer confined to traditional educational settings; many competencies are now being obtained informally at home or in professional environments. The ACT21S consortium underscored the significance of **creativity, critical thinking, and problem-solving as indispensable elements of digital literacy**[67]. These principles have been integrated into the EU's **DigComp** framework since 2013[68]. The framework has been expanded to encompass elements of sustainability. The JRC has put forth the **GreenComp** framework to define green skills, which encompass technical abilities pertinent to green jobs and broader competencies for sustainable living[69].

[64] TWI (2018), The digital revolution and sustainable development. Opportunities and challenges; The Shift Project (2019), *Lean ICT – Towards digital sobriety*, March 2019

[65] Payne PG and Wattchow B (2009), "Phenomenological deconstruction, slow pedagogy, and the corporeal turn in wild environmental/outdoor education", Canadian Journal of Environmental Education (CJEE) 14: 16–32.

[66] See Annex. Gree,/digital diagnosis

[67] M. Bikley and alii (2001), "Defining Twenty-First Century Skills", *Assessment and Teaching of the 21st Century Skills,* Dordrecht, Springer

[68] Redecker, European Framework for the Digital Competence of Educators: DigCompEdu. Punie, Y. (ed). EUR 28775 EN. Publications Office of the European Union, 2017

[69] Bianchi, G., U. Pisiotis, and M. Cabrera Giraldez (2022), GreenComp - The European Sustainability Competence Framework, Edited by M. Bacigalupo and Y. Punie, Vol. EUR 30955 EN of, Publications Office of the European Union, Luxembourg; European Commission: Directorate-General for Education, Youth, Sport and Culture, Javorka, Z., Nieth, L., Marinelli, E., Sutinen, L. et al. (2024), *GreenComp in practice – Case studies on the use of the European competence framework – Analytical report*, Javorka, Z.(editor), Nieth, L.(editor), Marinelli, E.(editor), Sutinen, L.(editor) and Auzinger, M.(editor), Publications Office of the European Union, https://data.europa.eu/doi/10.2766/053738

As a consequence of the growing importance attached to these skills in the labour market, educational systems must adapt their curricula to equip students with both foundational and specialised competencies, ensuring their ability to flourish in a complex and interconnected world.

It is imperative that **educational systems integrate digital and green skills** in order to adequately prepare students for the demands of a rapidly evolving job market. Recent discussions among practitioners have identified **the challenges posed by the necessity for both teachers and students to acquire new knowledge, skills, attitudes, and competencies** related to digital and environmental transitions. Although **there is no consensus regarding the specific skills that will be required in the future**, educational systems are diversifying their approaches to learning and increasing the volume of work assigned to students. This shift reflects a growing recognition that schools should not only focus on developing individual professional skills but also provide students with a general knowledge base that can adapt to changing market demands. Those with a stake in the matter argue for an educational system that encourages adaptability and lifelong learning. They emphasise the importance of digital competence as a means of engaging with technology in a responsible and effective manner.

The **demand for digital skills is particularly pronounced**, as they are increasingly necessary for participation in society and the workforce. The DigComp delineates the fundamental digital competencies that have been expanded to encompass elements of sustainability. The term "digital skills" is used to describe a range of **abilities, including information literacy, communication, collaboration, content creation, safety, and problem-solving**. In 2022, the updated DigComp framework incorporated new examples of knowledge and attitudes related to green and sustainability issues. The accelerated digitalisation of employment and public services in the EU has highlighted the imperative for citizens to possess fundamental digital competencies. However, considerable deficiencies persist, particularly among older demographics who may exhibit limited proficiency in advanced digital capabilities[70]. This discrepancy underscores the pressing necessity for educational institutions to provide all citizens with a foundation in digital skills.

Concurrently, the development of **environmentally-focused competencies** is becoming a crucial aspect of professional development, as the job market undergoes a transition towards greater emphasis on sustainability. The skills required for a green career are frequently similar to those taught in schools; however, they necessitate a more profound comprehension of environmental concepts, including waste reduction and biodiversity conservation. Green skills can be classified into three categories: technical skills pertinent to green jobs, generic capacities for sustainable behaviour in any occupational setting, and transformative capacities aimed at addressing climate change on a structural level. As educational institutions modify their curricula to encompass these

[70] Eurostat, Digitalisation in Europe, 2024 edition, KS-FW-24-001 ; ISBN 978-92-68-11769-9 ; ISSN 2600-3368 ; doi: 10.2785/120017

competencies, they must also determine the optimal methods for evaluating student learning outcomes pertaining to both digital and green skills, while ensuring the effective implementation of interdisciplinary approaches in practice.

2. A RISING NUMBER OF DIGITAL & GREEN ACTIVITIES DURING THE INSTRUCTIONAL TIME

KEY FINDINGS

This chapter looks at how digital and green activities are being used more in European schools.

The chapter shows how traditional teaching is changing to make use of digital tools. Teachers are under more pressure because of the digitalisation of teaching. Teachers are working harder in Europe, with more responsibilities and larger classes.

The chapter shows that more teaching hours do not always mean better education. The digital transition has also made it harder to manage instructional time.

The use of ICT and AI has had mixed results. These technologies can save time, but they also make it harder to maintain educational quality and adapt to students' and teachers' needs.

2.1. Quantitative and qualitative approach to instructional time

The measurement of school time has a long history. It was modelled on religious or even military time to divide and organise school time. Clocks were installed in playgrounds, corridors and classrooms. In terms of human resources management, this measurement can be explained by the need for a minimum of bookkeeping, as this is the basis on which teachers are paid. From this point of view, the advent of new technologies has facilitated the rapid monitoring of the required number of teaching hours and the identification of any problems related to absenteeism. Digitalisation has contributed to a growing trend towards a more accountable approach to teachers' working hours, which has the potential to put pressure on teachers[71]. The utilisation of digital tools has made teachers' time more visible and accessible to the public. The concept of time has shifted from one of free experimentation to one of efficiency and profitability.

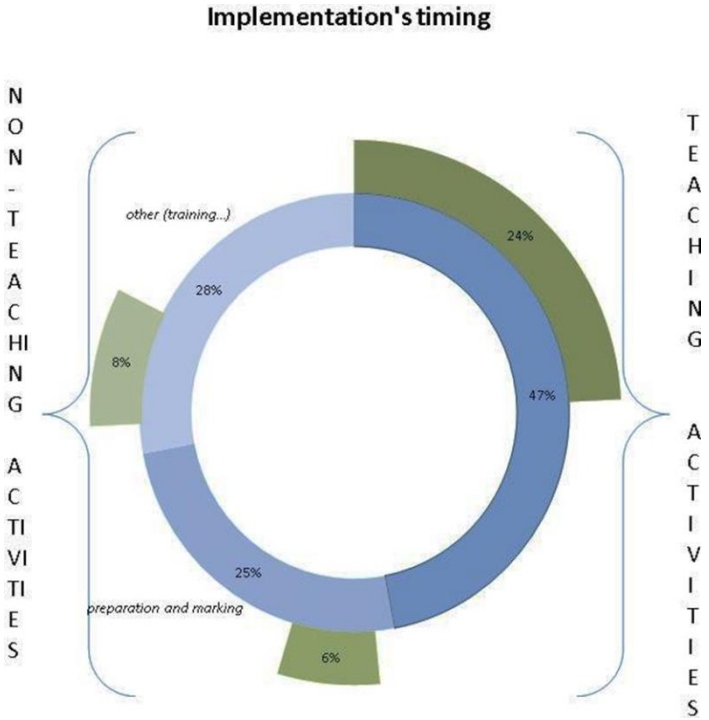
In this context, it may seem tempting for educational managers to go one step further and measure, using the new digital tools, the various concrete activities carried out during the lesson, in order to identify and track down any dead time, too much time wasted, or teaching progress that is too slow and does not allow the compulsory curricula to be covered. In practice, however, this monitoring would be almost impossible to carry out, because teachers teach *live* and cannot therefore measure and categorise their activities at the same time, because they

[71] Hardwig, T.; Mußmann, F. (2018): Zeiterfassungsstudien zur Arbeitszeit von Lehrkräften in Deutschland – Konzepte, Methoden und Ergebnisse von Studien zu Arbeitszeiten und Arbeitsverteilung im historischen Vergleich; Expertise im Auftrag der Max-Träger-Stiftung

multiply activities that overlap and are therefore difficult to qualify and categorise, and because certain 'time wasters' are involuntary or necessary for various needs, and teachers therefore have no concrete control or room for manoeuvre over this use of time. Furthermore, the introduction of such monitoring would serve to intensify the demands of a role that already entails a significant investment of time, spanning several dozen hours, and necessitating frequent, direct engagement with an extensive and diverse student population. Consequently, the success of this initiative hinges upon the willingness of educators to proactively contribute to its implementation. **This would entail the regular completion of their daily textbooks**, a practice that would facilitate the transfer of educational content to both their students and the educational institution, particularly in instances where digital or sustainable matters are concerned. Eventually, it is important to note that there is a fundamental difference between the time managed by administrators, who view this as an accounting unit, and the subjective time experienced by both teachers and pupils, which lasts much longer from a psychological point of view.

Rather than pursuing an all-encompassing vision, which would require addressing all hours with one or more aspects of the twin transition—or even both simultaneously—a more realistic approach **would be to focus on a single, discrete implementation**. This approach would naturally be fragmented due to its inherent nature, occurring within a timetable that is already fragmented. While **the majority of the transition occurs within the classroom**, it does so inconsistently across different subjects, formats, and systems. The ESMTT survey has provided insights that can guide the development of a model for this process:

Figure 1. The three stages of the weekly implementation of the twin transition

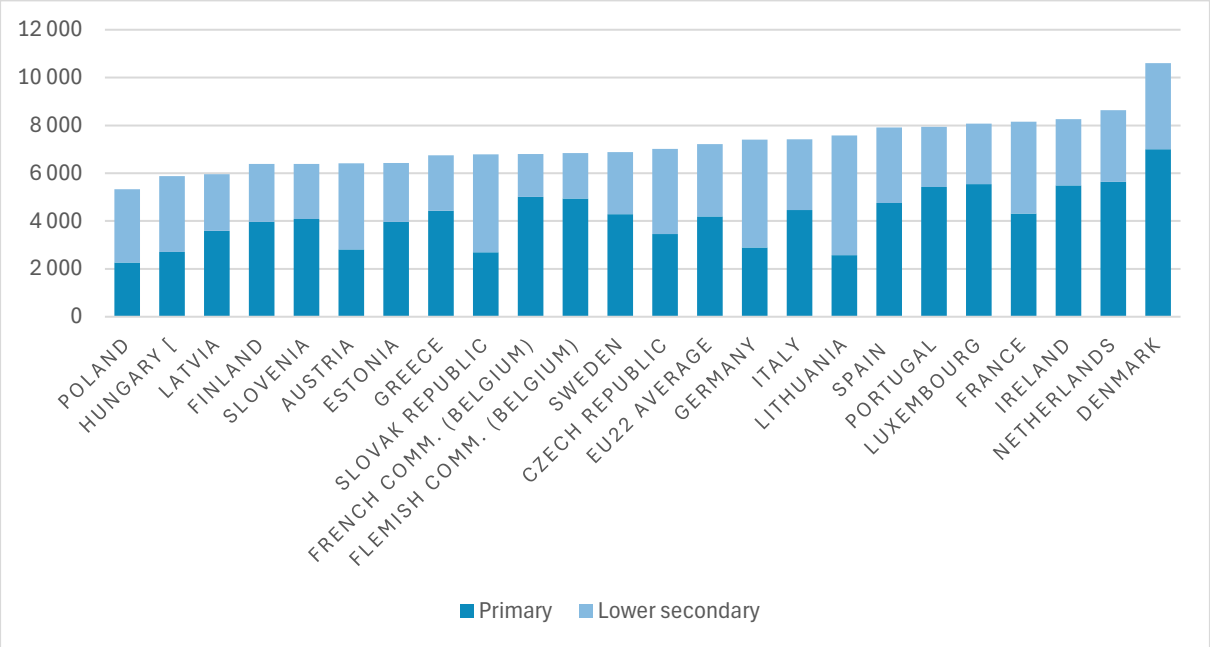


Source: Fabrice Serodes, ESMTT (2023)

2.1.1 A remarkable stability of teaching hours

There is no consensus on the ideal number of hours for education and there is no set number of teaching hours for a teaching service, but these essentially depend on the number of teaching hours required by ministries and of the number of teachers available for each level and subject. Public education in the EU averages around **7,500 hours** from primary to lower secondary level. Two groups of countries appear to differ markedly in terms of the number of hours: the top group, including Denmark, the Netherlands, France, Ireland and Luxembourg, have more than 8,000 hours, while the bottom group, including Bulgaria, Croatia, Poland, Latvia and Hungary, have less than 6,000 hours, a difference of more than 33 %.

Figure 2. Compulsory instruction time in general education (2021)



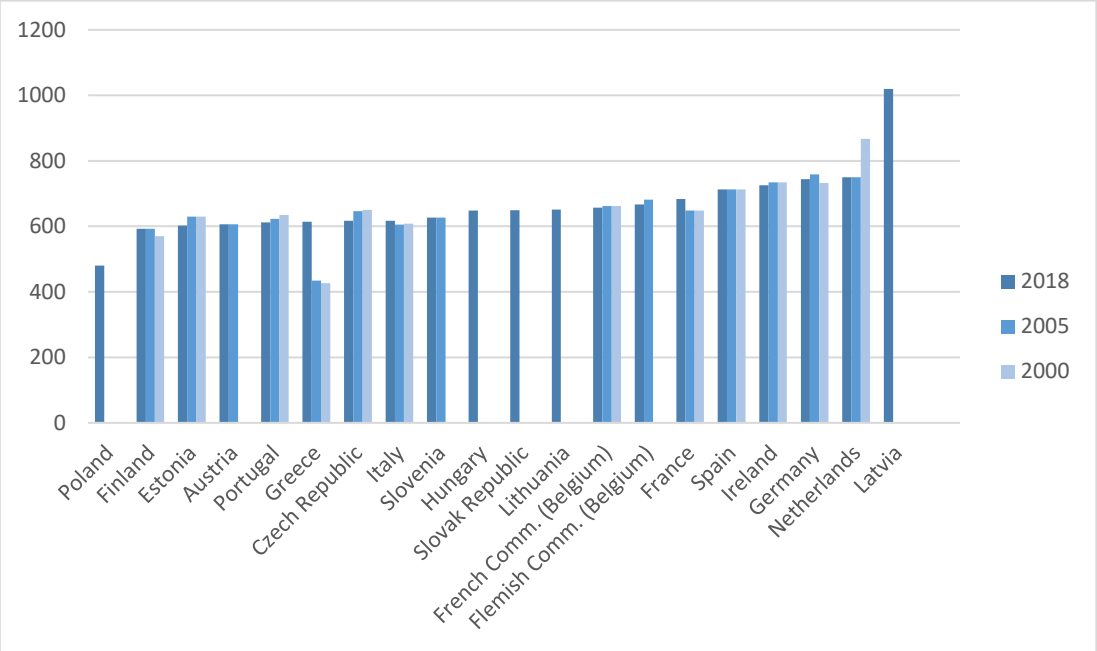
Source: OECD 2022

Thes figures show that there is a very wide divergence between countries in terms of views, practices and school traditions: a Danish pupil spends more than twice as much time at school as a Bulgarian pupil. Upon initial observation, it may appear that these discrepancies are indicative of disparities in investment in educational systems. and that they have a proportional impact on school results. **Intriguingly, it does not correlate with the quality of teaching**. The 'Finnish system,' which has long been considered a model, features fewer teaching hours, allowing teachers and students significant freedom. This graph illustrates the relative nature of a purely quantitative approach to instructional time across different educational systems. It challenges the notion that classroom teaching hours are paramount or that learning is significantly diminished in the absence of teachers. The number of hours is not the determining factor; rather, it is the content, intensity, productivity, combinations and synergies of those hours that are of consequence.

The European average for hours of teaching in the lower secondary is around seven hundred, but this is not the case for the upper secondary. Annual

services are quite logically correlated to these volumes of teaching hours and reflect these same differences, which are significant in the EU. The number of hours of teaching per year varies by a factor of more than two: the lower secondary education system of Lithuania stands out with a record number of hours of instruction of over 1,000, while Poland is below the five hundred threshold.

Figure 3. Number of teaching hours per year in general lower secondary education (2000, 2005 and 2018)



Source: OECD (2019)

A similar discrepancy can be observed on a weekly basis, albeit to a lesser extent. Based on information from TALIS, **EU countries lower secondary teachers generally allocate between 18 and 23 hours** per week to classroom instruction. Teachers in Finland typically dedicate around 15 hours per week to teaching at the level. In contrast teachers in the Czech Republic spend an average of 27 hours per week teaching. The number of hours also varies considerably within a single MS, as in the Federal Republic of Germany, where instruction time varies from 21 to 30 hours per week.

In the context of lower general education, the OECD data indicates that the situation has remained unchanged across the EU for the past 20 years. The global volume of hours has remained remarkably stable. This number of hours can hardly be changed for pedagogical reasons. 11 EU countries (from Hungary to Poland) are well below the European average. In most EU countries however, teachers are already complaining that they do not have the time to implement their own discipline[72]. A high hourly volume can have undesirable effects: the higher the number of hours of instruction is, the less time teachers have to prepare

[72] Survey for the OHTE annual conference, Council of Europe Strasbourg, 2023.

their lessons, which is detrimental to quality[73]. They also have less time to devote to working with the rest of the pedagogical team, which is however essential for teacher satisfaction[74] and the quality of a school (OECD, 2009). Some therefore suggest that teaching time could even be reduced, contrary to popular belief[75].

From this perspective, teachers are relatively protected by the existence of schedules that are not meant to be overstepped. The existence of a weekly or annual timetable and the nature of a service to a group of students, which is difficult to change, has protected them from "atomisation" of their working hours compared to other workers who work remotely and whose digitalisation has increased the intensification and standardisation of their working hours[76]. In some countries (Belgium, Ireland), the number of such hours is the main part of the contract which defines the hours worked by teaching staff.

2.1.2. More intensive lesson times

The apparent relative stability of this quantitative approach does not account for the profound changes in teaching hours. **Not only has the number of hours worked increased, but the work has also become more intense[77]**, with more tasks having to be completed in the same amount of time. This is due to a number of factors: maintaining excessive pupil numbers, adding new dimensions to the curriculum, including the twin transition, and direct or indirect pressure from superiors and parents, in an accounting logic that creates a certain unease. There is also the desire for school autonomy, which is laudable in that it allows them to modulate their working hours and choose appropriate and relevant local projects, but which in practice is often a case of delegation by the central authorities without the resources, leaving the staff to make up for these new shortcomings. This was particularly evident during the periods of confinement during the COVID-19 pandemic, when practitioners had to improvise largely alone in front of their remote students. Increased workload is a major concern as it can negatively impact an individual's well-being, work-life balance, health outcomes, and job satisfaction, with subsequent effects on broader social cohesion and flourishing[78].

European education systems are already divided on the best way to divide course units. These **"hours" varies significantly** between 40 (in Cyprus for instance) and 55/60 minutes. The relevance of this duration comes up again in the context of digitisation: what is the best course duration for implementing the twin transition?

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[73] Duflo, E.; Dupas, P.; Kremer, M. 2012. School Governance, Teacher Incentives, and Pupil-Teacher Ratios: Experimental Evidence from Kenyan Primary Schools. w17939. National Bureau of Economic Research, http://www.nber.org/papers/w17939 ; Burns, D.; Darling-Hammond, L. 2014. Teaching Around the World: What Can TALIS Tell Us? Stanford, CA: Stanford Center for Opportunity Policy in Education.

[74] Burns, D., & Darling-Hammond, L. (2014). Teaching around the World: What Can TALIS Tell Us? Stanford Center for Opportunity Policy in Education.
https://edpolicy.stanford.edu/library/publications/1295

[75] J. Fullard, *Labour market expectations and occupational choice: evidence from teaching, ISER working paper series*, 2023-01, March 2023

[76] Piasna, Agnieszka, Algorithms of Time: How Algorithmic Management Changes the Temporalities of Work and Prospects for Working Time Reduction (2023). Cambridge Journal of Economics (forthcoming), Available at SSRN: https://ssrn.com/abstract=4361557

[77]Beck, J. L. (2018). The weight of a heavy hour: understanding teacher experiences of work intensification, McGill Journal of Education / Revue Des Sciences De l'éducation de McGill, 52(3). https://mje.mcgill.ca/article/view/9352; Lawrence, David F., Loi, N., & Gudex, B. (2019). Understanding the relationship between work intensification and burnout in secondary teachers. Teachers and Teaching, 25(2): 189-199 ; G. Thompson, The Global Report on the Status of Teachers 2021, EI, 2021 ; Pyhältö, K., Pietarinen, J., & Salmela-Aro, K. (2011). Teacher–working-environment fit as a framework for burnout experienced by Finnish teachers. Teaching and teacher education, 27(7), 1101-1110

[78] Glaser, J., Seubert, C., Hornung, S., & Herbig, B. (2015). The impact of learning demands, work-related resources, and job stressors on creative performance and health. Journal of Personnel Psychology

- **Since at least 1911, the German education model has promoted 45-minute lessons, mainly to keep pupils concentrated in the afternoon**[79]. Even more so, those in favour of short courses argue that the new digital environment is reducing the attention span of students. Shorter periods, which can be combined, if necessary, allow students to breathe more frequently. They also prevent students from being glued to their screens.
- **At the same time, however, advocates of longer periods point out that longer periods are less intense**. This leaves more time to vary teaching methods and implement curricula. Either way, it is important for school leaders to adopt a policy to avoid pitfalls: a consistent policy to avoid the fragmentation and lack of cohesiveness of too brief a period, and the need for breaks and to avoid the accumulation of too much instructional time for the attention of both students and teachers.

2.1.3 A better time loss tracking

- In addition to their disciplinary skills related to the twin transition, teachers find themselves, by default, having to play a number of other professional roles such as psychologist, social worker, etc. Every year, a significant percentage of class time is lost. One of the main factors identified in international surveys, including those conducted by the OECD, and confirmed by many interviews, is **indiscipline**. Many respondents of the ESMTT survey confirm there are many **time wasters** which make these hours less effective. Teachers are faced with increasingly disruptive classroom behaviour. They need to have the possibility to separate and isolate these problems with supervisors and assistants. This means recruiting specific professions in the institutions. In the short term, administrative tasks should be outsourced to assistants, such as in Sweden, including absences and being late. On a more structural level, they must be able to lighten the burden of dealing with social and psychological problems. In Slovenia, at Bežigrad secondary school, there are three psychologists for around 1,200 pupils. This support is particularly lacking in small, isolated establishments.
- Additionally, there are unique occurrences, such as the growing number of ceremonies, moments of silence, and tributes for political or geopolitical reasons, which highlight the school's role within the broader society. In addition to public holidays linked to certain historical events, such as the First World War, more specific commemorations have been added for natural disasters and wars. Schools have had to make room and reorganise their time to accommodate Ukrainian pupils. All this is done in the same timetable. In light of these considerations, it becomes challenging to maintain a strict annual account of the aforementioned activities. A multitude of events, both voluntary and involuntary, are increasingly disrupting the established rhythm of the educational programme. The

[79] Kluth, R. (2018): Warum hat eine Schulstunde 45 Minuten?; 15.08.2018 https://www.dhm.de

volume per hour can only be used as an indication, especially when it comes to the implementation of new dimensions such as the twin transition.

- **However, it is not possible to eliminate all of this waste of time. They are an integral part of all learning: students need to be able to progress and go faster, and so do teachers, but it is difficult to establish an hourly productivity from the outset**. Many events can affect the course and slow it down. It is therefore unreasonable to anticipate that one should be working at optimal capacity at all times. As in any profession, productivity varies greatly. It is not possible to work more than to work more than a thousand hours with the same enthusiasm, for a wide variety of reasons: the teacher may be directly affected by a recent event, as may each of their students. The attention of students can also vary considerably, depending on the economic, political or sporting context. In Austria, Italy, the Netherlands, Poland, Slovakia, Spain, short breaks (of ten minutes or less) are included in the teaching time. While this may be seen as part of the educator's job and the learning of delays, being on time could be seen as a time to teach sustainable values. For some people, in a society of rapid change, school is also there to provide time for reflection, tattling, hesitation and even boredom, which are all part of an education that stretches over 7,500 hours.

2.2. The investment in new technologies at school

2.2.1 Digitising lesson times

Leadership and investment are key. Both literature and policy documents have identified school leadership as a key factor in the implementation of ICT in teaching and learning practices in the classroom[80]. The school's emphasis on technological advancement and, to a lesser extent, its commitment to environmental sustainability, contribute significantly to its overall image and align with the expectations of many parents seeking a prestigious and forward-thinking educational institution. Even if they have an effective digital strategy in place, they will still need to review and rethink their approach to teaching and learning and their organisational practices[81], especially as digital transformation is an ongoing process and not a one-off project[82].

Many schools, particularly in Spain[83], have already made significant investments in ICT, recognising that it is one of the most cost-effective investments a school can make[84]. Despite initial scepticism, school leaders have increasingly adopted these technologies to address and minimise the educational inequalities that

[80] Kirkland, K., & Sutch, D. (2009). Overcoming the barriers to educational innovation *Literature reviews*: futurelab; Kozma, R. B. (Ed.). (2003). *Technology, innovation, and educational change: a global perspective. A report of the Second Information Technology in Education Study Module 2*. Eugene, OR: ISTE.

[81] Pettersson, F. (2018), Digitally competent school organisations–developing supportive organisational infrastructures. International Journal of Media, Technology & Lifelong Learning, 14(2), 132-143

[82] Lipsmeier, A., Kühn, A., Joppen, R., & Dumitrescu, R. (2020). Process for the development of a digital strategy. Procedia CIRP, 88, 173–178. https://doi.org/10.1016/j.procir.2020.05.031

[83] Fernández-Gutiérrez, M., Gimenez, G., & Calero, J. (2020). Is the use of ICT in education leading to higher student outcomes? Analysis from the Spanish Autonomous Communities. Computers & Education, 157, 103969

[84] European Commission, Directorate-General for Education, Youth, Sport, and Culture, Investing in our future – Quality investment in education and training, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2766/45896

emerged during the COVID-19 pandemic[85]. To maximise the effectiveness of these investments, school administrators should ensure that all ICT equipment is fully operational, conduct thorough checks at the start and end of each day, and maintain backup resources to mitigate any technical problems.

The proliferation of **digital activities** within novel learning environments has demonstrably impacted instructional time management. While self-reported levels of ICT integration in classrooms vary considerably, ranging from basic document projection to immersive virtual experiences, significant disparities exist in the frequency and depth of utilisation among educators. In other words, not all teachers leverage ICT with equal consistency. While the Spanish teachers surveyed said they used ICT every day, their Greek counterparts used it less frequently[86]. In Italy and in Greece, students still rarely have the opportunity to take computer-based tests in class. Teachers who have access to ICT and use them regularly have noticed that the digital transition has freed them up time and made students more autonomous.

The most time saving and comfortable for teachers remains online **streaming**, watching documentaries and fictions and analysing some selected scenes. A series of websites, applications, software, documentaries and impressive web reports offer a highly stimulating way of quickly teaching people about CO2 emissions and projections of rising sea levels. In 2006, Al Gore's one-man show paved the way by showcasing the dramatic increase in CO2 levels through striking digital imagery and impactful video comparisons. More recently, UNESCO's Digital Week 2024 served as a reminder, during a conference, of how certain animations can significantly enhance knowledge and awareness, particularly through the innovative tools provided by press websites. The use of these resources is convincing, although they should be used sparingly so as not to lose the effect of surprise and the lesson does not have to become a show, as is sometimes the case in higher education, but the emotion must be able to be recontextualised.

Another successful way to attract attention, vary teaching practice and relieve the teacher is to leave room for **independent play**, with the twin transition being particularly well suited to this type of approach, provided there are sufficient computer workstations and the pupils have a good command of English. For example, the Bonzo website offers adapted formats, very simple **games** about the environment (coral quizzes), competitions between schools and even the creation of games via an ergonomic platform[87]. Ideally, when schools have the resources, virtual reality games have proven to be motivating for the students and time-saving for the teacher, as the student's progress is automatically recorded[88].

The advent of new technologies has had a paradoxical effect on knowledge, particularly digital knowledge, and above all on the environment. Social networks

[85] Costa, P., Castaño-Muñoz, J., & Kampylis, P. (2021). Capturing schools' digital capacity: Psychometric analyses of the SELFIE self-reflection tool. Computers & Education, 162, 104080.

[86] 77% of the 64 Spanish teachers surveyed compared with 21% of the 61 Greek teachers surveyed by the New Education forum in the summer of 2022.

[87] https://bonzo.knowledgeplatform.com/

[88] Dedíková, K. (2023). *Special education games in virtual reality* (Master's thesis). Brno University of Technology, Faculty of Informatics. https://is.muni.cz/th/ezl59/Special_education_games_in_Virtual_reality.pdf

have contributed to the circulation of fake news about the climate, fuelling certain myths and beliefs. However, these tools can also be used to facilitate critical thinking about their use and the implications of that use. Since 2004, the American blog realclimate.org has been working to combat climate scepticism.

More recently, some schools have been trying to integrate AI in order to save time. Several prospective studies share the same optimism regarding the potential time savings. Some estimate that teachers could save at least 13 hours per week, between 20 and 30% of their time could be reallocated to direct support to students, a percentage further elevated by certain general publications[89]. The authors do not take into account what constitutes the essence of pedagogical mediation: knowledge and adaptation to the context. In its standard usage as a super tool for research and planning, the automated responses provided by AI do not align with the specific pedagogical intentions of the teacher, the specific points covered in class, especially orally, the specific requests made or not by the students, the teacher's estimated level of the class or group, the overall pedagogical progression, and the constraints of pedagogical activities that must blend variety and enjoyment. In this usage, it represents an abstract and unrealistic conception of teaching, akin to mere recitation or rote memorisation, which essentially denies the role of the teacher. However, properly configuring the tool would require a significantly longer time and consideration of the entire learning context, assuming it is even possible to configure socio-economic criteria, for example.

Some simple tasks could be automated, provided there is a simplification of assessments and standardisation of the content (preparation, information search, evaluation, administration)[90]. Automation implies simplification and standardisation, which can be applied to certain general tasks at low levels. In Slovenia, the *Gimnazija Bežigrad* has adopted a proactive strategy for artificial intelligence, as it is considered as a major issue for today's generation. Indeed, artificial intelligence tools such as ChatGPT can be used to answer frequently asked questions (FAQs), freeing up teachers' time to focus on more complex tasks. In this automated system, the teacher's role as marker (annotating the papers with specific comments and assessments disappears), in favour of binary results and independent quizzes This automation is therefore changing both teaching techniques and the role of teachers.

Some schools have sought to capitalise on the potential of the teaching hour. Ireland is an exception, with the highest percentage of working hours spent teaching pupils (more than 90% in 2014). It is the only OECD country in 2021 where school heads claim they work less than thousand hours a year. This can be explained by an **optimisation of working hours**. The innovative City of Dublin Education and Training Board (CDETB)'s teaching projects implemented under the Erasmus+ programme was awarded in 2021 by the European. "Supporting 21st Century Teaching and Learning" sought to: explore new innovative practices to be utilised by the Board; to facilitate digital competences; to facilitate blended

[89] Kai-Fu Lee & Chen Qiufan, *AI 2041: Ten visions for our future*, Crown, 2021.
[90] J. Bryant and alii, McKinsey Global Institute's 2018 report on the future of work

learning; encourage the use of social media as a means of communicating with the 21st century student; implement the 'flipped classroom'; implement the 'bring your own devices' (BYOD) initiative, where learners bring their own technology into the classroom; facilitate interactive learning. This project is a good example of peer learning activities. Local management explored teaching and learning in similar large organisations in the EU, and gained first-hand knowledge of other European education systems, enhancing their professional skills and ensuring their CPD.

Given the importance of digital cross-cutting skills, some schools have advocated for a multidisciplinary approach from the outset, surpassing subject

CASE STUDIES (Box 1)

In some schools a one-to-one philosophy has been implemented, where students use traditional notebooks AND tablets at the same time to complete the lesson (for instance make an internet search) combining a traditional and digital experience.

Complete ready-made suites are now offered or sold by the GAFAM to schools, which are increasingly used by teachers: Microsoft has developed Dream space, based on the Irish curriculum; Apple apps also offer a series of educational tools; Google offers a wide range of tools. For instance, the Piper's Hill college has created links with Google and teachers use the learning platform Google classroom. Students are invited to learn more about air quality at school through the air quality index, collect data and illustrate it with a graph. The iPad allows teachers to illustrate their data on a graph. They can draw anywhere on the slide in an effortless way. Canva can help them to display and share their results. Using devices and software from the same manufacturer increase familiarity and reduce the likelihood of technical problems and avoids the multi-login issue.

Interactive software such as *Quizzizes*, *Kahoot*, *Menti*, or *Blooket* enables flipped classroom. These are valuable assessment tools because they provide pupils with rapid feedback without increasing the teacher workload. They are quite easy to use. Teachers invest some time in the preparation at home but can relax more in the classroom.

Some software has been created specifically to respond to the needs of the digital transition. Like many other schools, Emma O'Beirne uses the Schoology Assessment Management Platform, or AMP, which integrates learning management and assessment in one system.

These digital tools can be used to teach the digital transition. For example, a quiz at Piper Hill School asked students Piper Hill School asked pupils what kind of challenges they faced and they had to choose between several options (overpopulation, climate change). options (overpopulation, climate change, overfishing), which helped them to sort and prioritise the issues. and set priorities.

compartmentalisation in secondary education. In Finland, this is the case at *Lintumetsän koulu* in Helsinki. An entire week of classes is dedicated to allowing students to concretely engage with various digital tools. The teaching team is convinced of the importance of hands-on working with tools, rather than abstract and vertical training.

2.2.2 Distance learning is still underused

Few institutions had a digital strategy prior to the first lockdown. For some case-study interviewees, the development of a digital strategy was a 'fluid process', which developed rapidly after the first lockdown in March 2020. Despite digital fatigue, it would be unfortunate to lose all the benefits of this experience.

a) The COVID-19 pandemic has encouraged a change in thinking about counting hours and working in a traditional way. Some schools were much more proactive and forced digitation allowed **new forms of fruitful collaboration**. One of the main ways in which remote teaching reduced workload was by facilitating team teaching, whereby two or more teachers planned and/or taught their classes together. Having some teachers focussing on lesson planning and others delivering live lessons freed up other teachers' time. This example shows the way managers can merge teachers' hours instead of being accounted individually and break the walls of classrooms.

b) The pandemic has demonstrated the importance of **maintenance**, network control and dedicated staff. The twin transition has created **new interconnections with other professionals**: IT service, assistants. As reminded by the EU Council of the EU, the effective digitalisation of a school requires "close alignment among authorities responsible for infrastructure to ensure connectivity, finance to provide funding for investments, and education to align curricula and support teachers"[91]. In some schools, teachers are able to delegate and outsource work and there are auxiliary staff.

CASE STUDIES (Box 2)

At Bežigrad secondary school, IT represents up to 70 hours of instruction. The school has three recent computer rooms, which means that it is well equipped. Two teachers are ICT experts. In particular, as demonstrated in Ljubljana, it is essential that teachers can access a quick and direct hotline to ensure they do not get stuck. However, students are encouraged to disconnect in class. Wi-Fi

Several solutions are structural and part of a traditional comprehensive management of teachers time which could be applied to the twin transition: managers should let more time to plan and mark; the number of teachers should be increased; there should be fewer pupils per class, so that less time is spent assessing; administrative tasks for digital and green projects should be recentred

[91] Proposal for a Council recommendation on the key enabling factors for successful digital education and training {SWD(2023) 205 final}, 18th April 2023.

and not outsourced; recruit more people for administrative work; recruit assistant for IT or green projects… This also applies to teaching teams. Considering the limited amount of time and the number of tasks, digital and green activities could be **assigned according to the different teachers' potential**. It is a way to leverage and reward talents.

c) The pandemic has shown the usefulness of **remote teaching** in many cases. The pandemic has allowed to discover the diversity of possibilities and to familiarise with their best tools. In **Cyprus**, it is unfortunate that Teams is no longer used to teach when teachers are absent, but instead mainly used just to meet. It is especially true in terms of exchanges with the outside world. The advent of digital technology has facilitated real-time interactions with speakers and classes situated at disparate locations within the EU. This promising and engaging opportunity remains largely untapped. One of the primary challenges lies in identifying a synchronous time slot that aligns with the schedules of all parties involved. The new eTwinning portals provide a promising avenue for fostering such exchanges. To this end, it might be useful **to prioritise an afternoon** dedicated to transition activities, in consultation with partner schools, which would facilitate synchronisation if necessary.

d) Some studies, based on standard efficiency measures, report an increase in job satisfaction and efficiency, with less commuting and more time devoted to sober pursuits. In France, estimates by the Institut national de la statistique et des études économiques (Insee) indicate that an increase in the use of teleworking could lead to a productivity increase of around 10%. In the long term, schools would undoubtedly benefit from this. The pandemic has shown that it is possible to reduce the administrative and other tasks involved. For instance, with online teaching, it has been possible to have an immediate check on who is absent. Late or absent student management should be automated.

e) the pandemic has shown how important it is to streamline digital communications, especially when they are carried out live. To avoid the nightmare of repeated connections, **it could be easily solved via smartphones, cards systems and the attribution of fixed and personal computers.**

2.2.3 Greening lesson times

ESD teaching often remains theoretical. Only some of the green activities take place during lesson time (not mobility, thermal or the fight against waste). The most common measure that is practical and easy to implement is recycling and reducing paper consumption, which are often mentioned in the surveys.

Today's teachers have a range of new practical tools, both digital and green, they can use them to vary their teaching: storytelling, digital educational games, scientific measurements of the environment, and so on.

2.3. Redesigning schools

2.3.1 A new learning environment

The allocation of **teachers' classroom** is also key to save time[92]. The issue can be classified as twofold. Primarily, there is the matter of class allocation. Today's nomadic lifestyle, which encourages the rotation of classrooms, has led to significant and unnecessary loss of time. Sometimes, managers are forced to allocate different classrooms every hour or every two hours. It may be needed for some reasons, but a classroom where a teacher spends a majority of its time is a clear time saver. Permanent room changes have caused a huge waste of time as teachers have each time to log in/out, to take along their material; (re)arrange the classroom (traditional, U, islands…), to check the state of the (digital) equipment, switch on the computer and the overhead projector, check the heating…Changing rooms regularly **means losing 10-15% of class time, which amounts to dozens of hours a year.** It is therefore advisable that teachers be provided with their own classroom and lockers, in order to facilitate more efficient working practices.

A parallel improvement linked to digitisation can also be implemented in the digital world much more effectively. Teachers must login for each session and the link is far from being configured on the workstations and being part of the default environment for employees, who have to waste time looking for locations and logging on. Instead, they should be able to automatically access their files on their **drives**, which avoids having to go back and forth via other media and provides continuity between home and the workplace.

Outside the classroom, time can also be saved. When possible, several elements seem essential to save time: quick access through non-polluting transportation, centrally located green spaces that can serve as experimentation sites, and simple opportunities to connect with nature. Consulting with educational teams and involving students in adaptable spaces is much more effective in implementing the transition than relying on ready-made architectural concepts. In Belgium, Austria and Spain, as part of the "Green playground and outdoor learning" project, the naturalisation of school was designed in close collaboration with the teaching teams, earning it an award at the 2022 European Innovative Teaching Award (EITA). In Greece, Ireland, France, Portugal and Sweden, 5 New European Bauhaus Eco²-Schools sites have developed replicable inclusive climate action plans, where the premises of the school itself can be used as a support for the direct educational activities of the teachers[93].

To a lesser extent, without having to undertake any new renovation work, smaller-scale systems can help to make these lessons more effective on a day-to-day basis. A number of schools have adopted a **nudge** policy, a policy of encouraging students to follow recommendations and suggestions, creating a learning-friendly environment that saves time by making pupils more willing to learn[94]. For example, the installation of visible meters (for bike journeys, solar energy, litres

[92] OECD (2019), *Measuring Innovation in Education 2019: What has changed in the classroom?,* OECD, https://doi.org/10.1787/9789264311671-en
[93] Baierl, T.-M., & Sotiriou, S. (2023). *Social Value Framework and Self-Reflection Tools*. Erasmus+ Programme, European Union.
[94] I. de Maurissens et alii, EuCliPa, Guida NUDGE, #Nudgeforclimate - EuCliPa.IT

of water, etc.) in the shared areas not only makes it possible to work on them, but also to raise the environmental awareness of the educational community and to change practices[95]. In this way, the school participates in a global, scientific and autonomous project, which can serve an environmental objective of increasing or reducing energy consumption[96].

This is more pronounced in certain schools that have been specifically designed for this purpose.

- In Portugal, Spain, Greece and Slovenia, the *eSGarden* project has several dimensions: European, digital and interdisciplinary. It is being developed in several European countries with the advice of the Technical University of Valencia, which has developed a complete app to collect and process data from connected schoolyard gardens.
- In Ireland, for example, a chaplain is responsible for adapting the framework of the Kinsale Community School to accommodate this form of education. The playground of the future school would be a unique blend of education and environment, transforming the area into a real-life laboratory for students, including an 'insect hotel' and observation benches for studying different insects and their habitats, a biodiversity garden with rich flora and fauna, and several green areas for learning about plant life and ecosystems. The centrepiece will be a spiral path inspired by the Irish national symbol, the *triskel*, surrounded by greenery that could serve as a walking path or an area for outdoor education. There is also a viewing area with water features for studying aquatic life. Information boards throughout the courtyard provide educational content on environmental issues. This interactive design promotes a deeper understanding and appreciation of nature among students, making the courtyard a practical tool for environmental education.
- In France, around one hundred "Oasis" school playgrounds in Paris have been renovated on the basis of co-design for educational purposes[97].
- In Belgium, the Saint-Paul school in Kortrijk has benefited from the help of an association involved in greening its courses, parents to maintain a hive, and serves as an example for other schools in the community.

[95] Tiefenbeck, V., Goette, L., Degen, K., Tasic, V., Fleisch, E., Lalive, R., & Staake, T. (2018). Overcoming Salience Bias: How Real-Time Feedback Fosters Resource Conservation. Management Science 64(3), 1458–1476

[96] M. Gillott, A review of occupant-centric building control strategies to reduce building energy use, Renewable and Sustainable energy reviews, vol.96, November 2018.

[97] « Les « cours Oasis » de la Ville de Paris », *Rapport d'information parlementaire*, n°1974, 6 December 2023.

CASE STUDIES (Box 3)

At **Piper's Hill school**, teachers implement the "flags" designed by the national curriculum[1]: reducing water consumption. Many reminders are displayed at several strategic centres of the school to invite them to follow these principles. Besides, panels also resume achievements. Boards display 'green school' initiatives such as water conservation, recycling, environmental education, tree planting, gardening and energy saving, all contributing to a more sustainable and eco-friendly school environment, to show pride in achievement and to encourage others to join.

At the **Bežigrad school** in Ljubljana, the corridors, which are obligatory places of passage, are becoming places of information, communication and encouragement for sustainable action. The panels are a fine illustration of interdisciplinary action where different teachers can rely on their pupils to make presentations. The student-created panels on sustainability employ various methods to illustrate the consequences of human actions on ecosystems. One poster features a tree with branches labelled "climate change" and "deforestation," symbolising negative effects on nature. Another panel displays the artistic and graphic skills of the designers, who illustrate the impact of human pollution on ecosystems in an impressive pile entitled "Human influence on ecosystem pollution". It visually communicates the negative impact of human-induced pollution on ecosystems. It highlights air pollution (such as smog, acid rain and greenhouse gases), land pollution (including habitat destruction, health problems and disruption of the food chain) and water pollution (toxic waste, oil spills and soil erosion). Another panel is a copy of an article which discusses sustainability, focusing on "Climate Leaders to Inspire Us." It highlights efforts by individuals to promote environmental awareness and sustainable practices. The exercise in English indirectly teaches sustainability by engaging readers with content that emphasises environmental stewardship, potentially influencing attitudes and behaviours toward a more sustainable lifestyle. In addition, some panels promote conservation efforts, symbolising a commitment to preserving nature. Overall, the students communicate their message through a mix of text, imagery and symbolism, encouraging awareness and action for a more sustainable world. There is a digital screen for real-time communication and broadcasting of the day's news, but it remains discreet and does not overshadow the students' productions.

Source: Fabrice Serodes, Bežigrad school, 9 April 2024

2.3.2 Sound management of digital and environmental resources

The scientific literature has identified a less costly but more revolutionary alternative to overcome the constraints of implementing the twin transition in schools. The objective is no longer to pursue the latest high-tech innovations. Instead, it is to manage time and costs by **optimising the utilisation of existing resources**. The potential of digital resources is often perceived as limitless. However, these resources require time to be expended, which is a particularly valuable commodity. One of the added values of current teaching is precisely the ability to better define the relevance of the use of digital technology in relation to the teaching situation. The transition to the digital world should not automatically lead to the abandonment of tried and tested teaching methods: public speaking competitions, writing exercises, the use of the blackboard, reading from paper. This means that digital technology can be used more sparingly, less systematically and with less dependency[98]. The twin transition should therefore focus on the need for **sobriety**.

In many schools, **sharing digital tools** to avoid over-consumption is a practice that is already under way, often initially due to a lack of resources. School leaders should turn this constraint into an asset by rigorously organising how digital resources get shared. This can be achieved by controlling the scheduling of computing rooms to avoid conflicting uses. This is also the case for the **Wi-fi network**, which is still limited in many schools. As observed at Bežigrad secondary school, shared wi-fi enables pupils to obtain information on activities at school. Teachers can also use it to use smartphones to take quizzes, without prior reservation, which saves time. This solution is demonstrably superior to individual use in terms of environmental impact. The utilisation of a shared Wi-Fi network is a considerably more environmentally friendly alternative to the deployment of individual 4G/5G networks, which are known to consume up to 23 times more energy. Above all, this should be an encouragement of collaborative projects through the prioritisation of resource allocation. It may also involve temporarily allowing students to use equipment they already own as a backup. Data also needs to be stored and made more accessible to combat the over-consumption of electronic devices.

2.4. Making the twin transition more attractive through interdisciplinary projects

A number of adult testimonies provide a critical overview of the teaching received over an extended period in a number of disciplines. According to the latest national polls, this is particularly evident when Europeans are asked about their history syllabus in areas that have been taught for years, such as the Second World War. A simplistic analysis often attributes this to teachers rather than pupils, but the underlying issue remains the need to develop sustainable lessons. However, the sequences approach, with its isolated and fragmented units, has resulted in the subjects of the twin transitions being addressed on numerous occasions, including within the learning pathways. These subjects have not been sufficiently

[98] Courboulay, Vincent (2023), L' Archipel des GAFAM. Manifeste pour un numérique responsable, Actes Sud, 2023

articulated. It is therefore essential to implement **a school-wide thematic programming policy on an annual basis to ensure that all members of the educational community have a clear understanding of the key areas of focu**s. In this context, the role of the headteacher in developing the programme is becoming increasingly crucial.

According to the team working on UNESCO's Greening Education Partnership (GEP), research shows that the green transition has mainly been addressed by science teachers. However, since the transition now affects various subjects and teaching volumes remain stable, it is essential to maximise potential by integrating multiple aspects of the transitions across subjects. Teachers should be encouraged to create **interdisciplinary projects** covering several tasks. The twin transition should be seen not only as a challenge but also as a way to meet other goals. The components of the twin transition, though not explicitly mentioned in curricula, can be integrated into existing subjects like citizenship, global issues, development education[99], and education for peace[100], following UNESCO's suggestion for a global approach[101]. In Slovenia, the new curriculum includes sustainable development as one of the objectives of the skills to be acquired within the framework of a course on active citizenship for upper secondary education. Similarly, in Estonia, the general objective of the 2021-2035 education strategy is to equip the population with the skills that prepare them to promote sustainable developments[102]. Ideally, this teaching of global citizenship can be deployed internationally, based on exchanges.

[99] EFEE (2023), Joint EFEE-ETUCE project 'European Social Partners in Education promoting Environmental Sustainability in School Learning, Teaching and Management

[100] UNESCO (2023), Draft revised 1974 Recommendation concerning Education for International Understanding, Cooperation and Peace and Education relating to Human Rights and Fundamental Freedoms, Paris, UNESCO

[101] Varcher, P. (2011). L'Education en vue du Développement Durable : une filiation à assumer, des défis à affronter. In F. Audigier et al. (Hrsg.), L'éducation en vue du développement durable : sciences sociales et élèves en débats, Cahiers de la Section des Sciences de l'Education, n°130, Université de Genève, S. 25-46

[102] European Commission/EACEA/Eurydice, *Promoting diversity and inclusion in schools in Europe. Eurydice report.* Luxemburg: Publications Office of the European Union, 2023.

These projects are often local and initiated by the school principal. Teachers and teams working on these initiatives need to be supported by the institution's leadership and, if possible, integrated at the organisational level (whole school approach, WSA)[103]. Green schools have in the past enabled school leaders to use sustainability to advance other educational agendas, such as improving literacy and numeracy. The relevant timescale for projects may be a quarter, semester or year, as running multi-year projects can be challenging, especially if the project leader has to move on to other projects or leave the institution.

CASE STUDIES (Box 4)

This is the case with a beautiful thematic project on seeds carried out by the primary school students in Perivolia, a suburb of Larnaca (Cyprus). They worked on a theatrical and choral performance that combined singing and music, the Greek language, Cypriot history, geography, poetry, and natural sciences (native seeds). They also engaged in a concrete agricultural project in collaboration with the local community, growing seeds in the school's courtyards and maintaining a whole community orchard on a former vacant lot. These long term projects are challenging to sustain in the event of significant changes within the teaching team, as new leadership often tends to start afresh and leave their own mark. In an ideal world, the distinctive projects that are unique to the school would outlive their initiators for several years, but they are quite rare.

Source: Fabrice Serodes, *Demotiko Scholeio Perivolion*, 17th October 2023.

This also facilitates the establishment of a **network of partners**. In the Netherlands, the ***SustainaBul*** VO[104] encourages schools to enhance the sustainability of their teaching. Schools collaborate to implement the SDGs. Ideally, they have launched an autonomous dynamic that the students take over.

[103] Mogren, A., Gericke, N., & Scherp, H. Å. (2019). Whole school approaches to education for sustainable development: A model that links to school improvement. Environmental education research, 25(4), 508-531; Tilbury, D., "Empowering learners for a sustainable future: a whole-school approach", European School Education Platform, 6th June 2024, https://school-education.ec.europa.eu/en/discover/expert-views/empowering-learners-sustainable-future-whole-school-approach

[104] SustainaBul VO

These new networks have given rise to new needs for support for schools, on a national, European or global scale. On a global scale, UNESCO is supporting schools in their transformation. In the European Union, the **Sustainability Accelerator Program** (SAP) has the objective of assisting educational institutions in the structural integration of sustainability into their educational systems. The programme provides guidance to schools through a transformative sustainability model, commencing with the identification of their specific needs and resources and culminating in the experimentation with and implementation of sustainability initiatives. The ultimate goal is the transition from project-based approaches to the systemic, long-term integration of sustainability in schools. The programme also encompasses an online conference where schools can share experiences, inspirations, and challenges, thereby fostering a community of practice around sustainability in education. Given the global nature of the issues, these partnerships sometimes go beyond the European framework. In France, the Grenoble Academy has fostered enduring partnerships, particularly with African nations, through the "Des Alpes au Sahel" and "ACTECIM" programmes, to enhance collaboration among educators, researchers, NGOs, and communities, focusing on sustainable development education and culturally inclusive practices.

The numerous **competitions** (in computing, robotics, and the environment) that have been established at the regional, national, European and international levels represent an effective motivational tool for students, offering rewards and fostering a sense of momentum through intensified efforts over a defined period, with deadlines serving as a crucial motivator. These competitions also provide a valuable opportunity for students to assess their performance in a competitive yet supportive environment. Some educators may be hesitant to embrace an excessively competitive approach. However, many competitions maintain a collaborative and instructive tone, particularly in the realm of digital and technological advancement. In the most favourable circumstances, this enables the emergence of genuinely innovative concepts. The European **EUCYS** prize, which was awarded in Katowice (Poland) in September 2024, recognised approximately ten projects that combined digital technology and the environment[105]. These included innovative beekeeping practices in Romania, the determination of biomarkers and pharmaceuticals in Riga's wastewater in Latvia, the use of algae and biodegradation in Cyprus, and the influence of plant cover on water retention in Spain.

2.5. The management of external support

2.5.1 Making teaching hours more sustainable with the support of the entire local educational community

The **effectiveness** of teaching hours in promoting sustainable development depends a lot on a multitude of factors within the **educational community**, extending beyond socioeconomic considerations to include cultural and local nuances. Introducing sustainable concepts into an environment already receptive to these ideas is less time-consuming, whereas teachers may face greater

[105] https://eucyskatowice2024.eu/projects/

challenges in fostering such awareness in less environmentally conscious settings. Concurrently, the educational institution serves as a social model, and the optimal scenario is when its pedagogical approach can have a constructive influence and facilitate positive transformation within the surrounding community and society at large.

Although school administrators may not control their institutions' initial environmental policies, they can strategically choose themes and priorities that align with both curricula and local needs. This allows schools to shift from merely teaching environmental knowledge to actively promoting sustainability through collaboration with local stakeholders. Addressing local needs is essential for effective education, as it makes learning more tangible for students and enables schools to contribute concretely. **Tailoring approaches to regional priorities** requires research and up-to-date knowledge of national climate emergencies, as highlighted by European and national statistics.

- In regions facing severe waste management issues, schools can introduce **zero-waste** programmes, particularly during the European Waste Reduction Week. Surprisingly, some EU countries with strong environmental reputations still struggle with waste. Finland, for instance, generated an average of 21 tonnes of waste per capita in 2020, making it Europe's most wasteful nation. Sweden follows closely with nearly 15 tonnes per capita, far exceeding the EU average of 4.8 tonnes. Targeted education in these areas could foster more sustainable waste practices.
- **Mediterranean countries**, particularly in the Balkans, Iberian Peninsula, France, Italy, and Slovenia, could focus their educational efforts on **fire prevention** and resource conservation. In Slovenia, for example, students recently participated in a campaign to replant forests damaged by fires. Engaging youth in such local conservation activities can raise awareness and promote practices that mitigate natural hazards, creating a lasting impact on the environment.
- Regions with significant **air quality** concerns, such as Poland, Belgium, Italy's Po Valley, Slovenia, and Andalusia in Spain, could benefit from locally tailored educational initiatives. By focusing on air pollution in school curricula, students can learn about the causes and impacts of poor air quality. Contextually relevant education can encourage young people to adopt behaviours and support policies that contribute to cleaner air, resulting in more sustainable living conditions.
- Countries at risk of future water shortages, including Spain, Greece, Belgium, Corsica, Portugal, and Estonia, should prioritise **water conservation education**. With high water stress predicted by 2040, schools can play a crucial role in teaching effective water management and conservation strategies. Empowering students with knowledge and skills to address water scarcity can significantly aid efforts to safeguard this vital resource.
- The latest European energy statistics reveal that Ireland, the Czech Republic, Poland, and Cyprus have the highest per capita **CO2 emissions**,

exceeding 10 tonnes per person in 2023. Educational programmes in these countries can focus on reducing emissions from transport, consumption, and lifestyle choices. Ireland, despite its relatively pristine environment, faces challenges like rising temperatures and frequent flooding. Comprehensive climate education, as suggested by Ireland's Climate Change Assessment, is crucial to support eco-friendly actions and ensure a "just transition" to a sustainable future.

By integrating environmental awareness and action into local realities, schools can foster a sense of ownership and shared responsibility among communities, driving positive and lasting transformations.

Teachers often express feeling alone and unable to provide sufficient assistance during class hours. However, a proven factor for improving hourly productivity is students preparing for the class in advance. This can be done in two ways. Formally, by completing exercises and assignments regularly, following the principles of retention and memory exercise highlighted by neuroscience, which is still challenging to achieve for many students, including those in privileged environments. Unfortunately, too few teachers consistently update the class schedule with brief but necessary exercises for regular learning, citing workload overload.

Teachers can also save time and gain more casual support through the foundation established by **the educational system and the student's environment (including parents and family)**, which guides, supports, and motivates them to participate in activities. To illustrate this, interviews were conducted with potential candidates for the EUCYS prize in Brussels in September 2023, as the young people in question showed considerable motivation and had developed twin projects that were both remarkable and interesting. A Cypriot project sought to examine the "transformation of natural seagrass residues into a phosphorus-absorbing ally through the utilisation of the residue as a fertiliser"; a Luxembourg project aimed to "investigate the impact of sulphur dioxide on fruticose lichens" in Luxembourg. It is evident from their testimonies that, while the majority of them initially became aware of the EUCYS competitions through their educational institutions, it was frequently on an individual basis, outside the conventional school environment, and with the guidance of their educators, that they cultivated their enthusiasm and brought their projects to fruition.

This applies more generally to access to information for as many people as possible. **There is an ongoing misconception about the pivotal role of the teacher.** It is important to note that with the emergence of **television and smartphones**, teachers are no longer the primary source of information or the main educators of children. Yet the proportion of high-quality educational content is particularly low, especially on television. Television, being one-third more influential, is the primary educator of students, especially when considering the time spent on the internet. With the widespread digitisation at home, the role of the teacher is diminishing, and one of the significant challenges of this digitisation is its regulation, as a considerable portion occurs in an unstructured manner at home. Given the limited ability of schools and even ministries to regulate an open

market, it is the responsibility of parents to ensure that the content they access is of an educational standard, in order to support teachers.

2.5.2 Saving time through delegation/outsourcing to accredited institutions

With the proliferation of new digital and green content, teachers are more and more inclined **to outsource some of this new content to specialist organisations** in order to save time in training and preparation. Through personal invitations, online conferences, or museum visits with pedagogical activities, teachers can lighten their teaching load for a few hours, and in some cases, even delegate evaluation responsibilities, while still being present during uncompensated extra hours.

CASE STUDIES

One example that is highly regulated by the Cyprus ministry is the **seven Environmental Information and Educational Centers**, such as Cape Greko[1]. These centres offer to host students for a range of activities spanning from half a day to several days. The activities take place in centres with a museum component (guided tours featuring specimens of local flora and fauna), as well as field observations, providing educational materials, particularly on local fauna. These materials can be adopted by teachers who visit the centre with their classes.

The **higher levels of education** (institutes, universities,…) are ideal partners for collaboration on these subjects, because they need practical cases for their studies, are more advanced and can make certain resources available. This type of outsourcing is not confined to the Mediterranean countries, where the climate is favourable, but can be widely used in the various MS, in the form of a seaside class, a green class or a snow class, provided that there is a local contact person and that the entire workload does not fall on the teachers, as is usually the case. They may be botanists, museum staff, sports teachers, tour guides, mountain guides... or even academics.

- In Germany, from a more academic perspective, yet still in close connection with nature, students are encouraged to visit educational locations of the Floating University Berlin, related to the natural environment. *Kidsuni* is the programme for young explorers in the rainwater retention basin of Tempelhofer Feld, which has enabled children to do research, enable and reflect on the city, art and space since 2018[106].
- Accessibility and price are key. MS play a role by often supporting these centres with public funds. Belgian teachers taking part in the KIKS project (Kunstmatige Intelligentie, Klimaatverandering, Stomata) can benefit from the support of the University of Ghent, which is providing a manual and

[106] Website https://floating-berlin.org/programmes/kids-uni/

examples of natural science lessons to explain how students can use artificial intelligence to measure plant adaptation[107].

Europe's many **museums** also have their part to play in the twin transition, and their potential is not yet fully exploited. Noting that teachers and educators are often "extremely busy and preoccupied with fulfilling learning plans and curricula", the SMK (Denmark) proposes to make an extra effort to reach out to them and respond to their needs through the SMK's digital collection and outdoor lessons. At the Senckenberg Museum in Görlitz, Germany, an immersive VR app allows students to shrink down to the size of a woodlouse and explore the earth. These examples allow teachers to delegate some of their content to institutions they trust, to diversify their teaching at a reasonable cost, and to strengthen schools' links with other local institutions.

From an environmental standpoint, aquariums have emerged as a pivotal force in the realm of educational advancement. In 2023, Nausicaa, Europe's largest aquarium, located in Boulogne-sur-Mer, France, inaugurated the Blue Academy, an 800 m² facility dedicated to young people. The Academy offers educational activities conducted by ten scientific mediators and five teachers appointed by the French Ministry of Education, with a particular focus on primary and secondary schools. The objective is to gradually cultivate an *O'céan* generation, in part through a dedicated application that enables users to undertake an ocean challenge.

This educational material can serve as a foundation for assessment, but it is often perceived by students as too simplistic. Additionally, the perspective of private centres may not always align with the pedagogical projects of teachers, schools, and curriculum requirements. In this context, it is realistic to use teachers as experts, responsible for adapting the content to the group. Some centres have already been accredited by ministries (Czechitas in the Czech Republic), but, **given that the immensity of these new varied sources, they are no longer systematically verified, and teachers need to redouble their vigilance to ensure that the content is relevant.** The presence of an academic is not a sufficient guarantee of the pedagogical accessibility of the resources. The specialised skills required for IT or the environment, for example through the "environmental education officer profession"[108], one of the new high-skilled jobs identified at the heart of the twin transition, can then be entrusted to these experts, and removed from the training courses of teachers. Therefore, schools must invest significant effort in **identifying partner centres that can readily provide usable turnkey solutions for entire teams.**

Another powerful alternative way of putting students in the context of the twin transition is through **work placements.** They are particularly well-suited to the dual energy transition, as the career opportunities are so new and technical. They are also a way of inspiring vocations and responding to the demands of the job market. Last but not least, they take the pressure off the teaching staff, as most

[107] https://www.dwengo.org/en/kiks/

[108] R. Arnold et alii, *Twin Skills for the Twin Transition: Defining Green & Digital Skills and Jobs, 2023*, AE4RIA, ATHENA Research Centre, Sustainable Development Unit.

of the training is outsourced. We simply have to make sure that they are equally distributed, as one of the recurring problems is the difficulty for young people from disadvantaged backgrounds without support to find a good placement. Ministries and educational institutions must therefore do more to negotiate with the business world to open up more places, which is in the long-term interests of these sectors.

2.5.3 The right use of external evaluation

Progress is challenging in the absence of adequate monitoring and evaluation. The use of external assessments is currently restricted, which may result in some schools lacking benchmarks. Only one third of the European education systems report that their external school evaluation frameworks include specific criteria related to digital education. Audits are infrequent, and institutions rely on **self-evaluations**. However, it has been observed that institutions may be reluctant to self-evaluate, as is the case in Cyprus. There are digital and green labels in place, but they are often separated and not always verified or sought after. **Inspections** in the digital and environmental domains are few. Teachers and principals alike can adopt a different strategy, working only on the most profitable and valued subjects.

That's why it is essential for inspections to be reformed, to adopt a global vision and take into account efforts in the fields of digitalisation and the environment. **The awarding of logos, certificates and labels** has helped to implement the transition. Schools can therefore follow an indicative grid and be assessed, such as the 3,139 Irish green schools with a Green Flag and the 12,500 French E3D[109]. **Networking** to achieve these objectives is also important, such as the international Eco School movement[110]. Since 1992, in response to UN challenges, the Eco Schools network has been extended to 73 countries by FEE member organisations and in 26 countries by international schools. In Slovenia, the Eco school project comprises several projects, including one on food for two days, which invites pupils to think about food outside school. It also enables information to be shared, at least on a national scale. In all cases, the criteria for the evaluation of the twin transition, which can be similar to those already applied in other projects and competitions (quantity, quality, methodology, impact, originality), must be clear to all those involved from the outset, adapted to the institution and flexible with a view to improvement he effectiveness, particularly in terms of time, of the implementation of the twin transition.

2.6. Efficient time management: strategies to prevent unproductive hours and optimise schedules

For some time, the importance of scheduling has been overlooked, considered only a secondary technical matter. Scheduling adjustments have been often denied due to a lack of time and resources within various educational institutions. Internally, schedules may lead to significant disparities among teachers[111]. With equal salaries and qualifications, some find themselves working for periods of time up to twice as long. The same weekly teaching load of 15 hours can thus be

[109] https://eduscol.education.fr/1118/la-labellisation-e3d
[110] https://www.ecoschools.global/
[111] CSEE/ETUCE/EFEE, *Towards a Framework of Action on the Attractiveness of the Teaching Profession through Effective Social Dialogue in Education*, 2023

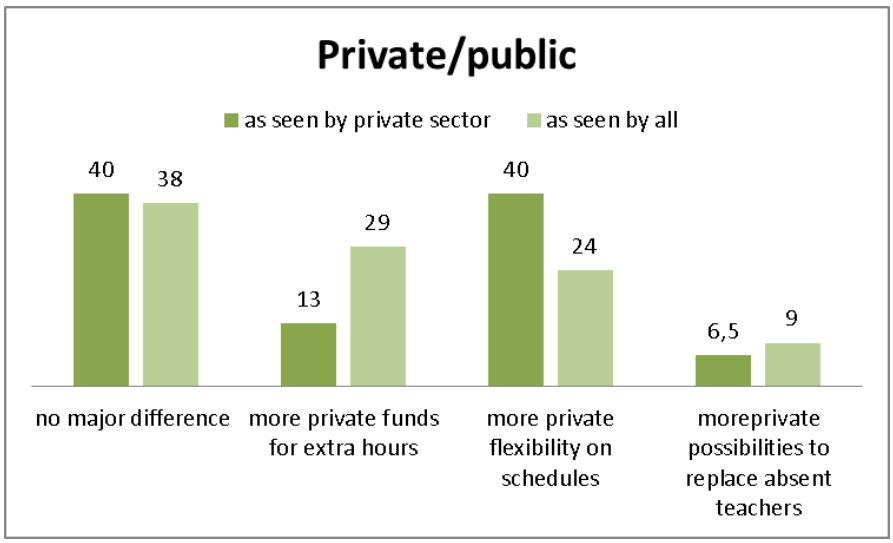
distributed over two to five days, fundamentally changing the daily lives of teachers. In the context of the COVID-19 pandemic, this subject has become a little more sensitive, as the contrast between teachers required to teach in person and the trend towards remote working, which has continued not only in many companies but also in international institutions, has intensified.

The technological tools available to managers have, for several years, enabled the creation of complex schedules that take into account a multitude of criteria. **Teaching hours and extra hours** can now be managed digitally. Digital tools now incorporate artificial intelligence calculations to design more optimal schedules[112].

2.6.1 More grouped teaching hours

Despite the massive use of digital software to integrate the numerous constraints, managers usually cannot start composing schedules before the very end of the schoolyear and are interrupted by holidays and it would be unrealistic to design "just in time" timetables without any intermediate hours. They are inclined to fix issues rapidly as it requires a lot of time. In addition, the ESMTT survey confirms that private schools have a greater degree of flexibility in this area than their public counterparts.

Figure 4. The different ways of implementing twin transition as seen by respondents from public and private establishments (in percentages)



Source: ESMTT survey (2023)

As a consequence, teachers are obliged to stay longer on school premises. In order to accurately measure the minimum working time of teachers in schools, it is not enough to count the official teaching hours for which they are paid**. It is also necessary to count the actual presence in the school as a result of their tasks and of the actual distribution of teaching hours, which always exceeds their statutory hours. On average, it can be considered teachers spend at least between 20 and 30 hours at school**. These hours are

[112] See getclockwise.com

necessary to complete the course to make tasks which are better performed at schools: to make copies, to check mail, to prepare classrooms, to discuss with colleagues, heads, students or parents, to use the resources in the laboratory or media library, to read or borrow resources, to fill in and submit paper-based administrative forms and to vote.

However, as this key moment will shape the entire year to come, it would be worth **investing more time** in it. Teachers can use the free periods only if the school is fully equipped. Our experience in a number of schools, even those with newer premises, is that they can hardly be fully effective because teachers do not have their own working space and need a lot of personal material. Besides, some lost hours are scattered and fragmented and some **teachers schedules are still poorly arranged**, some teachers having to come back to school for just an hour of class, which is all the more inefficient because these hours are isolated. By a multiplier effect, each single hourly problem has repercussions throughout the year, for around thirty-five/forty weeks. Grouping these hours together would make for greater efficiency by limiting travel and transport time and allowing teachers to work from home with their equipment.

Table 1. Measures considered effective by respondents compared to those suggested online

Solutions generated by A.I.	Efficient measures according to respondents
Digital Lesson Planning Platform *Flexible Work Arrangements Absence Management System* *Digital Professional Development* *Sustainability Integration in Curriculum* *Performance-Based Compensation* *Virtual Teacher Collaboration Hub*	A four-day week with a day free for projects (48.28%) Many possibilities to implement **green projects** during paid extra-hours (41.38%) A timetable which takes into account the family-life balance of each teacher (41.38%) A new **IT (Information Technology) charter** for the use of digital tools (34.48%) A day teleworking with online interactive sessions (31.03%) The possibility to switch: working more some weeks and working less at other times (31.03%)

Source: ESMTT survey (2023)

The ESMTT survey showed strong support for a 4-day week, backed by research from Cambridge University and trials in Ireland. In the UK, sixty-one companies implemented a 4-day week for six months with no pay reduction, leading to reduced stress and illness among employees, and improved retention[113]. Companies met their goals by enhancing work practices, such as shorter meetings and better task handover processes. In schools, similar trials are underway, such as at Paloke in Brussels, where a 4-day week was introduced in 2024 to address

[113] K. Lewi et alii (2023), The results are in ; the results of the UK's four day week pilot, Autonomy, https://autonomy.work/wp-content/uploads/2023/02/The-results-are-in-The-UKs-four-day-week-pilot.pdf

teacher shortages, reducing commuting time and giving teachers more time for lesson preparation and rest.

2.6.2 Replace more efficiently

A sensitive political issue is that of teacher **replacements**. Indeed, teacher absenteeism is noticeable, even though the absenteeism rate of teachers falls perfectly within the average for employees, despite the significant challenges and physical fatigue inherent to this profession. In reality, in many other professions, work can be often postponed. For teachers, it is difficult to be satisfied with a policy of systematically replacing every hour, sometimes at the last minute, and without additional payment (Ukraine, Slovenia).

The quality of replacement depends on the teams. Above all, the teaching community needs to change its relationship with time. Time cannot be considered in accounting terms and some hours may be lost, as others are "regained". It may be worthwhile converting the time lost to students (including any errors, hesitations, omissions or pedagogical doubts) into time gained in terms of quality. **The main problem is to implement this qualitative policy, the effects of which are not immediately visible to pupils and parents.**

Schools face the challenge of the structural inability to find sustainable and easy solutions to replace teachers. Replacement rates rarely reach 50%. Yet, simple solutions are made possible by the digital transition:

- Now the digital transition allows colleagues to be informed instantaneously of timetable and available hours they could replace. Using **collaborative spreadsheet** software, teachers can quickly communicate their availability and the administration can then validate or update a final schedule. However, a recurring issue is that teachers who need to be absent at short notice often leave minimal specific instructions. The efficiency of this new digital replacement system also presupposes a high level of mutual trust among colleagues. In any case, the primary purpose of **online schedules and lesson planners** is to ensure pedagogical continuity. Therefore, it is essential that they are consistently updated by teachers.
- In **the absence of willing or available colleagues, another solution has emerged, especially during the pandemic, which involves, granting the possibility for a teacher who cannot be absent but still wishes to communicate directly with their students to conduct a partial or full video conference**. This practically requires a **resource person** (a teacher, an assistant, or an educational advisor) to open the classroom and supervise the students while all or part of the class is being broadcasted. Although this option cannot be made compulsory for those who are absent, it can be offered on an occasional basis, allowing conscientious teachers to have peace of mind, especially in the case of extended absences or important assignments. This new option, made possible by video conferencing software, is still largely underused due to simple organisational reasons. Specific rooms can be dedicated to this earning type of arrangement. These inevitable periods offer students a

chance to take a break and collaborate. This system is particularly appropriate for schools with a minimum of thirty/forty colleagues.

- Apart from colleagues, it is entirely feasible for teaching assistants and monitors to oversee assignments without necessarily engaging in formal teaching. As supervisors or education assistants may not necessarily be disciplinary specialists, they can focus on **project supervision** for the school where they work. Digital and green transitions provide alternative activities that could be consistently carried out throughout the quarter/semester or year and progressed in the event of a teacher's absence. These project hours would enable collective achievements, and this would enable involving assistants in the projects of the institution, a task less tedious than mere supervision.

It is precisely during times of disrespect and challenges to a teacher's authority that the importance of the teacher's role becomes more pronounced, particularly when that role is lacking. Putting an end to the excessive individualisation of the teacher as a model figure, in favour of the valorisation of team time, is one way out of this impasse.

2.6.3 Optimisation of part time

In addition to full time, there are other working arrangements such as part time, often taken for family reasons. In some MS, such as Germany, it is widespread. Some would even like to use part-time teaching to make up for the shortage of teachers in certain sectors, by regaining this reserve of potential time. This is largely an illusion because, as practice and several studies have shown, the tasks outside the classroom tend to be those of full-time teachers: it is more a case of working three quarters of the time than half time[114]. On the other hand, there is every reason to believe that these teachers should be more systematically involved in implementing the additional tasks of twin transition.

2.7. Beyond a quantitative approach

In recent years, education systems have adopted a more administrative view of time, contrasting with the business world's shift towards outcome-focused management (e.g., Google). Applying this to education is challenging due to the twin transition and the significant time it requires. While intended to enhance teacher responsibility and productivity, this approach is impractical, given teachers' frequent curriculum changes, increased interactivity, and evolving challenges[115]. Comparing teachers' working hours with other professions overlooks **the unique, intense nature of teaching**, which involves constant *live* interaction. **Quality is not tied to lesson length**, as shown by Finland's example. Organisations now advocate replacing this quantitative approach with a results-based policy.

[114] Seibt R and Kreuzfeld S (2023) Working time reduction, mental health, and early retirement among part-time teachers at German upper secondary schools - a cross-sectional study, Front. Public Health 11:1293239, doi: 10.3389/fpubh.2023.1293239

[115] Schulte, Matthew, « Exploring the Inherent Tensions at the Nexus of Education for Sustainable Development and Neoliberalism », *Journal of Education for Sustainable Development*, v16 n1-2 p80-101 Mar-Sep 2022

3. A RISING NUMBER OF DIGITAL & GREEN ACTIVITIES OTSIDE CLASS HOURS

KEY FINDINGS

This chapter reveals a significant increase in digital and green activities during instructional time, with teachers facing an expanding workload of non-teaching tasks. The study estimates 4-5 billion hours of invisible work annually across the EU, representing 47-57% of teachers' total hours. Working weeks for teachers range from 35-47 hours, exceeding both legal limits and averages in other professions. Workload distribution varies by school type, subject, and education level, with secondary teachers experiencing heavier burdens.

Salary disparities among EU Member States further complicate workload management. Non-teaching tasks, including lesson preparation, grading, and administrative duties, are often poorly organised and insufficiently productive.

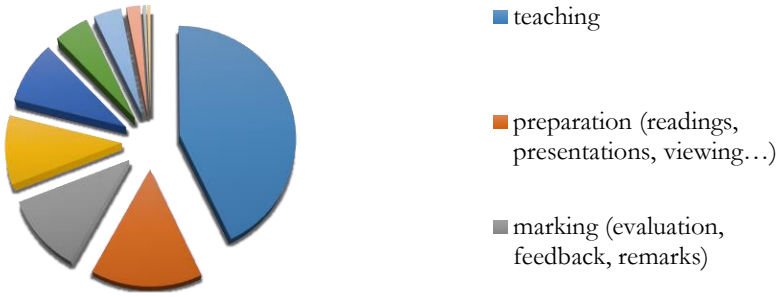
While digitisation offers potential for task simplification, it requires proper implementation and skill development. The chapter emphasises the need for better time allocation and management of extra-curricular activities, rather than imposing additional tasks on an already strained workforce.

3.1. The five billion hours continent

Scientific studies on education have long aimed to adopt a global perspective on teachers' time use by including estimates of non-teaching hours to obtain a realistic total of service hours. However, this effort faces several methodological challenges, as measuring these extra-curricular hours has proven difficult for several reasons.

- A primary challenge lies in defining these hours. Cataloguing the full diversity of non-teaching tasks is challenging. In recent years, these have expanded into core activities and many derivative tasks, particularly due to the digital transition, leading to work fragmentation. They can be broken down into as many as fifty activities over the course of the year (See Table in Annex).

Figure 5. A teacher's time divided across multiple responsibilities



Source: McKinsey (2020), Fabrice Serodes (2024)

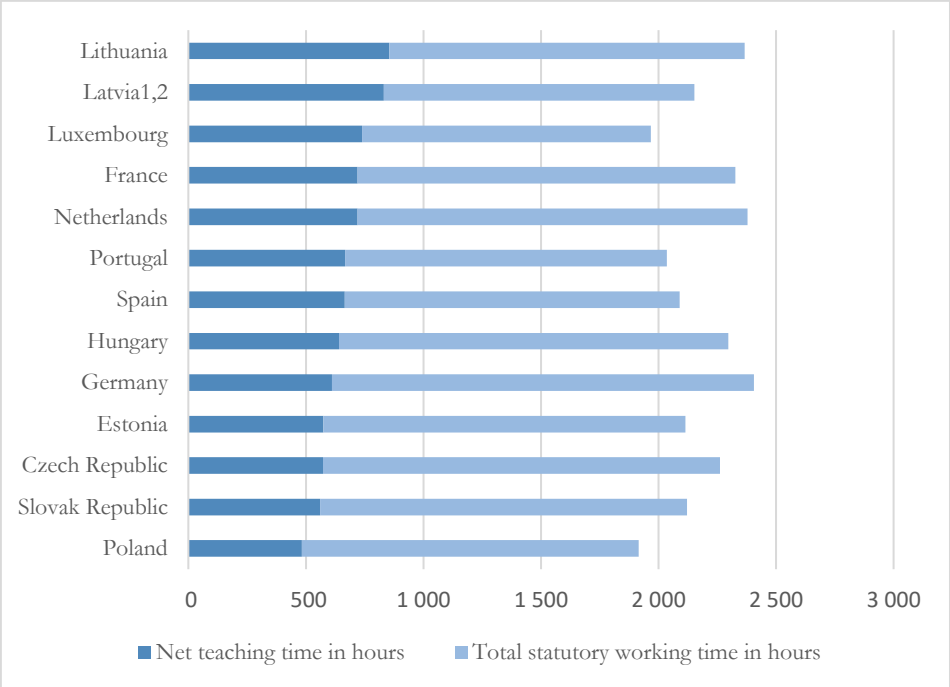
- The second is the methodology used to measure non-instructional hours. These hours constitute a paradox, because even though they are absolutely strategic for planning teaching, whether for school heads or teachers, they are and remain relatively difficult to evaluate insofar as they are neither visible, fixed nor measured. Researchers lack scientific data and must rely on surveys. Some studies have proposed estimating and mapping this hidden overtime. As this time is mostly spent in the privacy of the home, in the evenings and at weekends, it is difficult to measure these activities outside school. Some researchers have suggested interviewing teachers on a voluntary basis, using a survey database sent to teachers who are asked to fill in their activities, or using diaries filled in by teachers themselves. Whatever the activity, it is always difficult to measure exactly how much time is spent on it, not only because several activities can be done at the same time, especially at home - although this is not recommended in terms of effective time management - but also because it is difficult, tedious and requires a good deal of discipline. Some activities cut across several categories: for example, cultural outings for reading, which are particularly important for teachers and are both a leisure activity and a professional activity for drama teachers who go to the theatre, or for art or history teachers who go to museums. Thanks to digitalisation, a number of digital tools can measure time spent on computers. There are brand new digital tools, such as *Jibble*, which can use artificial intelligence to measure a team's online activities, but it is still difficult to do this for non-digital activities, of which there are still many, and which are related to teaching, because of all the preparation work and correction work. It is also unrealistic to imagine the intervention of an external third party. Therefore, the practical application of this measure seems to be difficult.

According to all the measurements carried out, overtime seems to have increased overall for teachers in all the EU Member States, unlike teaching hours. **Invisible working hours have risen** at least in 24 EU MS between 2013 and 2018 and have risen by 5-10% between 2016 and 2022 in all OECD countries. On average,

they account for between **47% to 57%** of teachers' hours[116] and represent the bulk of working hours in European countries, with the exception of Luxembourg, where teaching hours remain the majority. Some of the teachers who responded to the ESMTT survey even put this non-teaching time at 61%. On the basis of the 5.1 million primary and secondary school teachers in the EU (2018 estimate), the number of these hours can be roughly estimated to be between **4 and 5 billion hours of invisible work per year across the EU**. This trend is all the more remarkable in that it takes place against a backdrop of global stability or decline (for instance for male workers in Finland, Austria, Greece)[117].

This rise partly explains the views of teachers' professional associations, most (55%) of whom feel that the workload has already become excessive, especially in terms of preparation, marking and administrative tasks[118]. This estimate challenges politically driven narratives against teachers, which often exaggerate the number of lost hours and foster unrealistic expectations about this additional territory to "conquer." In practice, the room for manoeuvre is considerably limited for implementing new policies. For managers, this means that time management is much less about creating or imposing new additional tasks outside school hours than it is about **better allocating, managing and redistributing an extra-curricular time allocation that is often poorly organised and insufficiently productive**.

Figure 6. Number of hours of teaching and percentage of working time spent teaching for upper secondary teachers (2021)



Source: OECD (2022)

[116] OECD, *Education at a glance*, 2024
[117] Eurostat (LFSQ_EWHUN2), mentioned by N Contouris et alii, Benchmarking Working Europe 2023, ETUI and ETUIC, 2023, p.58.
[118] G. Thompson, The Global Report on the Status of Teachers 2021, Education international. 2020 survey based on 128 actual responses from teachers' associations or organisations.

Table 2. Some examples of the proportion of teaching hours in the total service for upper secondary teachers

	Percentage of total statutory working time spent teaching	Total statutory working time in hours	Net teaching time in hours
Latvia	63,0%	1 320	832
Luxembourg	60,2%	1 229	739
Lithuania	56,5%	1 512	854
Portugal	48,8%	1 368	667
Spain	46,7%	1 425	665
France	44,8%	1 607	720
Netherlands	43,4%	1 659	720
Hungary	38,7%	1 656	641
Estonia	37,3%	1 540	574
Slovakia	36,0%	1 560	561
Germany	34,0%	1 795	610
Austria	33,3%-34,1%	1736-1776	592
Czech Republic	33,9%	1 688	573
Poland	33,8%	1 432	483

As regards the working week, the average hours worked vary but are high in all cases, **between around 35 and 47 hours a week**, both compared to the legal working week and to the average hours worked in other occupations. In most European countries, teachers in lower secondary education work between 35 and 40 hours per week. National surveys show much higher averages. In Denmark, lower secondary teachers work an average of 32 hours per week. In Italy, a recent survey put the average working week at 35.9 h/w[119]. In France, teachers report working 42,5[120] h/w. In Germany, a recent study which aims to recognise all hours proposes paying teachers for 46-48 h/w. Similarly, in Flanders (Belgium), a survey of 9600 teachers showed an average of 47 h/w. In Poland, recent surveys reach the same figure of 47 h/w[121].

In detail, this burden can vary.

[119] Survey by the Osservatorio sui Conti Pubblici Italiani (2022), https://osservatoriocpi.unicatt.it/ocpi-pubblicazioni-le-ore-di-lavoro-dei-docenti-italiani-i-risultati-di-una-nostra-indagine

[120] Dion É. , Feuillet P., 2022, "La moitié des enseignants déclarent travailler au moins 43 heures par semaine", Note d'Information, n° 22.30, DEPP. https://doi.org/10.48464/ni-22-30

[121] IBE, Liczą się nauczyciele. Raport o stanie edukacji 2013, Warsaw, 2014

- The distribution of the allocation of time varies according to the type of school in question: in Germany, the number of compulsory hours varies by up to 12 per cent, which is slightly below the OECD average. In the countries in the following comparison group, the range is much wider: In Denmark, the required number of hours varies by up to 42 per cent depending on the type of school, and in countries such as Austria and Spain by more than 20 per cent[122].
- It depends also on subjects and levels taught: sport teachers spend by nature less hours marking and preparing; it appears also that teachers in human sciences may have more extra-work dedicated to marking assignments (in philosophy, literature,…) than teachers in science[123]. One could question the equality and even the existence of a common status: it is no longer obvious that a music teacher performs the same kind of task as a philosophy marker in the A-Level examination. Without pitting teachers against each other, it is not unreasonable to work towards greater equity among colleagues, and there is no reason it should be the same people who play a leading role, leading to situations of overwork and dissatisfaction. It would not be unreasonable to assign the implementation of the transition to teachers who, for example, have less marking and preparation work than others, rather than assigning sustainability to science or geography teachers.
- This applies more to secondary school teachers than primary school teachers[124].
- Similarly, salary conditions vary considerably between MS. One cannot manage or ask for too many teachers when they are not paid enough. Management cannot ignore the overall level of remuneration. In the primary sector, the differences are particularly important. While Luxembourgian, Portuguese, and Spanish teachers are at the top of the scale, this is not the case for their Hungarian, Czech, or Austrian counterparts[125]. Salaries for professors can vary by a factor of two. Under these conditions, it is difficult to ask them to work much more.

3.2. How to manage non-teaching compulsory activities?

Teachers often need to perform certain instructional tasks, and non-instructional tasks are part of teachers' workload and conditions[126].These activities include systematically:

- **preparing and planning lessons.**
- **marking, assessing, oral and written evaluations, participation in final evaluations (jury).**

[122] Rackles, M (2023), Lehrkräftearbeitszeit in Deutschland - Veränderungsdruck und Handlungsempfehlungen. Expertise im Auftrag der Deutsche Telekom Stiftung, Berlin: Telekom Stiftung

[123] Survey by the Osservatorio sui Conti Pubblici Italiani, 2021, https://osservatoriocpi.unicatt.it/ocpi-pubblicazioni-le-ore-di-lavoro-dei-docenti-italiani-i-risultati-di-una-nostra-indagine

[124] For France see DEPP, *Note d'Information*, n° 22.30, octobre 2022.

[125] Indicator 4.c.5. of UIS, *UIS SDG Database*, Montreal, 2023. http://data.uis.unesco.org/index.aspx?queryid=3798.

[126] OECD indicator 2020

- **responding to questions raised by students, colleagues, parents, and at staff meetings;**
- **participating in class council.**

These activities are sometimes strictly regulated. The most popular legal obligation is to accompany new teachers in at least 15 EU countries. **In many countries, these activities are considered as part of their overall hours.** Incentives such as reduced teaching time and financial compensation are rare for such duties[127].

- **Some countries regulate a statutory time work package**, which includes all the tasks carried out by teachers, in schools or elsewhere, except those who fall under overtime. According to previous Eurydice reports for 2006, a number of countries (Greece, Poland, Slovakia) took measures at an early stage to enshrine these extra-curricular obligations in law: supervision after school hours, standing in for absent colleagues and accompanying new colleagues. In Slovenia, the salary is based on two equal parts of approximately 20-25 hours of lessons, and the same approximate amount of other hours. These hours spent for the implementation of the twin transition are then mixed with other activities and not always visible.
- There are less formal requirements on performing specific non-teaching hours in France, Finland, Italy, Belgium (French Community). In France but also in Portugal, this time corresponds to the legal working time of all employees. In France, the service hours have been recently clarified to integrate these tasks into the overall service hours[128]. The legal duration of work (1,607 hours per year) applies to teachers as well as to all employees, but, unlike other professions, it does not constitute the threshold from which are calculated overtime (this threshold is defined by the time teaching statute). In Germany, the total working time of civil servant teachers is governed by the regulations of the civil service of the *Länder* (between 40 and 41 hours per week depending on the *Land*) and by collective wage agreements for contract teachers (from 39.4 h to 41 h). In Austria, the overall weekly limit is 40 hours. In Belgium (Flemish Community), only some additional non-teaching hours are defined at school level.
- On the other hand, another group of countries has opted for a more liberal policy, with less explicit statutory obligations, as in the Netherlands, Ireland, Estonia, Romania and Sweden, where it is more difficult for school heads to rely on national texts to impose hours and where this depends on the local context. In the Netherlands, only the overall working time is specified in the legislation.

These tasks lend themselves particularly well to digitisation, which would simplify them. Some studies suggest that AI can reduce teachers' workload by taking over routine tasks, provided they have the necessary skills. Fulfilling an old hope raised

[127] OECD 2020

[128] Décret n° 2014-940 du 20 août 2014 relatif aux obligations de service et aux missions des personnels enseignants exerçant dans un établissement public d'enseignement du second degré - Légifrance (legifrance.gouv.fr)

by digitisation[129], recent papers suggest that if teachers are supported to use these tools, they can save a significant amount of time[130]. (Hashem et al., 2023). However, this needs to be complemented by questioning about the use of the newly available time.

3.2.1 A more collaborative and digital preparation time

Seen from the outside, the time teachers spend preparing lessons has long been underestimated. The recurrence of lessons, at the same level and from one year to the next, specific to teaching, can indeed lead to routines that save a lot of time, especially for experienced teachers. Despite this, teachers, even experienced ones, must plan their various tasks regularly, which takes a certain amount of time: refreshing knowledge, even finding new material to avoid boredom and encourage self-stimulation, planning sequences, assessments, events, etc. Because of the fast-changing nature of these disciplines, the programmes have changed more regularly, requiring regular adaptation. The digital transition requires many hours of learning. For the green transition, teachers face significant challenges in preparing resources for teaching climate change due to the limited coverage in their curriculum, leading to extensive time commitments for adaptation and creation. In addition to their professional obligations, teachers may find themselves overwhelmed by the sheer volume of information at the outset of their careers, particularly given the current abundance of information.

- **The new digital tools offer the first opportunity to save time, provided they are used properly**. As for **preparation**, digital technologies have been mainly used on a voluntary basis by teachers to prepare their lessons (looking for information; elaboration class material; creating exercises, summarising a text)[131]. The incorporation of digital content into the curriculum has led to an increase in the workload for educators. A survey conducted by PISA in 2018 revealed that only 61% of 15-year-olds in OECD countries attended a school where teachers had sufficient time to prepare lessons integrating digital devices. In Latvia, Hungary, and Spain, less than 40% of principals reported that teachers had sufficient time to prepare lessons with digital educational materials[132]. Nevertheless, once proficiency in the most recent digital tools has been achieved, greater efficiency will be attained over the longer term. This is the most obvious potential timesaver, even if the productivity gains must be put into perspective given the diverse and precise nature of the teachings. With a little tweaking of the basic software to suit the local curriculum, it is now possible to…

[129] Selwood, I., & Pilkington, R. (2005). Teacher workload: using ICT to release time to teach. Educational Review. https://doi.org/10.1080/0013191042000308341

[130] Ahmad, S., Alam, M. M., Rahmat, M. K., Mubarik, M., & Hyder, S. (2022). Academic and Administrative Role of Artificial Intelligence in Education. Sustainability. https://doi.org/10.3390/su14031101; Hashem, R., Ali, N., El Zein, F., Fidalgo, P., & Abu Khurma, O. (2023). AI to the rescue: Exploring the potential of ChatGPT as a teacher ally for workload relief and burnout prevention. Res. Pract. Technol. Enhanc. Learn. https://doi.org/10.58459/rptel.2024.19023

[131] DEPP, Dossier « Les technologies de l'information et de la communication (TIC) en classe au collège et au lycée : éléments d'usages et enjeux », October 2010 https://www.education.gouv.fr/media/15203/download

[132] OECD (2023), Shaping Digital Education: Enabling Factors for Quality, Equity and Efficiency, OECD Publishing, Paris

_define the learning objectives
_search for more relevant information in the form of precise questions,
_collect a wider range of sources,
_locate passages in documents,
_synthesise information,
_analyse text or images,
_translate complex sources more quickly,
_check the spelling and grammar of courses,
_automate a number of writing tasks,
_create educational materials (quizzes, test questions, rubrics, study guides)
_as well as create presentations on a given topic…[133]

A McKinsey report, as referenced by the American Office of Educational Technology, estimates the current preparation time for American, Canadian, Singaporean, and Australian teachers to be 11 hours, with a projected reduction to 6 hours[134]. **Some software and online platforms claim to save schools time through the use of artificial intelligence.** For example, the British software *TeachMate.ai*, used by some Irish teachers, claims to save teachers more than 10 hours a week by generating ideas, creating presentations, helping to fill in reports, and completing absence requests. It can also assist school leaders in completing group interviews, performance observations, concept mapping, conventional text assessments, analysing regular coursework for evidence of competence and completing their School Improvement Plans (SIPs) and Self-Evaluation Forms (SEFs). *Magicschool*, used by Dublin city schools, claims to save time, combat burnout, and promote sustainability. For **students with special needs**, who usually require more time and attention from the teacher, it is possible to outsource some of these tasks using conversational robots such as *schoolai*[135]. Numerical exercises can be automatically adapted to the computer according to given criteria (font size, limited number of questions, etc.). The teacher can then quickly monitor and measure student-machine exchanges and interactions[136], even though we need to distinguish between commercial exaggeration and potential productivity gains that depend on the diverse and specific needs of students. The *nolej* software also promises to save teachers around ten hours per project by integrating directly into work environments and web browsers to quickly generate teaching tools such as quizzes and flashcards, or to support flipped classes. A priori, the choice of these tools can be left to the teachers, but the use of common software, especially when it is

[133] Samala, A. D., Zhai, X., Aoki, K., Bojic, L., & Zikic, S. (2024). An in-depth review of ChatGPT's pros and cons for learning and teaching in education. International Journal of Interactive Mobile Technologies, 18(2), 96–117. https://doi.org/10.3991/ijim.v18i02.46509
[134] Bryant, J., Heitz, C., Sanghvi, S., & Wagle, D. (2020, January 14). How artificial intelligence will impact K-12 teachers. McKinsey.
[135] Available at schoolai.com
[136] Vuorikari, R., Punie, Y., & Cabrera Giraldez, M. (2020). Emerging technologies and the teaching profession: Ethical and pedagogical considerations based on near-future scenarios (No. JRC120183). Joint Research Centre (Seville site)

common, is more productive and coherent and therefore requires a choice by the management.

- **A second means to save time is the digital pooling of schools' resources**. For a long time, the individual approach to finding resources was the rule, depending on the teacher's knowledge, training, personal preferences and plans. Despite efforts to utilise recommended curriculum resources, many educators still resort to conducting their own research, which proves time-consuming and challenging to integrate into classroom instruction. As a consequence, a large number of lesson sequences overlap. In centralised and convergent curricula, the time spent searching for information can be extremely high. Pooling resources at the national, academic, regional, or school level is one way of compensating. Worldwide, dedicated digital resources provide teachers with course materials on the climate[137]. This voluntary archiving and indexing, on a secure local cloud, would give teachers more time to focus on important subjects. This access would quickly provide a model, even if the teacher has to personalise it.
- A joint, coordinated approach to the issues, which require a minimum of **collaborative preparation**, is more appropriate for the twin transition. Some meetings are already used to jointly prepare the overall direction of courses, but they are often held on a discipline-by-discipline basis, given the difference in subject matter between maths and history teachers, for example, who do not have the same pedagogical priorities, and in limited time. In Sweden, headteachers have already been able to encourage collective course preparation at the local level by planning regular team meetings (around ten per term), but they tend to underestimate these needs, even though 75% of teachers testify to the need for significant collective consultation time[138]. It would therefore be useful to schedule at least one general meeting for the twin transition, even if it means supplementing it with more non-formal exchanges during the year.

The extent of this reorganisation has not yet been fully grasped by legislators and practitioners. **To take stock of this evolution, the workload has to be rebalanced**. The ministries and authorities responsible for timetabling services should allow more time for course preparation. To this end, the Latvian Ministry of Education has increased the number of hours spent preparing for 2022 within the overall workload.

3.2.2 A change in assessment methods

One of the key challenges associated with the twin transition is the extent to which traditional **evaluation** methods can be adapted to accommodate the incorporation of new forms of evaluation, particularly in the context of school performance assessment by teachers. The digital transformation of education has demonstrably begun to reshape assessment practices. While the initial optimism regarding the

[137] https://oercommons.org/hubs/climate ; https://www.edx.org/school/sdgacademyx

[138] Survey of 2,285 teachers and 2,094 school heads Martin Jakobsson, Ann-Christin Randahl et Kenneth Nordgren, « Planification et préparation collégiale des cours en Suède », Revue internationale d'éducation de Sèvres, 90 | septembre 2022, URL : http://journals.openedition.org/ries/13000 ; DOI : https://doi.org/10.4000/ries.13000

liberation of significant classroom time through digitalisation may have been somewhat overstated, it remains undeniable that this shift allows for the provision of **quicker personalised feedback** based on data analysis and calculations that supplement human evaluation. For example, the *Včelka* application draws on findings from educational psychology that advocate for adapting teaching methods to meet diverse learner needs. Similar to traditional paper-based methods with written comments and periodic data reviews, this personalisation is likely to occur primarily outside of class time. The digital transition has demonstrably simplified the monitoring of student progress and achievement.

- First, **online and digital grading processes have already facilitated significant time savings for educators**[139]. Since 2012 and Hewlett's first trials, the use of deep learning has enabled automated corrections that can analyse the grammatical consistency or overall coherence of a text and alleviate routine correction tasks with human supervision[140]. Provided that pupils are duly authorised, capable and have access to a computer, the automated correction of simple quizzes offered by websites such as *Socrative* can facilitate more efficient use of time at the end of primary school and the beginning of secondary school.
- Secondly, more fundamentally, digitisation allows a better **follow-up of students**. It offers opportunities, which are still underused such as actionable data on their students' strengths and weaknesses which allows teacher to know more about the educational history of their students, to put their results in perspective and it is a valuable tool for the measurement of student progress[141]. The digital environments enable the tracking of student performance over extended periods through the implementation of **digital portfolios**. To maximise pedagogical effectiveness, school management must prioritise the selection of appropriate assessment tools that align with educator comfort levels and effectively present student performance history through data visualisation tools such as graphs and curves[142]. This data makes direct exchanges with pupils, e-mail communications with parents and class councils with colleagues more effective. To facilitate successful implementation, targeted in-house training initiatives, alongside mentor or brand manager support, are particularly beneficial, especially for new teachers. For this purpose, a burgeoning market offers a plethora of online platforms and tools featuring auto-graded exercises that provide immediate feedback and performance data.

At the same time, **the accumulation of new skills has increased the complexity of the proofreading process**, making it difficult to disentangle them *a posteriori* for precise assessments. This difficulty is already encountered by some language teachers, who may use the Common European Framework of Reference (CEFR) for Languages to facilitate their work, but in practice, find themselves juggling several grids. This is especially true of non-linguistic subjects (e.g. biology, history, geography) taught in a foreign language (English, German,

[139] Leaton Gray, S. and N. Kucirkova (2021), "AI and the human in education: Editorial", *London Review of Education*, Vol. 19/1, https://doi.org/10.14324/lre.19.1.10

[140] Kumar, V.S., Boulanger, D (2021). Automated Essay Scoring and the Deep Learning Black Box: How Are Rubric Scores Determined?. Int J Artif Intell Educ 31, 538–584. https://doi.org/10.1007/s40593-020-00211-5

[141] Veldkamp, B. and C. Sluijter (eds.) (2019), *Theoretical and Practical Advances in Computer-based Educational Measurement*, Springer International Publishing, Cham, https://doi.org/10.1007/978-3-030-18480-3

[142] See for instance Classkick, Purple Mash, Seesaw, Class Dojo, Formative, LearningbyQuestions, Bordfolio

Spanish, etc.) as part of non-language subject. Members of the jury assessing oral exams have found themselves in diametrically opposed positions if certain language skills are met while basic subject knowledge is not. In practice, it weakens the legitimacy of a teacher who assesses a digital or cross-disciplinary skill very differently from their colleague. It seems essential to avoid these contradictions, which could undermine the foundations of these new subjects.

In order to gain time, it is necessary to adopt a new perspective and to rethink the methods of evaluation currently in use. Some educational institutions have introduced new, highly complex and controversial evaluation frameworks, or implemented exhaustive verification processes, which have the potential to exacerbate existing inequalities. In 2018, 15-year-old students from socio-economically disadvantaged backgrounds demonstrated an average awareness of climate change that was approximately 25% lower than that of their more privileged counterparts across 25 EU countries[143]. Conversely, other educators have regarded this approach as an inadequate solution, and their students may have perceived it as an arbitrary teaching method involving low-cost assessments. It would be preferable to take note of technological developments by **establishing a clear distinction between table-top evaluation and other complementary forms of evaluation**. The objective of the twin transition should be to transform assessment methods, giving priority to skills, aptitudes, commitment, and outcomes. **Formative assessments** should be given particular consideration[144]. These approaches, which have previously been trialled in isolation, include scaled self-assessment, reflective writing, scenario/case tests, focus group/interviews, performance observation, concept mapping, conventional text assessments, and analysis of regular coursework for evidence of competence. The implementation of the teaching of sustainable development presents a unique opportunity to address a number of challenges. Rather than being used as a mere tool for evaluation, they should be employed to eliminate linguistic and other integration barriers, thereby fostering **a more global, inclusive, and egalitarian assessment process**. Some even propose that certain practices should combat rating inflation and move away from rating escalation[145]. It is imperative for educators to recognise that this is not merely another form of standardisation, but a novel approach to skill valuation that enables them to capitalise on the time-saving potential of digitisation through more automated computer-based evaluation, for instance.

Eventually, **the rise of digital fraud is inevitable** with new technologies. It has become the number one concern of education leaders[146]. It is extremely difficult to detect certain AI-generated content in homework. Moreover, it must be possible to prove fraud, and this human verification work is laborious. Therefore, there

[143] OCDE (2024), Education at a glance, Paris, Éditions OCDE

[144] Nusche, D., M. Fuster Rabella et S. Lauterbach (2024), « Rethinking education in the context of climate change: Leverage points for transformative change », *Documents de travail de l'OCDE sur l'éducation*, n° 307, Éditions OCDE, Paris, https://doi.org/10.1787/f14c8a81-en.

[145] Perkins, M., et alii, The Artificial Intelligence Assessment Scale (AIAS): A Framework for Ethical Integration of Generative AI in Educational Assessment. (2024). Journal of University Teaching and Learning Practice, 21(06). https://doi.org/10.53761/q3azde36

[146] Microsoft. (2023). AI in education: A Microsoft special report. Microsoft. https://cdn-dynmedia-1.microsoft.com/is/content/microsoftcorp/microsoft/final/en-us/microsoft-product-and-services/microsoft-education/downloadables/AI-in-Education-A-Microsoft-Special-Report.pdf

needs to be a strict separation between light, quick, digital assessments and more official, serious, lengthy assessments carried out in class, as several teachers in the schools visited are already doing. Conversely, the school must establish clear rules for penalising new forms of digital fraud, to prevent the general undervaluation of assessments and subjects related to the twin transition.

This also applies to late submissions and failure to meet deadlines for homework or online assignments. Encouraging students to be punctual is part of the school's mission, particularly from a vocational and professional perspective. Schools also have the task of automating various writing tasks and creating presentations on given topics. However, with the advent of digital technology, homework can be sent 24 hours a day, and many pupils send their homework late, thanks to computers and mailboxes that remain open, as teachers no longer have the possibility to close their inbox. This flexibility and adaptability must not be misused by students, contributing to a further imbalance in marking times. Teachers should be able to close their inboxes, as they can on *Moodle* or *Teams*-type platforms, and not receive late submissions from students, as they would in their professional lives. The internal rules and regulations governing the use of IT must take this into account.

3.2.3 A better self-evaluation

In order to save time, it is sometimes necessary to know how to lose time and take a step back from practices already in place. In the absence of comprehensive and costly external assessments, the practice of self-assessment is often widespread, but the consequences of reviews, questionnaires and internal audits have rarely been integrated to improve implementation. School self-evaluation is often already practised by teachers under stressful and time-consuming conditions. According to research, school directors need to be able to allocate sufficient time and use it more as a means of making progress[147]. The implementation of an auto-evaluation process has resulted in significant time savings across various areas. It enables a reflective approach to progress monitoring and the setting of improvement targets, facilitating the identification of areas requiring adjustments and reducing the time spent on unnecessary revisions. By clearly defining objectives and collecting data, schools can anticipate future needs and plan targeted actions, thereby avoiding late reactions to problems and saving time. Once improvement areas are identified, schools can implement effective strategies, including setting clear timelines to evaluate capacity needs, which helps manage time more efficiently. Local district officials can support continuous improvement plans by examining auto-evaluation reports and progress of implemented strategies, enhancing coordination and reducing time needed for meetings. Estonian schools benefit from ongoing professional development programmes for future leaders, including on-site training and modules on human resource management and pedagogy, strengthening skills and reducing time required for training and adaptation[148].

[147] Galvin C (2022), Leading learning for sustainability: the role of school leaders Working Group on Schools: Learning for Sustainability Input paper Brussels: EC. DG EAC

[148] Normand R. (2024), « L'approche de l'auto-évaluation dans les pays ayant obtenu des bons résultats à PISA (I) », Université de Strasbourg

3.2.4 Harnessing the potential of digital communication

Digitisation has facilitated and increased information on grades, ratings, course content, schedules, events, projects[149]. There are several examples of these new tasks that are made easier by digitalisation. Digitisation through **emails** has facilitated communication with students, parents, colleagues and leaders, making the traditional correspondence book or letters obsolete[150].

However, this powerful communication tool has been delivered without any guidelines, it is essential not to send too many emails for digital and environmental reasons. These emails need to be prioritised, especially in the world of education, where the stakes that seem high are actually very low (grades, averages, etc.). A significant proportion of emails may be unnecessary or inefficient[151]. It is essential to adopt an organisational policy which considers the following:

- the charters stipulate that pupils and parents should only use email for important unresolved issues;
- teachers are supported by their superiors to stop exchanges when someone (a student/parent) is too insistent and has already received a reply;
- parents should not be encouraged to turn email inboxes into an ever inflating after-sales service, but rather into a place for constructive and limited exchanges, thanks to the attachments, dispensing with time-consuming appointments
- teachers themselves send as few emails as possible at weekends and during holidays. To do this, the mailbox must have a deferred delivery mechanism and automatic absence replies. School leaders can tell teachers that they are not expected to work outside of working hours, however in case parents send late emails, a school can make it a policy to 'delay sending' the email to within office hours[152].

The expansion of new communication skills does not stop here. For attracting pupils to linguistic sections or optional subjects and seduce their parents, teachers spend more time than before in **communication** (posters, letters, newsletters, blogs, wikis, social networks' posts, digital working environment…). Furthermore, teachers need to keep abreast of the information circulating online on a regular basis. Like journalists, they must stay informed and be able to answer to their students' unexpected current affairs questions, which creates a certain amount of tension.

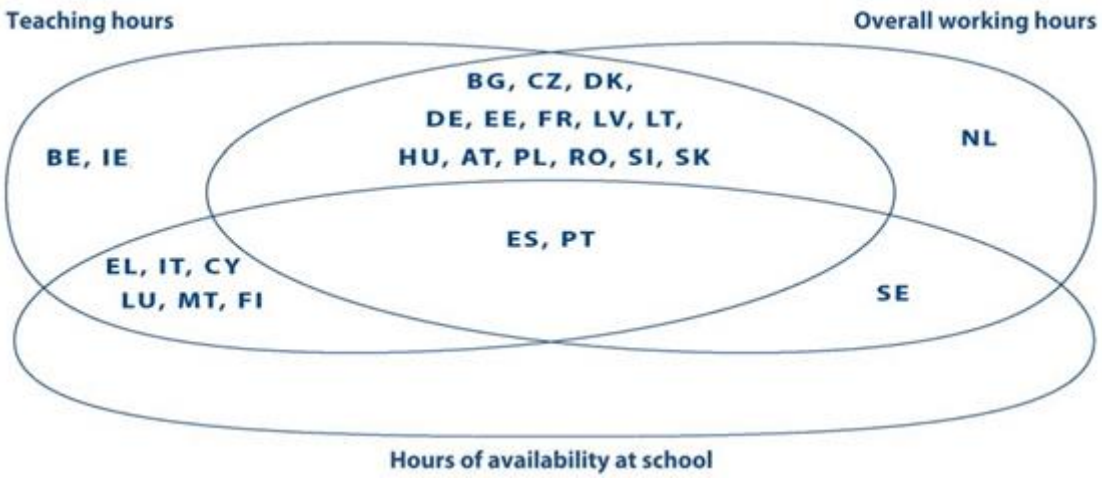
3.2.5 A tricky return to the staffroom

In some countries, school managers can ask teachers to perform some of these tasks **at school**. Before the COVID-19 pandemic, seven groups had been

[149] Escueta, M. et alii, Education Technology: An Evidence-Based Review, National Bureau of Economic Research, 2017
[150] Rott, B., & Marouane, C. (2018). Digitalisation in schools–organisation, collaboration and communication. In Digital Marketplaces Unleashed (pp. 113-124). Springer, Berlin, Heidelberg
[151] According to several studies by the university of Glasgow https://www.gla.ac.uk/news/archiveofnews/2007/august/headline_37307_en.html ; https://www.prevention.com/life/a20458186/work-email-is-unnecessary/
[152] As shown by digilead project, https://digilead-project.eu/

distinguished: the majority of countries does not impose hours of availability, and teachers are free to perform non-teaching hours outside of the school.

Figure 7. Former initial definition of the working time of teachers (ISCED 1 and 2, 2006-2007)



Source: Eurydice (2008)

In the first cycle of secondary, this is the case in Hungary, Ireland, Latvia, Portugal, Spain, Sweden.

Some education systems require teachers to be present at school. The working time of teacher includes both teaching hours and hours of availability at school in Cyprus, Greece, Italy, Luxembourg, Malta and Finland. In Finland, in education elementary and general secondary, a collective agreement for municipal staff defines the total working time, which corresponds to the hours of teaching and the hours of presence in establishments for purposes of cooperation and continuous training (for a total varying from 686 h to 818 h primary/secondary schools). A recent reform has increased this attendance time by 24 hours per year for all teachers, regardless of the level of education. In Sweden, an overall annual amount of working time in hours is specified, along with time during which teachers should be present at school[153], but not the time devoted to the actual teaching. In Poland teachers can be asked to perform certain tasks at school. These non-teaching obligations remain limited, however, throughout the EU. Without this being a physical constraint, sufficient time must be set aside in the timetable for consultation.

These meetings continue to face capacity issues, with staff rooms symbolising the challenging post-COVID recovery, now less busy than before. In an era of teleworking and 4-day workweeks, some teachers prefer working from home, where they have their own space and equipment. Shared workspaces have seen a decline since 2020, and the traditional staffroom model is outdated. While some schools introduced amenities like relaxation rooms, success has been limited, especially due to budget constraints. Teachers, already overburdened by face-to-face teaching during the

[153] Levels of Autonomy and Responsibilities of Teachers in Europe

pandemic, find it harder to stay extra hours. To improve comfort, schools should create dedicated areas for rest and private work, with partitioned spaces for privacy, internet access, and work preparation.

However, the COVID-19 has shown that some meetings are pointless, and the question is whether many of them can be shortened and simply held at a distance. **Class councils have been made easier by the transition. Digitalisation has made it possible to increase collective productivity** by replacing brainstorming with brainwriting, allowing even the shiest to express themselves. It has encouraged a more flexible approach to scheduling outside the framework of the timetable. This flexibility needs to be monitored[154]. Headteachers must take care to maintain a minimum number of personal meetings, as it can be tempting to let tools take meeting minutes, to be content with them and thus dispense with interpersonal exchanges. The primary objective is **to enhance their effectiveness**. Rather than addressing the full spectrum of transition concerns, educators can collaborate in thematic teams, each with a specific area of expertise.

For students, schools have also been confirmed in their social role following the pandemic. Studies point to the importance of **social life outside the classroom**. This is already happening in many other preventive activities (prevention of alcoholism, harassment, drug use), as well as artistic and sport activities. The twin transition lends itself well to the development of club-type activities outside school hours. In Greece, these activities have recently been made compulsory. However, the busy schedules of both teachers and pupils need to be considered and an attempt made to combine them into a multi-purpose activity, including twin transition.

3.3. The soft management of the twin transition outside school hours

Non-teaching activities required by legislation, regulations or agreements between stakeholders (e.g. teachers' unions, local authorities and school boards) do not necessarily reflect teachers' actual participation in non-teaching activities. Responsibilities such as **participating in school or other management in addition to teaching duties** have been largely distributed. These activities have often gone far beyond what is required for a variety of reasons, including the fact that teachers are committed and enthusiastic, that they need to promote their subject (some subjects may disappear due to low enrolment), that they do not want to be shunned by their colleagues, especially those who are new, that they want to progress, or that there is a formal deadline to be met. According to the OECD, these hours are even essential for building a close relationship with the student, "teachers spend a lot of time with students, run social clubs, clean classrooms with them after classes" and this factor could explain the excellent results of certain education systems in the PISA tests, particularly in Asian countries, such as Singapore[155]. It remains to be seen whether these hours require additional compensation.

[154] Sliwka, A.; Klopsch, B. (2022a): Innovative Zeitmodelle – Zeitfenster für Kooperation von Lehrkräften festlegen; in: Deutsches Schulportal, 27.01.2022

[155] Borrett, A (2023), "The true extent of damage to schools from Covid-19", Financial Times, 10 December 2023

3.3.1 The self-management of voluntary overtime

Teachers do not only perform the tasks that are required by regulations or school heads; they also often perform tasks **voluntarily**. There are specific reasons for working for free: the educational, civic, edifying and superior dimension of the teaching profession; the *ethos* of public service; the goodwill of teachers. There are also less laudable reasons for this, such as competition between teachers, a desire to demonstrate commitment to the school or an inbuilt obligation to meet social requirements (in comparison to other workers who have an office timetable).

Historically, in many countries, managers could rely on teachers' generosity, motivation and enthusiasm. This was further reinforced by the global COVID-19 pandemic, when teachers were required to adapt their working practices. Since the end of the pandemic, many teachers have resumed their social activities on a voluntary basis[156]. For some participants (in Ireland, for example), this voluntarism is an excellent thing and an asset for the schools, whereas the payment of teachers' salaries has had a detrimental effect on their precious spontaneity.

As the European dialogue on attractiveness showed, this freedom can be one of the most crucial factors in making the profession attractive[157]: **This freedom of action and pedagogy meets a demand from teachers who want to be more autonomous.** Many see it as an essential dimension of their job to produce ideas, follow up projects and help measure the results of their efforts[158]. The diversity of digital and green projects is a perfect opportunity for managers to encourage autonomy, as studies confirm that empowering teachers makes them more efficient[159].

But it can also have more negative aspects, which can sometimes even lead to forms of malaise, if the managers do not stop them[160]. That is why this spontaneity needs to be guided and channelled at the very least by managers. Furthermore, the map of voluntary work, created using data from the ESMTT survey, illustrates significant discrepancies within the EU. Several countries may lack the necessary pool of volunteer teachers to facilitate the twin transition.

Map 3. Degree of voluntary implementation of TT by teachers

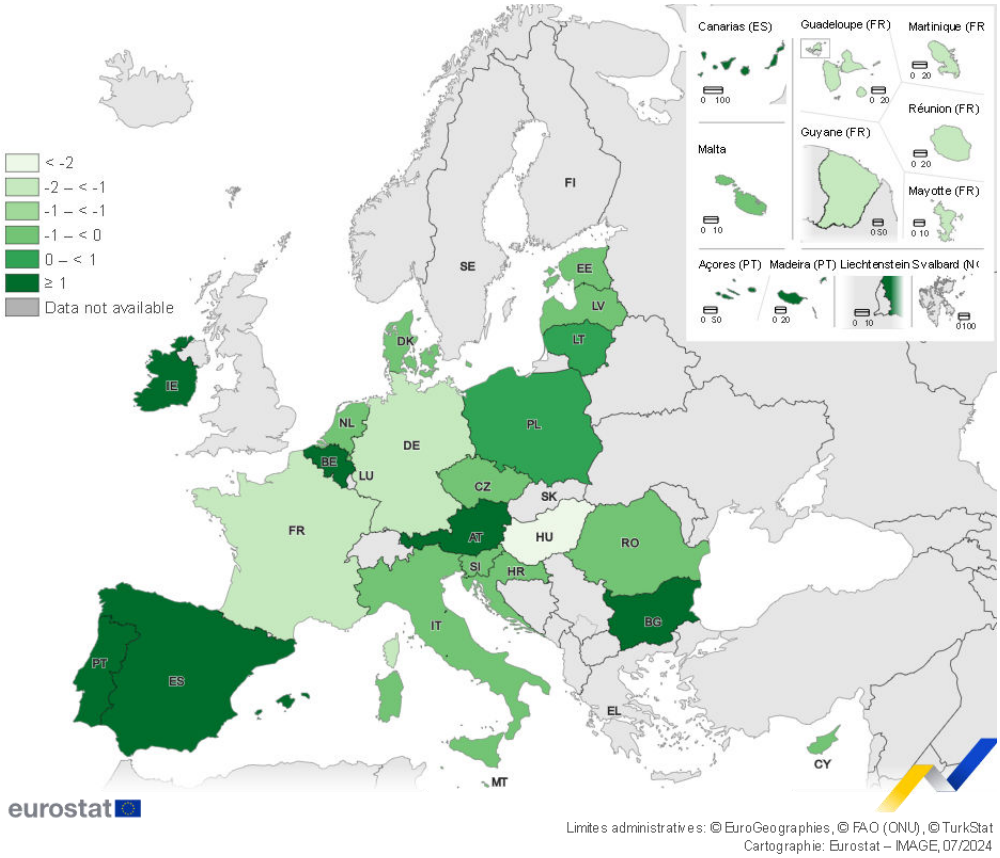
[156] Gerd de Roeck (HRM-coördinator, GO! onderwijs van de Vlaamse Gemeenschap, BE)

[157] ETUCE/EFEE "Declaration Towards a Framework of Action on the Teaching Profession" (2018) and in the current ESSDE Work Programme, as well as new elements which emerged during the fact-finding seminar in October 2021; ETUCE and EFEE held their second social dialogue capacity building seminar in Riga, Latvia. The event took place in the frame of the EU-funded project "Towards a Framework of Action on the Attractiveness of the Teaching Profession through effective Social Dialogue in Education" (14/15/09/2022). See https://www.csee-etuce.org/images/Reports/Report_2ndSeminar_Attractiveness.pdf

[158] Henderson, N., & Milstein, M. M. (2003). *Resiliency in schools: Making it happen for students and educators* (Updated ed.). Corwin Press

[159] A. Brassard, C. Lessard, « L'expérience nord-américaine du changement en éducation : un double regard », in Pelletier G., Charron R. ed, *Diriger en période de transformation*, Québec, Affides, 1998, p. 65-10.

[160] Gicheva D. Altruism and burnout: long hours in the teaching profession. ILR Rev. (2020) 75:427–57. doi: 10.1177/0019793920981055



To encourage vocations, a number of initiatives have been launched:

a) Some stakeholders believe that the two initiatives, particularly the green ones, should be implemented in a more bottom-up manner, which would necessitate increased micro-management. Research has identified several factors influencing the effectiveness of teachers and school leaders, indicating that school can be considered as learning organisation[161]. Nevertheless, it would be erroneous to suggest that this management should be imposed from the top down by school leaders. **Rather, it would be more appropriate to rely on the digital and green culture of teachers[162]. In particular, maximum flexibility should be allowed to adapt green transition to the local context[163].** This is essential because achieving the twin transition involves trial, errors, tests, without any predefined plans, as many of the PLA participants mentioned[164].

In the event of a volunteer shortage, it is less effective to ask everyone to take part in some broad, ambiguous sustainable and green projects than it is **to pinpoint exactly which roles—coordinator(s), fundraiser, participant, evaluator, etc.—need to be filled**. Then, internal calls for applications are issued in accordance with these needs, making teachers feel much more valuable

[161] ET 2020 learning groups, *Teachers and school leaders in schools as learning organisations. Guiding principles for policy development in school education*, European Commission, 2018
[162] John Irvin (IE)
[163] Ilias Michailidis (OFFE, EL)
[164] According to Paul Fields (Director of post-primary schools, ETBI, IE)

and making the roles interchangeable. The natural distribution of spots is often uneven and random. In some cases, a compulsory status (a regular, yearly rotation) may help to overcome resistance, share the burden and gain a holistic understanding of sustainable development.

b) It is often driven from the top down by national ministries. In Cyprus, the policy is impulsed at the national level by ESD horizontal unit supervising activities. Environmental education is an integral part of the new primary and secondary curricula. The country is in the process of revising its national strategy for education for sustainable development under the framework of education for the environment, sustainable development and green transition 2030.

c) More time should be invested in the transition to a larger scale (national, European, etc.).

Beyond the dichotomy between national/regional and local levels, there is a collective and European alternative to advancing the twin transition in education, which is underutilised due to the initial time investment required. The digital transition offers a significant opportunity to open the doors of schools and promote exchanges while implementing new educational content. Over time, especially with long-term partnerships, these initiatives can eventually save time.

In addition to the human challenge, the EU can also provide additional funding for ambitious projects. Based on estimates, the overall EU expenditure for education and skills will be tripled between 2021 and 2027 compared to the 2014-2020 period. While the Erasmus+ budget has almost doubled (to over € 26 billion), the **Recovery and Resilience Facility is the most important financing source with around € 71 million (14% of RRF goes to education)**. Furthermore, cohesion policy funds continue to provide support and drive recovery in line with EEA objectives[165]. In addition, Action 5 of the DEAP on digital transformation plans for education and training institutions includes support for the digital transformation plans of education and training institutions through Erasmus+-funded cooperation projects; the setting up of Erasmus+ Teachers Academies to enhance digital pedagogies, assist teachers in using digital tools and promote cooperation between teachers.

The **exchange of teachers**, one of the priorities of European mobility policies, especially within the framework of Erasmus+, remains limited overall compared to its potential. This limitation arises because such exchanges require significant adaptation and time, effectively doubling the workload for teachers, who may not always perceive the return on investment.

By contrast, the eTwinning exchanges show satisfactory results[166]. It allows a lot of digital and green European projects. The online platform has facilitated collaboration and enhanced teachers' ICT skills. Despite these benefits, eTwinning demands considerable time, and building a European team is challenging without prior acquaintance among colleagues.

[165] K. Binder, "Taking stock of progress towards the European education area", EPRS, January 2023
[166] A. Gouseti, *Digital technologies for school collaboration*, London, Palgrave, 2014.

3.3.2 New incentives for the implementation of the twin transition

In many countries, participation in school or other management of digital and green activities can result in specific **compensation for teachers**. In some countries, their teaching time might be reduced to balance the workload between teaching and other responsibilities, in addition to financial compensation. There are numerous benefits to paying for extra hours. First, it allows making more visible this large share of invisible work and contributing to more recognition of the work effectively done by teachers. Secondly, it can help encouraging initiatives, in particular in European countries where green culture is less attractive for many reasons. Thirdly, it is also a way to protect themselves from arbitrary local decisions, favouritism or the pressure or parental pressures who can be against these projects for some reasons.

Schools are generally given autonomy in managing their teaching staff's time. A previous European study has shown that autonomy has already been granted to schools in a large number of countries with respect to the selection for substituting absent teachers and **the awarding of additional salary payments for overtime worked or for work not included in the normal teaching contract**, a potential which could be used nowadays to implement the twin transition. The autonomy of schools in managing teacher payments and responsibilities varies across countries. In Belgium (French grant-aided sector and Flemish Communities), Estonia, Ireland (ISCED 2), Latvia, Slovakia, and Sweden, schools have nearly full autonomy to select teachers for covering absences, determine their duties, and award additional salary payments. In Denmark and Finland, schools can decide teachers' roles and duties, although replacement selection or delegation of responsibilities may involve a competent authority. Lithuania, Hungary, and Slovenia exhibit varying degrees of autonomy based on specific decision-making areas. In Greece, schools can sometimes choose whether to pay staff for extra hours, while in Luxembourg, Portugal, and Liechtenstein, schools have some autonomy in this field. Conversely, in the German-speaking Community of Belgium (grant-aided sector) and the Czech Republic, schools' autonomy is primarily restricted in awarding overtime payments. Finally, schools in Ireland (ISCED 1), Cyprus, and Malta have no autonomy in these matters[167].

Table 3. Decision makers at school level when offering additional salary payments to teachers, ISCED 1 and 2

Countries	School head	Teachers	School management body	Discretionary delegation	Not a school responsibility
AT			X		
BE	X		X		
BG		X		X	
CY	X				
CZ			X		X
DE			X		
DK	X				

[167] DG EAC, *School Autonomy in Europe. Policies and Measures*, Eurydice, 2007.

EE	X			
EL			X	
ES	X			
FI	X			
FR			X	
HU			X	
IE		X		
IT		X		
LT		X		
LU	X			
LV			X	
MT		X		
NL	X			
PL		X		
PT	X			
RO			X	
SE			X	
SK		X		

Source: Eurydice (2007)

In many countries, individual teachers decide themselves whether to engage in green or digital activities. Teaching more classes or hours than their full-time contract requires is also a voluntary decision by teachers. However, the voluntary nature of these activities is uncertain, as the implementation of the twin transition on the ground will depend on the local pool of goodwill, which necessarily leads to disparities, particularly in small schools. It varies depending on age, duration, and resources and does not allow all staff to be involved in the twin transition. The call for volunteers is far from working throughout the EU. The ESMTT survey confirmed that not all professors are willing to work unpaid hours, and only a minority within a minority in each Member State. This can also be explained by schedules. Irish professors who report spending most of their hours in front of students have more time to implement the transition voluntarily. In several countries, the green transition is still often implemented only by natural sciences teacher[168].

There are several means to assist professors in implementing the transition, depending on the resources, legal possibilities and objectives of the school.

a) The first option is **to pay for overtime**.

b) As this can put a strain on schedules, distort volunteerism and create pay inequalities, as not all voluntary work is recognised or rewarded, one variation that is already in practice is, where legally possible, to offer teachers not more money **but more time, freeing them from some of their weekly service obligations**. This is an easy and popular way to increase hourly pay without spending too much, especially for institutions with limited resources. We could

[168] D. Kalniņa,. *Pētnieciskās prasmes attīstība dabaszinībās* [Development of Research Skills in Natural Sciences]. Rīga: RaKa, 2012, quoted by European Commission, Directorate-General for Education, Youth, Sport and Culture, Tasiopoulou, E., Billon, N., Finlayson, A.et al., *Education for environmental sustainability – Policies and approaches in European Union Member States: final report*, Tasiopoulou, E.(editor), Billon, N.(editor), Finlayson, A.(editor), Siarova, H.(editor), Pribuišis, K.(editor), Gras-Velazquez, A.(editor), Mulvik, I.(editor), Bajorinaitė, M.(editor), Sabaliauskas, E.(editor), Fronza, V.(editor), Vežikauskaitė, J.(editor), Disterheft, A.(editor), Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2766/391

imagine setting up a system of credits and credit transfers with individual time accounts. However, it requires regular monitoring of the effective use of these hours through a digital or green project progress assessment.

c) The third means is to **enhance the careers of the most committed teachers** in the transition by assigning them roles with responsibilities, better appreciating their work, giving them better pay, promoting their transfer to higher positions after a certain period of service. This obviously poses a human resources problem, as school principals tend to retain the best elements. In many European educational systems, digital middle leadership skills are not yet recognised and considered for promotion. In Slovenia, teachers can occupy different roles, such as class tutors, heads of subjects or team leaders, which are defined either by central legislation or schools' internal acts, but not formally recognised as career advancement, and they do not lead structurally to more senior positions at the school level[169]. In the Flemish Community of Belgium, a reform has been prepared during the 2022/2023 academic year focusing on team-based ICT support at the school level. The reform consists of the publication of a job profile for ICT coordinators, characteristics of ICT teams and a guideline to develop and establish ICT teams.

d) **Honorary rewards can provide valuable recognition for teachers'** long-term professional commitment and address the often overlooked need for recognition in their profession. Although more symbolic than material, these rewards can be significant for teachers who value their work. Although prizes and awards exist to recognise professional commitment, they are often under-utilised or awarded within the school, rendering teachers' efforts invisible. This approach is not widely supported by respondents to the ESMTT survey, mainly because of concerns about fostering jealousy among colleagues, which could be demotivating. International and national systems, such as UNESCO and the EU, tend to individualise teachers' merits, as demonstrated by prizes like the Global Teacher Prize, which frequently overlook elements like digital and green transitions. Similarly, some Member States' campaigns highlight individual significant teachers, overlooking the wider, long-term impact of less visible educators. This focus on individual recognition is at odds with the collective effort needed for the twin transitions. **Currently, there is still a notable lack of recognition for educational teams in Europe.** A shift towards collective rewards at institutional, regional, national and European levels could be more effective, as demonstrated by the success of team-based awards on platforms such as eTwinning, which recognise inspiring green education initiatives.

3.4. Empowering students for the twin transition

A recent way of offloading teachers' workload has been to have the pupils take over, which gives them the opportunity to put the twin transition into practice on their own. In **France**, some 250,000 eco-class representatives are responsible for implementing the green transition, from eco gestures to more complicated

[169] ET 2020 learning groups, *Teachers and school leaders in schools as learning organisations. Guiding principles for policy development in school education*, European Commission, 2018

projects[170]. In **Ireland**, eco schools offer a wide range of activities. These actions could include water saving measures such as using water-saving taps or collecting rainwater for watering plants; setting up and managing recycling programmes for different types of waste generated in the school; organising workshops or presentations to raise awareness among their peers about the importance of sustainability and environmental protection; taking part in tree planting and creating school gardens to increase biodiversity and create green spaces; and striving to reduce the school's energy consumption, for example by switching off lights and electronic devices when not in use. All of these activities help to create but also carry the torch to the next generation. However, they only do so if the students are driven and their teachers have faith in them.

3.5. Extra time for twin projects

The implementation of the twin transition also raises the question of the impact of exchanges and trips organised by schools. For a long time, these physical exchanges have contributed to the well-being of students, improved mutual knowledge, the discovery of new school environments and the influence of schools. The COVID-19 pandemic has put a temporary end to these exchanges and more deeply questioned their role and usefulness. Today, the very conditions of these exchanges are under severe constraints, with new safety standards, ever more administrative paperwork, a sometimes more complicated geopolitical context and growing responsibilities, all of which limit the enthusiasm of volunteer teachers who spend an enormous amount of time preparing and following up the trips. More fundamentally, these trips are also being called into question in the name of the environment, with short trips increasingly having to justify their usefulness when there are live online solutions that consume less energy, cost less, are quicker and much less time-consuming. The reduction in exchanges can be positive for the environment, by reducing travel and facilitating virtual exchanges[171].

It is still the case that longer periods of residence are necessary for some courses, particularly those that deal with the sustainable environment. The observation of nature is facilitated by classes held at sea and other environmentally-focused curricula. Most importantly, they permit students to disengage from the external environment, particularly the digital domain, as mobile phones are eschewed during these pursuits. Slovenian school curricula are especially noteworthy with regard to the nature-based excursion planned for pupils in the initial nine years of their academic careers and can be accommodated in centres with specific, trained staff. This is where the objectives of the transition may appear to be in apparent contradiction, **but in fact they are complementary. These extended digital abstentions compensate for the high level of daily utilisation**.

In this context, **school leaders are tasked with a new responsibility: to evaluate and arbitrate proposed projects** by considering both the environmental footprint and the tangible educational benefits of activities, particularly in cases where these initiatives cannot be promoted in the media. It

[170] MENJ (2023), Agir pour la transition écologique dans les écoles, collèges et lycées
[171] Paddy Flood (IE)

seems likely that educational exchanges, in particular those which provide meaningful opportunities for linguistic immersion, will continue to be offered, given the clear pedagogical advantages they offer. However, this raises the question of other types of travel, such as holidays to coastal, rural or mountainous destinations. What justifications can be made for these trips, especially when their educational impact may not be as readily apparent? It becomes crucial to assess whether such excursions provide significant developmental or experiential learning opportunities that justify their environmental cost.

4. BALANCING PROFESSIONAL DEVELOPMENT AND REST TIME IN THE ERA OF DIGITAL AND GREEN TRANSITIONS

KEY FINDINGS

The twin transition, particularly digitalisation, requires the implementation of a continuous training programme for teachers in the acquisition of digital and green skills. Nevertheless, a considerable proportion of teachers already demonstrate a foundation of digital proficiency that is more advanced than that observed in other sectors. Consequently, training should be more targeted and based on the teachers' existing knowledge, with objectives that are both realistic and achievable. Time management represents a significant challenge for teachers, given the increased demands on their time and the difficulties they often experience in achieving a satisfactory work-life balance. Training in time management is essential for professional development, as inefficient habits can become ingrained throughout a teacher's career.

A significant proportion of digital skills can be developed through non-formal and informal learning. A variety of self-training resources, including instructional videos and Massive Open Online Courses (MOOCs), are available for educators. Tools such as SELFIE and TET-SAT assist educators in evaluating their digital competencies and identifying areas for enhancement. A variety of specialised training programmes, such as Erasmus+ Teacher Academies, provide instruction on the twin transition. Additionally, accelerated European training programmes in artificial intelligence are accessible via online platforms.

Micro-credentials are emerging as a useful tool for recognising small units of learning, particularly in the context of the twin transition. In some school systems, digital badges have been distributed to validate teachers' progress. Nevertheless, self-training can be fragmented and time-consuming, particularly for those teaching in primary schools. It is evident that there is a necessity for the implementation of more structured and comprehensive training methodologies that take into account the diverse requirements and time constraints of teachers.

There is a clear necessity for ongoing training in light of the twin transition, especially in the realm of digitalisation. Most recent conferences and scientific papers stress the systematic need to provide "more training" for teachers with a view to quality teaching. During these conferences, the ideal teacher is portrayed as someone equipped with comprehensive social, humanistic, linguistic, civic, ecological, and digital competencies, all of which are enhanced through additional training. Digital and green skills have been added to this long catalogue of skills. However, these contributions rarely specify exactly when this type of new training is to take place, as if time were a mere adjustment variable, even though teachers' actual timetables are already very full.

In contrast, the value of **reskilling** is still not fully recognised, even though it could lead to significant time and resource savings. Various surveys indicate that the EU's 5 million teachers are already partially skilled, particularly in digital competencies, compared to other sectors. They confirm that estimates of need

are not as high as the recurrent theme of 'more training' would suggest: in 2023, **almost 80% of those working in education consider themselves to have basic skills (compared with 65.19% of those employed)[172].** It is therefore necessary for training to be much more targeted and much more widespread, with more realistic objectives. Training must be based on invaluable existing knowledge and skills of teachers.

In view of the current workload, the introduction of extensive new training in the areas of digital and green transition seems rather unrealistic. Education systems should better anticipate these demands to streamline training, focus on teacher support, and ease logistical challenges for school administrators. In some ways, training teachers in such ambitious subjects feels a bit late once they are already in service. Some experts, such as Mona Nabhani (American University, Beirut), recommend strengthening **pre-service training**, particularly in the area of green education, as digital technology requires more frequent updating as part of in-service training.

The nature and duration of training vary significantly based on the objectives of individual schools and teachers. At primary and secondary level, not every teacher needs to be a 'digital native' or an environmental expert. **Estonia** presents its digital success story as the result, among other things, of the diversification of training formats and media, from one-off tutorials and one-hour webinars to annual cycles and courses lasting a few days[173]. In accordance with the recommendations of the OECD on climate change education, training should be even adapted at the local level, and classroom resources and teaching approaches should remain flexible in order to integrate emerging knowledge regarding the effectiveness of different approaches and the contexts in which they are most effective[174]. The training content varies also depending on countries: in the Netherlands, teachers are entitled to follow 80 h /y in average, whose digital or green teaching content may vary. It is essential to find a balance between ensuring that all teachers receive a minimum level of digital and green training and allowing individual teachers the flexibility to adapt their teaching methods to suit their own needs.

4.1. Many skills for teachers can be developed non-formally

4.1.1 Helping teachers manage their own time

Time management is a critical aspect of teaching proficiency that pertains to organisational skills. Without a proper guidance, inefficient time management habits, such as those related to handling electronic correspondence or indefinite preparation time of the projects, may become entrenched and persist throughout teachers' professional careers.

While this overload can be explained by the multiplication of tasks, it may also be related to a degree of disorganisation in handling the influx of these new teaching components. It is imperative that educators are trained in this regard, as acquiring

[172] Eurostat, Digitalisation in Europe, 2024 edition, KS-FW-24-001 ; ISBN 978-92-68-11769-9 ; ISSN 2600-3368 ; doi: 10.2785/120017
[173] In-service training for teachers. Estonian experience, https://www.youtube.com/watch?v=mWciYaH2M5I
[174] Nusche, D., M. Fuster Rabella et S. Lauterbach (2024), « Rethinking education in the context of climate change: Leverage points for transformative change », *Documents de travail de l'OCDE sur l'éducation*, n° 307, Éditions OCDE, Paris, https://doi.org/10.1787/f14c8a81-en.

time management skills is an integral component of professional development. It is expected that novice teachers will undergo a period of adjustment, during which time may not be utilised optimally. While numerous productivity strategies can be learned experientially, efforts can be made to expedite this learning process and standardise effective practices.

The accumulation of new skills for themselves and the infinite combinations of students' skills can be confusing. An excessive amount of resources on digital technology or the environment are still mistakenly given to instructors in many training courses, which is ultimately detrimental. Educators are frequently confronted with an array of options and a plethora of references. **They should have access to collective support in prioritising their goals**. While they remain free to make their own pedagogical choices, they may need help in making decisions, for instance working together on a particular digital skill; choosing 1 or 2 SDGs out of the 17 possible, as is already the case in some schools.

The challenge is not merely about the total number of hours, but also about their distribution and equilibrium. It is therefore necessary to determine **at what times these activities are held** during the week. It is inherent to the nature of teaching that tasks are carried out at different times. While many enjoy their profession, few enjoy the late nights marking papers, preparing lessons plans or filling out paperwork. The "Sunday night blues" is more pronounced among teachers, as they are accompanied by practical tasks such as preparation, drafting emails or marking papers. For instance, in Flanders, like in many EU regions, the lack of a designated "Sunday evening" for teachers[175] presents a challenge to maintaining a healthy work-life balance.

Moreover, this situation is unequal: teachers are not equal when it comes to working hours. Young people, single people, colleagues close to retirement whose children have left home, are not in the same situation, and by their very nature do not have the same opportunities. This extreme inequality was brought to light by the COVID-19 pandemic, where some people were very enthusiastic while others were unable to teach at all due to their children. This unhealthy competition is the exact antithesis of successful, virtuous digitisation. Failing to address this issue has had a negative impact on the project. We have seen teachers with three children refused part-time work or forced to return to the school for an hour. On the contrary, the twin transition must be fairer and consider the fact that time at home cannot be the same.

In an effort to help teachers manage their time more efficiently, teaching departments have implemented self-training resources in several broad areas. Those can take the form of instructional videos on YouTube (e.g. Estonia[176], Latvia), MOOC for teachers (e.g. Spain). Estonia's HARNO (*Haridus- ja Noorteamet*), an agency of the education ministry, manages a YouTube channel that features webinars and lessons pertaining to teaching methods, helping

[175] They should then be added to the declining minority (11,8% in 2021)´of workers considered by Eurostat as working on Sundays even if they are not formally paid nor forced to pay this practice. See Employed persons working on Sundays as a percentage of the total employment, by sex, age and professional status (%)

[176] https://www.youtube.com/@EducationEstonia

teachers seeking for professional development opportunities. Several public MOOC platforms are either dedicated to including dedicated sections for teachers (*aprendeINTEF* in Spain[177]). Finally, Denmark's *Emu*, the education ministry's online platform on which educators can find teaching resources and activities, exemplars of pedagogical practices, as well as templates for research papers and legal guidelines for the use of resources.

4.1.2. Self digital and green upskilling

Digital skills are unique in that they can be widely developed in a non-formal/an informal setting, which saves time compared to traditional training courses. Many skills have been acquired outside an institutional framework, in everyday life, informally; they can be developed in a **non-formal** way, without a fixed or restrictive framework, but with a more targeted intention of making up for certain shortcomings and developing certain skills, particularly for work at home. A large part of the training and skills required is primarily in identifying, learning about and adopting the latest digital environments and software. The issue does not lie with a lack of supply, with teachers spoilt for choice: numerous courses[178] and websites[179] provide a list of digital tools that are useful for teaching, often free and ready for use by teachers and students. The COVID-19 pandemic has led to the development of a large number of upskilling and reskilling programmes. In accordance with the recently adopted BIK+ strategy (2022), a European platform has been established to provide educators with resources on internet safety. In Finland, this has led to the creation of cross-sectoral, public- and private-sector-led programmes for the acquisition of basic digital literacy skills[180]. In fact, teachers can afterwards learn alone how to use digital tools and software. In France, for instance, more than four out of five respondents confirm that they acquired their digital skills alone, through social networks and internet websites[181].

Managers should encourage their teams to take part in training, at the very least by promoting the free digital tools available online and ensuring that they are used. To better identify their needs, DEAP's Action 5 includes the launch an online digital toolkit called **SELFIE** (Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies), that has been developed by the EC in 2022 and helps primary and secondary teachers assess their digital competences (among its many skills, it also assesses a number of sustainable skills relating to safety, responsible use and inclusion) and plan further training. It takes around only 30 minutes to complete as such. SELFIE for teachers reached over 180,000 users by January 2023. To support users, the Commission has also released a SELFIE for teachers toolkit and set up an expert network. Depending on the results, teachers will be able to train

[177] https://enlinea.intef.es/

[178] See for instance « There is an app for that ! » by the Teacher Academy https://www.teacheracademy.eu/course/there-is-an-app-for-that/

[179] See for instance for AI tools and website: https://view.genial.ly/63ec8abdc804dc0018561bbe?fbclid=IwAR3FfHFK_hWIsiVoW8GFjYaLeL8XZfkKfILVB94oiKumKpUohLL0AG_lxgk

[180] European Commission, European Innovation Council and SMEs Executive Agency, Pact for skills – Analysing of up- and reskilling policy initiatives and identifying best practices – Final report, Publications Office of the European Union, 2024, https://data.europa.eu/doi/10.2826/324945

[181] DEPP, Dossier « Les technologies de l'information et de la communication (TIC) en classe au collège et au lycée : éléments d'usages et enjeux », October 2010 https://www.education.gouv.fr/media/15203/download; Observatoire Ecolehuma, *Baromètre - Formation continue des enseignants : usages et besoins*, May 2023.

themselves online with special courses, making digital learning even more attractive[182].

SELFIE for schools, the 2018-2020 action plan's ongoing initiative, helps schools reflect on their digital readiness. By October 2022, the tool had reached more than 3.5 million users. By identifying local digital needs, it enables managers to plan training courses. In Estonia, the IT Academy offers a skills self-assessment model for managers and teachers, with 360° feedback[183]. In Belgium, the Flemish Community provides a ministry-developed online platform called Digisnap, based on the EU's SELFIE tool. To be efficient, however, the design and implementation of this tool must integrate the objectives of return on investment, change and alignment with the institution's missions, including sustainable projects[184]. The school leader will often need to appoint a group creator to send the invitations and to analyse the results[185]. TET-SAT is another tool enables teachers to self-assess digital skills[186].

Funding for Erasmus+ cooperation projects addressing digital and green transformation plans for education and training institutions at all levels of education is available under the Erasmus+ annual general call until 2027. The **Erasmus+ Teacher Academies** offer training for teachers on the twin transition:

- GEO-Academy for the use of GEO digital tools for ESD;
- Nature-based Solutions for new competences for ESD;
- acaSTEMy for skills of STEM teachers for ESD).
    -

More specifically, rapid European training courses in artificial intelligence are available online to introduce students to the basics of AI through MOOCs and guides[187].

However, self-training has certain limitations. First, it is very often fragmented, gathered from a variety of sources on different occasions, with no overall framework. Secondly, it is time-consuming, even if only to master a single software programme, especially in primary schools[188]. One solution could therefore be to master a **software package** for which the teacher would be the school's reference. For this, the software needs to be accessible, easy to use and rich enough to have developed tools. This is the case for the most important tools. Naturally, many teachers are turning to games as a source of learning. Take, for example, the popular game Minecraft, which has sold over two hundred million copies and makes it easy to create models and virtual worlds. The company has also developed an educational section, MinecraftEdu, covering a range of disciplines, including sustainable development (building a passive house, a

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[182] Euacademy, "Unlocking the power of teachers' digital competence: "Facilitating learners' digital competence", 2024, https://academy.europa.eu/courses/unlocking-the-power-of-teachers-digital-competence-facilitating-learners-digital-competence

[183] Kompetentsimudel

[184] Liang, H. & alii (2022). Impact assessment and measurement with Sustainable Development Goals. In Handbook on the Business of Sustainability. Edward Elgar Publishing

[185] European Commission, Joint Research Centre, Economou, A., *SELFIE for teachers – Toolkit Using SELFIEforTEACHERS: supporting teachers in building their digital competence*, Publications Office of the European Union, 2023, p.40 https://data.europa.eu/doi/10.2760/626409

[186] http://mentep.eun.org/

[187] Website https://www.ai4t.eu/

[188] P. Josefsson, K.M. Jää-Aro, S. Lundmark, A. Mutvei Berrez, "The implementation of digital tools in teaching: a qualitative case study at a swedish primary school", *EDULEARN19 Proceedings*, 2019, pp. 2382-2387.

beehive, a zero-waste school), which enables teachers not only to track objectives, but also to monitor class progress. When sites are developed in this way, they can facilitate the teacher's work, especially at middle-school level, popular teaching approaches in Cyprus, Greece and Poland.

Micro-credentials - the record of the learning outcomes that a learner has acquired following a small volume of learning[189]- have been around in vocational circles for several years and could be very useful to implement the twin transition for already experienced teachers. This type of training is gradually being acknowledged by educational institutions, albeit at a gradual pace. Throughout the EU, the Academy for Sustainable Future Educators (EduSta academy) is trying to develop micro-credentials in environmental skills, suitable for both beginners and experienced teachers, based on a common frame of reference[190]. In Spain, the National Institute of Educational Technologies and Teacher Training has developed several self-learning activities that are offered through an innovative mobile application called "EduPills"[191]. In the Netherlands, institutes validate the various components of professional experience in just a few hours, particularly for informal or non-formal teaching. These courses are particularly well suited to the fragmented field of twin transition. Some school systems have distributed digital badges to teachers[192], especially in Finland, where the badges validated, among other things, the progress made by the teams in digital teaching. However, these badges are still too light, symbolic and even infantilising. **It is evident that enhanced recognition of digital credentials, whether at the national or school level, would serve to motivate teachers to become more engaged.**

More specifically, at a higher level, to increase the pool of specialist informatics teachers in secondary education, more than half of the education systems offer retraining programmes to allow teachers to obtain an additional qualification to teach informatics. Retraining programmes may be part of the CPD of in-service teachers or full-time studies. They give teachers the opportunity to extend their qualifications to another subject that they did not originally study.

4.1.3 Peer learning

As schools have been seen progressively as self-learning organisations, professional development tends to be partly refocused on them. Schools have learned by doing, by experimenting with twin transition and are self-improving[193].

In most cases, colleagues in schools have acquired knowledge from one another. Mutual learning is encouraged at all levels. **Peer learning is a popular option that has been developed in the frame of the twin transition**. Some lessons have been learned from the COVID-19 pandemic. Teams learned how to organise

[189] European Council, Proposal for a Council Recommendation on a European approach to micro-credentials for lifelong learning and employability 2021/0402(NLE), 25 May 2022
[190] Available at https://projects.tuni.fi/edusta/
[191] Available at https://edupills.intef.es/
[192] Brauer, S. (2020). Digital Open Badge-Driven Learning: Practical applications to support Validation of Prior Learning. In R. Duvekot, A. Karttunen, M. Noack & L. Van den Brande (Eds.), Making Policy Work: Validation of Prior Learning for Education and the Labour Market (pp. 147-158). Houten/Berlin: EC-VPL/Bertelsmann Stiftung; Brauer, S. (2023). Case study Finland: Microcredentials for labour market education and training. First look at mapping microcredentials in European labour-market-related education, training and learning: take-up, characteristics and functions. Thessaloniki: Cedefop.
[193] Hargreaves, A self-improving school system in international context, Nottingham, National College for School Leadership, 2012

efficient mutual help for digital skills. In Naas, Ireland, a skills audit was conducted to identify basic skills requirements. Subsequently, peer learning webinars and exchanges were held to bridge the digital divide[194]. This habit has been preserved and, more widely, Irish teachers meet on Monday evenings at 7PM to regularly discuss their practices. Peer learning has been developed at a more global scale. In 2022, a school-to-school mentoring for digital innovation has been offered[195]. It is part of the more global Mentoring for School Improvement (MenSI) project, which was a 28-month Coordination and Support Action (November 2020 – February 2023) funded by the EC H2020 programme, carrying out a pan-European investigation into how different approaches to mentoring can support the mainstreaming of innovative digital teaching practices in primary and secondary schools.

On occasion, this knowledge can be gleaned from the students themselves. Indeed, a little-known source of twin transition, and especially of digitalisation, is bottom-up reverse learning by students. Teachers often find themselves in situations where students are more likely to share what they know with them. As sometimes happens in languages, or in other disciplines for very gifted students, one particularity of computing is that **students often know more** than their teachers about certain sites and software. In this area, therefore, teachers need to accept the inversion of the traditional pedagogical relationship, without undermining their authority as assessors. This is why, assessment criteria need to be flexible, as teachers are not immune to being outdone. This should be seen as an opportunity to highlight certain projects and disseminate them within the school and beyond.

Unfortunately, peer learning activities have not been pushed far enough and the timetable of the majority of teachers in the EU does not allow for this kind of initiative to be generalised, as it interferes even more with family life. In the Netherlands, teachers express a desire for more time for professional development opportunities in ESD, with an emphasis on collaborative learning environments and the sharing of knowledge about successful initiatives from other programmes and institutions[196]. In the Czech Republic, teachers and school principals see very little time to actively search for new training and courses, as there are no comprehensive documents available on the professional development of ESD teachers. In Spain (Catalunya), despite government support, the need for more resources and time to implement ESD policies and/or actions is evident, teachers and experts agree[197].

At the EU level, schools in the EU could consider implementing bi-monthly consultation meetings at the school, ideally at the start of the week, with the aim of sharing best practice and progress on digital and green projects. It would be interesting to take advantage of the digital transition to record a lecture, for instance, and discuss it among colleagues. Video of live sessions is not used

[194] M. O'Doherty, Piper School, Naas (IE).
[195] https://www.europeanschoolnetacademy.eu/courses/course-v1:MenSI+MentoringSchools+2022/about
[196] Jaume Ametller, Eveliina Asikainen, Marta Gual Oliva and Karel Němejc (2024), Teacher training for education for sustainable development: developing a shared competence framework , Czech University of Life Sciences Prague
[197] CNEA. (2021). Declaració del II Congrés Nacional d'Educació Ambiental "Per transitar l'acció individual a la transformació col·lectiva", II Congrés Nacional d'Educació Ambiental, CNEA 20/21 24 de novembre de 2021.

enough in training. This kind of **training sessions to develop a digital and green culture**[198] **can be easily provided by the school**. The content of these training courses should not be confined to training hours alone but should be shared and posted on the school's servers on a regular basis (video, recordings, reports, diagrams) in files accessible to all, or even shared with the community/network. In Italy, since 2022, as part of the *RiGenerazione Scuola* plan, external input has been brought together under the term community to "regenerate" certain schools by forming strong groups of 300 members (public, cultural and scientific institutions) capable of advising schools on their ecological choices, sharing and disseminating the community's educational experiences, training coordinators in pilot schools (Polo), etc. In the Netherlands, this is how, for example, the network of MBO schools works. Across the EU, the TAP-TS (Teaching and Learning for Sustainability) project is a European initiative aimed at advancing sustainability education among teachers and teacher educators, which started in 2022. It plays a key role in supporting the twin transition of digitalisation and sustainability by equipping educators with the tools and skills needed to integrate sustainability into their teaching. Part of the Erasmus+ Teacher Academies, the project fosters international collaboration and the sharing of best practices. With partners from seven countries (Austria, Belgium, Cyprus, Germany, Ireland, Portugal, and Sweden), TAP-TS offers digital resources, such as e-learning modules and Learning & Teaching Packages (LTPs), which help save teachers time while promoting sustainability competences in schools across Europe. By integrating these tools, the project prepares educators to engage students in sustainability, thereby contributing to a greener, more digital future[199]. It is also the case for the AEFE's French schools abroad, although the access to the cloud is still restricted and cannot be consulted by everyone. These training courses should help to professionalise and even specialise certain teachers, who should be able to show that they have spent time on these training courses by means of course recognition certificates that are visible in their digital training account and that they can use to their advantage.

4.2. Professional development activities

Participation in **professional development activities** is considered an important responsibility of teachers at all levels of education, as it is mandatory for teachers in many countries. Regardless of the requirement, a large majority of teachers in EU countries participate in professional development on digital and green activities. In OECD countries, teachers receive an average of 8 days of training per year.

4.2.1. CPD for teachers

Some national education systems have encouraged the training of specialists, a policy encouraged by the EC. In Slovakia, a teacher career system was introduced in 2009 to raise the quality and attractiveness of the profession, putting an

[198]N Coetsier et alii, Competenties Leidiggeven aan onderwijs en ICT, iXperium

[199] European Commission: Directorate-General for Education, Youth, Sport and Culture, Javorka, Z., Nieth, L., Marinelli, E., Sutinen, L. et al. (2024), *GreenComp in practice – Case studies on the use of the European competence framework – Analytical report*, Javorka, Z.(editor), Nieth, L.(editor), Marinelli, E.(editor), Sutinen, L.(editor) and Auzinger, M.(editor), Publications Office of the European Union, https://data.europa.eu/doi/10.2766/053738

emphasis on continuous professional growth. It comprises four career stages (novice teaching staff, independent teaching staff, teaching staff with a first attestation and teaching staff with a second attestation). In each case, the system offers opportunities for horizontal specialisation, including specific professional activities such as career counsellor, digital coordinator or head of subject area, as well as leadership positions. The career system is currently being reviewed to build on strengths and address shortcomings. Among other proposals the government is considering stricter selection criteria for Initial Teacher Education, support for training (laboratory) schools closely linked to ITE faculties, and a new incentive-based remuneration scheme for teachers. The Netherlands introduced differentiated salary scales in 2009. Within primary schools, this move created opportunities to appoint **specialist teachers** in mathematics, Dutch language, and topics such as culture and the arts. These specialist teachers have several roles within a school: developing the curriculum on that topic and supporting colleagues. Within larger school boards, expert teachers from different schools collaborate across schools to develop new teaching and learning strategies using outcomes from research.

There should be more focus on assessing its impact on teachers' skills to avoid a mismatch between the training offer and the needs of educators. The content of this training can indeed be questioned as the trainers, who are often colleagues, are not always digital experts. Courses are repeatedly reported as being inefficient because they only focus on the technical use of an unrealistic compilation of webpages, toolkits and software, which require many years to be used efficiently, and not on the pedagogical aspects of ICTs (approaches, resources)[200] to be reused rapidly[201]. Still, in France, 47% think that training is not adapted[202]. This approach can be exclusive, and because of the diversity of levels, a more **collaborative** approach is often needed.

It is essential to differentiate between two key areas within human resources: first, the school must have the ability to engage with a referent who can demonstrate advanced technical, security and data processing skills. **It is unlikely that this responsibility can be fulfilled by a full-time subject teacher**. It is also essential that all teaching teams have a fundamental grasp of technology. **With so many IT options available, relying solely on one specialist, even an ICT expert, for the digital transition seems impractical.** For instance, in the German-speaking Community of Belgium, secondary schools have allocated half of a middle manager position since September 2022 to support information and media literacy, including developing the school's media concept based on a new guide. In Sweden, school leaders and organisers are responsible for creating conditions for using digital learning resources in teaching, ensuring staff have time for skill development and collaborative learning, and providing access to support and resources. In larger teams, it is beneficial to leverage each teacher's unique skills, regardless of their subject area, such as digital editing,

[200] Maverick, J.A., Zhang, S., Hartley, K., Marchand, G. (2015) Preservice Teachers and Self-Assessing Digital Competence. *Journal of Educational Computing Research* 54, 326–351

[201] C. Rabyi. *Analyse du cheminement qui a mené des enseignants du primaire à développer une utilisation exemplaire des technologies de l'information et de la communication en classe,* Université de Montréal, 2004

[202] UNSA, Baromètre des métiers 2023

programming, or text editing. Establishing a task distribution plan at the beginning of the academic year can help navigate the digital landscape, and school leaders should value the specialised expertise of their teachers.

A number of countries also provide **CPD for green activities**, although the majority of European countries have not yet incorporated environmental skills into teacher training. According to David Wilgenbus, expert and director of the Office for Climate Education, it takes around **80 hours** of training to introduce both the content and the pedagogy of sustainable development (investigation, project approach, interdisciplinarity, emotional approach). For example, in Cyprus, compulsory education and training courses for primary teachers on the implementation of the National Curriculum for Environmental Education are implemented centrally each year. In these courses, teachers are introduced to planning their school's EES (education for environmental sustainability) School Plan (SEEP), developing EES lessons using an interdisciplinary approach, and using various EES pedagogical techniques such as concept maps, moral dilemmas and simulations. Courses were revised to focus more on a competence-based approach[203].

4.2.2 Initial CPD for teachers and induction

It is a common occurrence that younger teachers are frequently assigned to classes that are more challenging to manage, on the basis that they have longer and more flexible working hours than their more experienced colleagues. This is a strategic mistake, which has the effect of driving them out of the profession in the first five strategic years. On the contrary, more time should be devoted to support and initial training, but above all to integrating them into teams and school projects. There have been recent efforts to bridge the gap between university and theoretical training and teaching practice in the initial years, but this remains a work in progress. In Finland, the Ministry of Education and Culture in January 2016 appointed a Teacher Education Forum to support the reform of Initial Teacher Education and Continuous Professional Development. The objective of this reform programme is to introduce a systematic, coherent structure for teachers' competence development spanning their entire career. Particular attention has been paid to building up the competences of beginning teachers and to offering them support during their first years in the profession. The programme will promote competence development in teams and networks and make mentoring a more systematic element in the induction of novice teachers[204]. **The twin transition represents an ideal opportunity to integrate newcomers into the organisation and to provide them with tangible motivation**. This can be at school level or outside, as the example of eTwinning projects in Finland shows, where more experienced teachers can advise newcomers[205].

[203] A. Zachariou, 'Teacher education for sustainable development: Cyprus example', 2013, http://www.unece.org/fileadmin/DAM/env/esd/8thMeetSC/Presentations/Cyprus_teacher_education.pdf

[204] ET 2020 learning groups, *Teachers and school leaders in schools as learning organisations. Guiding principles for policy development in school education*, European Commission, 2018

[205] European Commission, European Education and Culture Executive Agency, The impact of eTwinning on initial teacher education – Placing teacher educators and student teachers in the spotlight – Full monitoring report, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2797/908466

4.2.3 CPD for teachers during their career

Teachers engage either compulsorily or voluntarily in learning to develop their digital skills to provide students with a better quality of education. Many countries have **compulsory CPD requirements** for all teachers in at least one level of education, and some have compulsory CPD requirements for teachers in all levels of education (from pre-primary to upper secondary). At all levels of education, a majority has minimum requirements for the duration of these CPD activities, either each year or over a period of several years, with a duration ranging from approximatively 16 hours per three-year period **(about five hours per year) in Luxembourg (at pre-primary and primary levels) to five days** per year in Slovenia. In Hungary, since 2018, ESD is a component of teacher's evaluation. For validation purposes, an electronic portfolio records proof of certificates, courses and projects. Teachers and school heads are obliged to participate in in-service training for 120 hours over 7 years to develop their proficiency in environmental education among others[206]. Even though a large number of countries have no minimum duration requirements, they can use other ways to ensure all teachers participate in CPDs. For example, in the Czech Republic, schools are legally obliged to organise CPD for teachers, and the relevant government body checks that schools are implementing this rule. In about one-third of the countries with compulsory CPD for teachers, teachers are required to participate in these activities during non-teaching working time. In Ireland, 40 minutes of CPD are part of post-primary teachers' weekly hours. In Poland, teachers are obliged to train to reskill and upskill during their non-teaching hours and do so[207]. In addition to compulsory CPD throughout their teaching career, teachers can be required to participate in compulsory CPD activities at specific points in their careers. In Portugal, even though in-service teacher training, including training in EES-related pedagogical approaches, is not compulsory, it counts as credit units towards career progression[208]. In some countries, teachers are required to participate in these activities outside of their scheduled teaching hours.

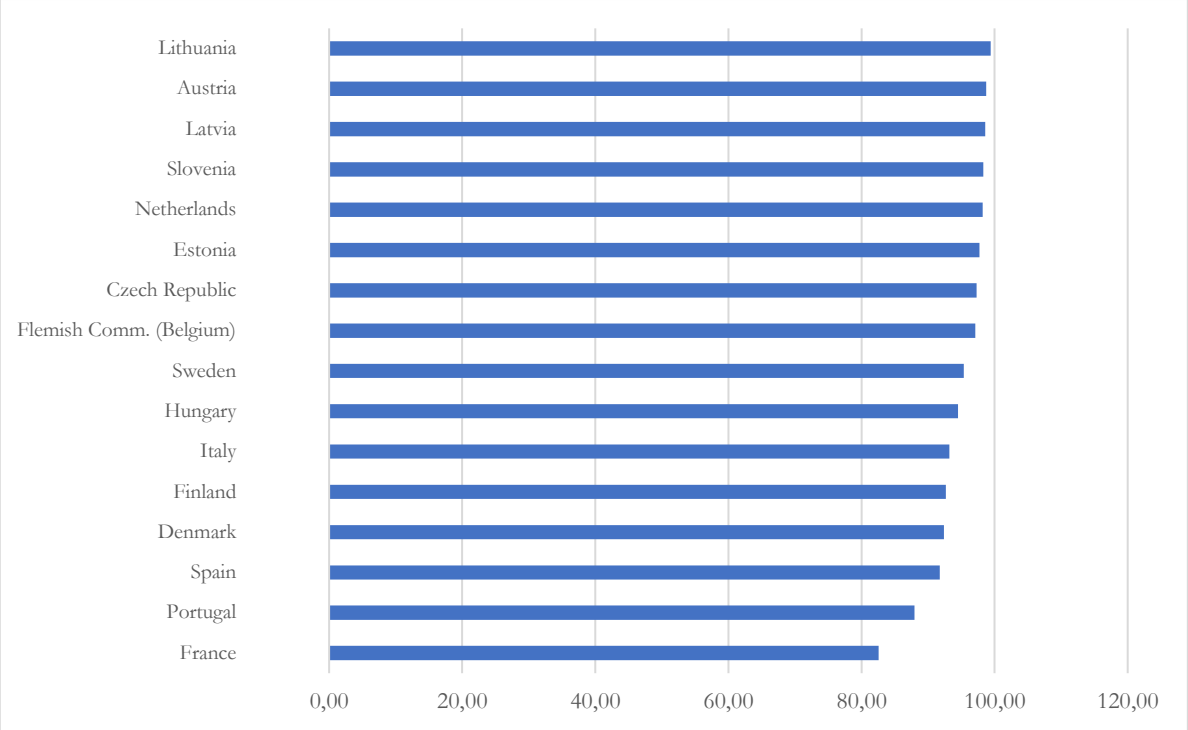
Figure 8. Participation in professional development activities[209] for teachers in lower secondary general programmes

[206] A. Varga and R. Kinzey, 'Which ways of evaluation of education for sustainability is acceptable for Hungarian teachers?', 2019, https://akjournals.com/view/journals/063/9/4/article-p654.xml

[207] as shown by the New Education Forum's summer 2022 survey of 443 teachers in Austria, Greece, Portugal, Italy and Portugal. Polish teachers were the (72%) to have received training in group management.

[208] National Scientific and Pedagogical Council for Continuing Education, http://www.ccpfc.uminho.pt/

[209] Source: OECD (2019) and OECD-INES NESLI 2019 Survey on requirements related to examination days and professional development. *StatLink* https://doi.org/10.1787/888934165871. Note: This figure only includes countries and economies with information in both TALIS and the NESLI Survey. The NESLI Survey reflects information on full-time, fully qualified teachers in public institutions for the school year 2018/19, whereas TALIS 2018 was also conducted with teachers in government-dependent and/or private schools for the school year 2017/18. Please refer to TALIS Technical Report (OECD, 2019) for more information on sampling. The scope of professional development activities in the NESLI Survey is limited to formal and compulsory professional development activities, whereas the scope of professional development activities in TALIS 2018 was broader, including non-formal activities such as reading professional literature.
Countries and economies are ranked in descending order of the percentage of lower secondary teachers who participated in professional development activities in the 12 months prior to the survey



Source: OECD TALIS 2019 (simplified)

CPD is not a mandatory requirement for teachers in all cases. The results of the second survey of schools, "ICT in Education" (ESSIE2), indicate that over 60% of European students are taught by teachers who engage in ICT-related professional development activities outside of their regular working hours. In Sweden, while CPD is not a mandatory requirement, teachers may participate in CPD activities during their regular working hours, at the discretion of their respective schools. In Denmark, the responsibility for determining CPD requirements for upper secondary teachers is not centralised but devolved to local authorities. In Finland, the Ministry of Education does not impose strict monitoring of compulsory training hours. Instead, teachers are expected to seek out and pursue training opportunities autonomously.

It is not enough for these courses to exist; they must also be relevant. In France, 71% of teachers report a lack of adequate training, with 41% believing that the green transition is not a priority for their employer, and 30% feeling they must pursue these activities independently[210]. Content needs to be constantly updated, which is particularly difficult when it comes to digitisation. Training must keep pace with innovation: with the acceleration of AI, needs are even greater, and mastering AI requires even more training time[211]. They also need to be attractive, otherwise some people would not have followed them in the past. The challenge of equipping educators with ESD competences is exacerbated by the voluntary nature of training opportunities in some countries, such as the Netherlands[212].

[210] UNSA, Baromètre des métiers 2023
[211] Sliwka, A.; Klopsch, B. (2022b): Deeper Learning in der Schule – Pädagogik des digitalen Zeitalters
[212] Economic Commission for Europe Committee on Environmental Policy , United Nations Economic Commission for Europe Steering Committee on Education for Sustainable Development, "Implementation of the United Nations Economic Commission for Europe Strategy for Education for Sustainable Development: summary of outcomes of the progress report on the fourth phase of implementation", Information paper no. 2, "Learning from each other: achievements, challenges and ways forward", Geneva, 19-20 (am) October 2020

While the number of available courses is increasing, attracting teachers to participate remains difficult, as seen in Latvia and Malta, where time constraints are also a significant factor. The question of whether teachers should be compensated for their participation in CPD arises, especially as some training may be offered by private entities. For instance, through a partnership, vocational training in digital skills is being provided free of charge to dozens of teachers. Teachers who lacked confidence during the pandemic have found value in this vocational training, particularly when delivered by a reputable company.

While the twin transition reinforces the need for training, another fundamental question, rarely asked by a literature that merely piles up new skills, concerns the **right timing for scheduling these training** sessions for teachers. On a weekly basis, digital self-training takes up a lot of weekends and late hours. While teachers prefer to undergo training during the academic year, some managers prefer that teachers receive training during their vacations. This new outsourcing, in addition to the ones mentioned earlier, further erodes and adds to the burden of teachers. This question has become largely a political matter, as parents have adopted a cost-oriented approach, believing that students should always be with the same teacher during their scheduled hours (though accounting does not consider grading, lesson planning, coordination, and training). This viewpoint is shared by the administration, which finds ways to save by avoiding substitutions they cannot afford. Consequently, more or less insidiously, teachers are encouraged to seek training during their own vacations. The administration thus aligns itself with a portion of public opinion by playing on the stereotype of laziness.

Teachers lose one of the few remaining comparative advantages, compensation for the intensity of their annual workload and low salaries. In reality, the absence for training represents only 10% of the total hours of absence in France. **From a pedagogical standpoint, this outsourcing during the long summer holidays presents several problems**: teachers do not disconnect from their profession, they remain tied to computers, mostly online, just as they are throughout the year, and they cannot immediately apply the tips and tricks they have learned in the complete absence of students, making these training sessions abstract. Teachers often undergo training and continue to do so in their free time through reading, outings, and field trips. In France, for example, in the summer of 2023, without any obligation, 170,000 teachers (around 25%) received training through the website *etreprof.com*. In our last survey, **many managers agree that this time should be a time of disconnection**. Some countries (for example, Belgium, France and Portugal) have introduced legislation to protect "the right to disconnect"[213].

In many countries, teachers are required to finance their own professional development, which poses a significant challenge to ensuring equitable access to training opportunities. Although this issue was somewhat mitigated during the pandemic in countries like Portugal and Greece, the broader question of access to

[213] World Economic Forum, "Right to Disconnect: The Countries Passing Laws to Stop Employees Working Out of Hours", 3 February 2023, cited by

training remains critical. In some instances, private vocational training programmes, particularly in digital skills, have been offered for free to a number of teachers through partnerships with major companies. These programmes have been especially valuable for educators who lacked confidence in using digital tools during the pandemic, helping to enhance their proficiency and comfort in a rapidly changing educational landscape[214].

4.2.4. Encouraging local research on the twin transition

Research policy is still far from influencing ministerial policy in the majority of Member States, although some are showing signs of receptiveness, as the OECD has recently shown[215]. In the EU, the ministries that most systematically utilise research in their education policies, such as that of Finland, are also the most actively involved in the digital transition. This stands in stark contrast to countries such as Latvia and Hungary, where research utilisation is only occasional. Schools have a role to play in filling this gap at local level, using the relative autonomy they enjoy. There is nothing to prevent them from developing their own research capacities, databases, pools of researchers and networks with universities to ensure not only the quality but also the dynamism of the twin-transition approach to teaching. It is not just a question of serving as yet another centre of experimentation for external university research, like a new case study, but of emancipating ourselves through research.

This policy is a way of boosting the attractiveness of the schools and offering some prospects to their teachers. Some teachers hold a master's degree or a Ph.D and have already an interest in research. Others with a master's degree aspire to go on to do a PhD, but there are no arrangements in place for them to do so. A number of recent changes can be used to develop this policy at the local level. In **Hungary**, the status of research professor is explicitly recognised in their role as coordinator of environmental actions, based on their expertise and work. In Ireland, teachers enter the profession with high qualifications, which is a potential source of wealth for research, not just teaching. Bringing a researcher to the school (as exemplified by projects like "REACT/Back to School" and "Science is Wonderful") on topics such as digitalisation or climate change is an interesting way to diversify pedagogy by changing the speaker and increasing interactivity. In the short term, this saves time since it is not the teacher who prepares or leads the class. In the long term, it also strengthens teachers' scientific expertise, allowing them to be recognised over time by maintaining a dialogue with research[216].

The twin transition allows the school to become a mini research lab. Data collection provides an excellent opportunity to actively engage in a scientific project. At Piper's Hill College (Naas), some students were involved in collecting data from local stations on air quality. These data points can effectively contribute to research projects conducted by academics through **crowdsourcing** initiatives. It

[214] Kimberley Edwards, Piper school, IE.
[215] OECD (2024), « Yes Minister, Yes Evidence: Structures and skills for better evidence use in education policy », OECD Education Policy Perspectives, n° 96, Éditions OCDE, Paris, https://doi.org/10.1787/6f97bcda-en
[216] See M. Daehlen, *The Twin Transition Century. The role of digital research for a successful green transition of society?*, The Guild, 2023

is a win-win situation where both teachers and researchers save time. The school also benefits, in terms of scientific independence and influence.

4.2.5. The school leaders' training time

These skills may be required by recruitment services, but many of them are developed on the job. There are multiple approaches to training school heads, including toolkits, courses, online platforms, case study collections, seminars, exchanges with colleagues, and observations. Many school heads do not need courses or extra lessons, but they can share information, network meetings, collaboration with schools, communication, PLA. Collaborative leadership frameworks are essential, as they facilitate leaders in cultivating and leveraging networks for resource pooling, and potentially alleviating the stress they experienced during the pandemic[217]. In Belgium (Flanders), CPD for school leaders are not mandatory, but recommended, and survey revealed that most of the school leaders in Flemish primary education (94 %) participate in CPD's every year, but the twin transition is not necessarily the preferred theme. In Estonia, since 2016, the school leaders' competence model is adapted, and they still focus on every-day problem solving. In secondary education, an annually returning monitor research on professional development of school leaders shows that approximately 90 percent (n=351) engages in CPD. They attend multi- or single-day conferences, peer reflection meetings and peer coaching. Most school leaders indicated that they are developing their personal view on leadership, their leadership competences, and their skills and knowledge on the school as a learning institution.

In addition to professional teaching experience, specific training is required in most EU countries to become a school head. Overall, training for headship is required in around twenty countries or regions, which includes more and more digital ad green skills. In most of these countries, this training takes place before appointment. The duration of headship training varies between one week (Romania), which is clearly too short to implement the twin transition, and a 60 ECTS master's programme. Common modules include school management, team building, communication and leadership skills, school development, school law and organisation, some include digital skills, few offer training on sustainable development. The University of Malta offers a training programme in educational leadership and management, which includes 5 ECTS on **digital management** (Digital Mediated Leadership: Implications of School Management in Age of Digital Pervasiveness or Educating School Leaders for the Internet) but none on sustainable development. Some countries clearly define a practical component besides the more theoretical content.

While there are still significant gaps in research regarding the specific requirements for leading schools toward sustainability[218], **there has been a notable increase in the incorporation of ESD competencies in the training**

[217] Alma Harris & Michelle Jones (2020) COVID 19 – school leadership in disruptive times, School Leadership & Management, 40:4, 243-247, DOI:10.1080/13632434.2020.1811479

[218] Verhelst, D., Vanhoof, J., & Van Petegem, P. (2021). School effectiveness for education for sustainable development (ESD): What characterizes an ESD-effective school organization? Educational Management Administration & Leadership

of education leaders. However, only one-third of European education systems have implemented national strategies that explicitly address the training of school principals in digital skills[219]. In 14 countries (as of 2013) where CPD for school heads is optional, relevant training for school leaders and policymakers is offered on a voluntary basis. Examples of these countries include Bulgaria, Hungary, Latvia, and Malta. In France, a 'Climate and Biodiversity ABC' course has been in place for new school heads since the start of the 2024/2025 academic year, but the focus is on the fundamental principles of sustainable development, rather than on implementing them in practice at school and in human relations. Certain countries require this training. For example, in Cyprus and Germany, the concept of ESD is integrated into the foundational training for both new and experienced school principals. In Cyprus, the training addresses the limited time teachers have to implement ESD initiatives due to overcrowded curricula and the reluctance of some principals to prioritise ESD applications because of other school priorities. Despite these efforts, there is still a gap in leadership training focused on sustainability. Many school leaders are calling for such training to be tailored to local needs and supported by structured timetables. The advent of digital technology has made it possible to offer online courses designed to help professionals build public-private partnerships, which can be particularly beneficial in the context of this ongoing transition[220]..

4.3. The management of teachers' careers in the long run

4.3.1. A change in dynamics: greater time for oneself, though more dispersed

Teachers have traditionally entered the profession to have more time for themselves and their families, valuing the stability and lifelong career prospects it offers - a trend that continues in many countries today. However, current conditions may not offer the same long-term flexibility, as teachers are likely to work fewer hours in the future due to changing dynamics in the profession. The unpredictable nature of teaching, where it is impossible to determine in advance how much time is needed to ensure that students grasp a concept, has always been a central aspect of the profession.

It is also necessary to reconsider the way in which our profession is perceived. Historically, teaching was viewed as a long-term career choice, with individuals entering the profession and remaining in it throughout their professional lives. This ensured a certain level of stability. Some individuals continue to adhere to this concept, precisely because it provides them with long-term visibility. However, the challenging nature of the role and the lack of career advancement have meant that many teachers no longer view it as a vocation, but rather as an initiation, or conversely, for those in the private sector, as a culmination that provides purpose to their lives. Career management therefore needs to become more flexible. In the Netherlands, many tracks for teachers are considered.

[219] Eurydice (2019). Digital Education at School in Europe, Luxembourg: Publications Office of the European Union.: https://eacea.ec.europa.eu/national-policies/eurydice/content/digital-education-schooleurope_en

[220] EU Academy, "Building School -Company Partnership",2022, https://academy.europa.eu/courses/building-school-company-partnerships-1665409178

4.3.2. Navigating school autonomy and teacher management

The degree of autonomy schools have enjoyed has been dependent on the legislative framework, which has evolved over time. With regard to school governance, **there are notable differences between countries in the degree of autonomy afforded to schools in the management of their teaching staff**. For example, in 2007, schools in countries such as Ireland (ISCED 1), Cyprus and Malta had minimal autonomy. Conversely, in countries such as the Flemish and French-speaking communities of Belgium, Estonia, Sweden and Slovakia, schools enjoy considerable independence in selecting teachers, determining their roles and even dismissing or disciplining staff. Other countries, such as the Netherlands (*bevoegd gezag*) and Austria, also allow considerable autonomy in these areas. However, in some countries, such as Finland and Luxembourg, schools have limited or no autonomy in certain areas, particularly in the dismissal of teachers[221]. These variations reflect the different governance models that influence teacher management in different education systems. **Giving school leaders more control over teachers' time can help them meet local needs and strategic priorities more effectively**[222]. However, this solution should be seen not as making the profession more flexible, but as enabling teachers to manage their time more effectively.

One area of school management that would benefit from greater autonomy is the time allocated to teachers. By allowing school leaders to exercise greater control over how teachers spend their time, it becomes possible to align staff efforts more closely with local strategic priorities. However, this should not be viewed as a mere shift towards greater flexibility. Instead, it is about empowering teachers to manage their time more efficiently, ensuring their work aligns with both their personal and professional development, and the school's objectives. This necessitates a considered, individualised approach to management. For instance, headteachers should ideally hold **annual one-on-one discussions** with each teacher to review roles, timetables, and career goals. Such interactions are essential for effective and humane management, yet they are often overlooked due to the administrative burden faced by headteachers.

Another common solution, when facing changes in teaching needs or staff shortages, is to bring in new recruits. While this can provide fresh perspectives and updated skills, it comes with significant costs. **The potential of reskilling is often ignored** in favour of new recruitment: many managers are tempted to rotate their staff on a temporary or flexible basis. This takes more time, and the downside is that this increases the overall time wasted by the teams. Reskilling requires a better understanding of the full range of skills within a company. In large establishments, it is very likely that several teachers already have many digital and green skills. It is possible to identify them either by analysing CVs, or by survey or interview. This will enable the headteachers to measure the gap

[221] DG EAC, *School Autonomy in Europe. Policies and Measures*, Eurydice, 2007.
[222] OECD (2023), Shaping Digital Education: Enabling Factors for Quality, Equity and Efficiency, Paris, Éditions OCDE, https://doi.org/10.1787/bac4dc9f-en

between their needs and the needs of their teachers and to avoid having to recruit them a second time.

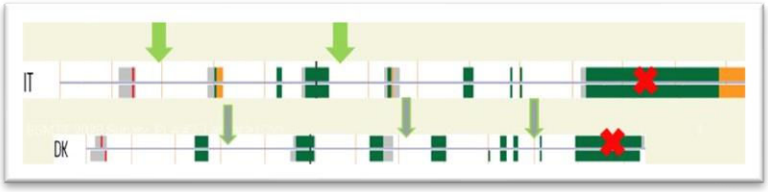
4.4. The management of free time? Caring about teachers' well being

4.4.1. More appropriate school timetables

A way of implementing the climate agenda could be to adopt a **calendar** for one or more schools, both displayed and online, with milestone dates for digital and digital activities during the academic year. It can draw on a number of existing initiatives. An annual calendar of digital events is already organised by various entities, including the EU (EU Code Week, All Digital Week), environmental organisations (EU Mobility Week, EU Ocean Days, EWWR for waste reduction, EU Sustainable Development Week), the private sector, and international players (International Day of Forests, Sustainable Gastronomy Day, World Water Day, International Day for the Eradication of Poverty on 17/10). These events provide opportunities for alignment if clearly chosen and made visible through corridors, classrooms, online and paper diaries, and emails. They have the advantage of saving time by building on existing initiatives and extending the network internationally, but they are often fragmented and sometimes come at the wrong time, because they do not coincide with the progress and dates of existing educational projects.

Implementation must be able to integrate these weeks into an **annual perspective**, the fruit of a global vision. The pace of implementation depends on the school calendar. Experiments are under way on the length of the intermediate periods, with some (France, Belgium) claiming that, for pupils, the rhythm of 7 weeks of work/2 weeks for learning is better. Without claiming to be the final word, this rhythm determines the implementation of the transition. It is difficult to harmonise the implementation of an annual timetable for the twin transition when the school year starts between 8 August (Finland) and 23 September (Malta) in 2024, as the effort depends on the length and intensity of the calendar. The number of teaching days varies considerably from country to country. In France, for example, there are 162 days of teaching per year, while in Sweden the figure is 227 days. There are therefore two types of implementations: countries (Denmark) with a large number of holidays may favour short projects, while others (Italy) may favour half-yearly or even (multi-)yearly projects[223].

Figure 9. Two different yearly implementations



Source: EC (2023), Fabrice Serodes, ESMTT survey (2023).

[223] https://educationemployers.eu/report-from-the-2nd-peer-learning-activity-of-the-esmtt-project-in-larnaca-cyprus/

Whatever the timetable, they are increasingly affected by the effects of global warming in the EU, and implementation policies need to take this into account: you cannot put the same aspects on in a freezing Scandinavian winter as you could in the "good old days". The months do not have the same value, and June lends itself even more to certain outings, for example. The political desire to reduce this legacy in the name of public management is now coming up against the full force of **climate change.** Studies are already showing the effects of rising temperatures on lower results[224], which confirms the need to slow down, adapt and diversify learning during this period. Several European countries have already had to take new measures. In France, the "reclamation of the month of June", long burdened by exams, is coming up against the full force of the situation, forcing, on the one hand, to consider postponing the existing exams until 2019 and 2022, and, on the other hand, to switch to continuous assessment. In Spain, during heatwaves, from April to October, some autonomous communities permit institutions to adjust schedules, welcoming students earlier and concluding classes in the early afternoon. In Italy, summer school vacations are extended to avoid requiring students to work in intense heat. In Germany graduated measures have been implemented: at 27 degrees, the law mandates a six-hour workday, further reducing it to four hours at 29 degrees, and if exceeding 35 degrees, employees must stop working. In the event of a heatwave, a school break, known as *Hitzefrei*, is declared to allow parents who are unable to attend work due to the extreme temperatures to take a period of leave. In addition to global warming, climatic disasters can impact the school calendar, necessitating caution and flexibility. While hazards are less frequent than in other parts of the world, they remain a significant and disruptive force. For instance, winter storms in January and February 2024 led to school closures in central and eastern Europe[225].

It is also possible to work on a monthly basis. In the Netherlands, some schools have gone further by choosing, more or less arbitrarily, a **monthly reference theme**, so that all the teachers can work on a common theme that is visible to everyone and can be anticipated. In a school within the network, various environmental themes are **synchronously** addressed each month by different teachers.

4.4.2. The school as a living space

While the digital transition has enhanced many aspects of teaching, it has also led to increased isolation among educators. As virtual meetings, online grading and digital lesson planning have become standard practice, opportunities for face-to-face interaction have significantly diminished. It is, therefore, important for schools to remain human-centric environments, where collaboration and social bonds among teachers are actively nurtured. To foster a sense of community and enhance communication, school managers should consider **organising social activities**, such as entrepreneurial team-building events. Such activities can focus

[224] Park, R.J., Behrer, A.P. & Goodman, J. Publisher Correction: Learning is inhibited by heat exposure, both internationally and within the United States. Nat Hum Behav 5, 170 (2021). https://doi.org/10.1038/s41562-020-01032-1
[225] World Bank (2024), The impact of climate change on education

on both digital and green initiatives, aligning with current educational priorities while promoting teamwork.

Such initiatives provide an opportunity for teachers to step away from their routine, develop new skills, share best practices, and build mutual support networks. For instance, **team-building exercises with a focus on sustainability projects or digital innovation** can foster shared experiences that enhance morale and contribute to a more unified school culture. By facilitating these social interactions, school managers can help teachers feel more connected, reducing the sense of isolation that often accompanies the digital transition. Additionally, these activities can serve as informal professional development opportunities, enabling teachers to explore new strategies and technologies collaboratively. Ultimately, this approach supports a more holistic and supportive work environment, leading to higher job satisfaction, improved performance, and a more dynamic educational community.

4.4.3. Transportation time, a key challenge for a successful green transition

Green schools objective is valuable but significantly challenged by the ongoing interactions between buildings and their environment. They have to take into account the overall carbon footprint of the school, and one of the major sources of pollution and CO2 emissions, which is **transport**, particularly in the many schools with poor public transport links. Transport cannot be ignored in the overall assessment, nor can it be delegated to other public and private players, as the school has its origins in the nature, number and frequency of the journeys it makes.

Teachers' travel time must also be considered, as it can make the job more difficult. A majority of teachers **commute** by car, above national averages, which means more than **197 hours** a year for a Swedish teacher. Few opt for green transportation options, and this can be attributed to various reasons: teachers have a distinct disadvantage when it comes to commuting, compared to the rest of the blue- and white-collar workers, as schools can be found all over the EU MS, often in places not always well served by public transport. Besides, teachers are carrying more resources, and bags of marking are just some of the things they have to bring to work.

In 2020 all schools saw their footprint improve through forced lockdown and reduced commuting. The consumption of electricity and of individual household consumption by online sessions is largely balanced by decreasing emissions of still polluting means of transport (school buses, cars, certain railway lines etc.). The COVID-19 pandemic was a unique observation experiment in this respect, with forced home working leading to a drop in polluting vehicle commuting. In Germany, it is estimated to have reduced emissions by 3% in 2020. In Cyprus, one hour of teleworking per one hundred employees saves 7.5 kg per year. In France, it is estimated that one day of teleworking saves an average of 271 kg of C02 per person per year. In Ireland, this corresponds to a reduction of 164,407

t/year[226]. Since the end of the pandemic, teacher transportation, despite a relatively increased electrification of the fleet, has again contributed to pollution. Schools' footprints have sometimes been weakened by *laissez-faire* in terms of transportation.

There is still a lack of green alternative. Some schools offer people incentives to adopt an eco-friendlier choice of commuting. Cycle-to-work-schemes has long been seen as THE solution. But, considering the extra time needed to go to school, the weight of material, the need to arrive on time and to look decent and professional, the absence of infrastructure, the lack of safety, cycling, and even walking long distances, are not always compatible with the teaching profession. Hence, it is not at all clear that the big campaigns to get schools to provide bicycle parking for their employees are fully justified.

A minority of schools (and next to no schools elsewhere) offer season ticket loans for public transport[227] or a green car scheme). Schools must give priority to working closely with local public authorities, because only public authorities can offer the potential to save time, even under constrained conditions. The potential of these hundreds of hours, not all of which are intended to be used, remains untapped. First, public transport time can be converted into time for rest, reflection, distancing. Secondly, digitisation enables us to recapture some of this time that was once completely lost. By using public transport, teachers are more inclined to read, get rid of administrative tasks, prepare their lessons, correct some homework and even attend training courses. So far, the Irish (22% of employees), the Poles (19%), the Slovenians (19%) and the Romanians (18%) have been the most successful in terms of commuting time[228]. There is still plenty of room for improvement.

4.4.4. Effective weekends and holidays

Teachers are frequently regarded with envy due to the perception of their having a substantial amount of leisure time, a subject that has evolved from a matter of personal opinion to one of political debate. Many individuals outside the teaching profession find it challenging to grasp the significance of rest in the teaching profession, which arguably holds greater importance than in many other occupations. The physically demanding nature of the role, coupled with the mental strain of constant interaction throughout the week, can be far more exhausting than the routine tasks typically associated with office-based roles. Teaching requires sustained attention, emotional engagement and the management of numerous simultaneous responsibilities, all of which contribute to the significant levels of exhaustion that educators experience.

Additionally, the boundaries of leisure time for teachers have become increasingly blurred. Unlike many employees who can handle tasks like emails or calls while multitasking at their desks, teachers face a different reality. They cannot spend

[226] Countouris, Nicola; De Stefano, Valerio; Piasna, Agnieszka; and Rainone, Silvia, "The Future of Remote Work" (2023). *Books*. 395. https://digitalcommons.osgoode.yorku.ca/faculty_books/395

[227] Just 7% of London schools offer seasons ticket loans for public transport; Meanwhile, just one per cent of schools have a green car scheme and three per cent (mostly secondaries) have electric car charging points. According to 6000 UK teachers interviewed by Teacher Tapp's poll in 2021.

[228] SD Worx (2024), "Les Belges, champions d'Europe en distance et temps de trajet domicile-travail",

fifteen to thirty hours a week during their workday on administrative tasks, such as sending or responding to emails. This phenomenon, combined with the **increasing intrusion of digital tools** and training into their personal time, leaves little room for genuine rest. Teaching has no clear starting or ending time anymore, making it hard for educators to mentally disconnect. While **summer holidays** were once viewed as a unique privilege of the profession, often compensating for lower wages and intensive workloads, international comparisons now reveal that these breaks are quite similar across countries. There is a general consensus on the need for a substantial summer break, not only for teachers but also for students and parents.

The digital transition has made it necessary to extend the **disconnection time**. This does not mean doing nothing, and part of it can be devoted to self-training: in Ireland, part of this time is included EPV during holidays +30h meetings and CPD, but the summer holidays here are among the longest in the EU. Managers should care about it to avoid exhaustion. Disconnection should be a clear practice from the start. It should be included into the local digital tech education charter if needed. **The use of emails, a major source of stress, should be limited. Some good practices should be followed, like those used in companies: not responding to all; displaying an automatic response in case of absence; auto-limiting oneself to checking one's mailbox from time to time on holidays; prioritising one's emails.**

5. CONCLUSION

The transition to digitalisation and sustainability must be used to enhance the status of teachers and improve the quality of education. Over the past two years, the ESMTT project has been active as European educational institutions have dealt with the aftermath of the pandemic and are now facing the profound implications of the generative AI revolution. While this revolution has the potential to significantly reduce the time required to perform various tasks, **its implementation faces numerous technical, legal and ethical challenges**. The widespread use of AI risks lowering the quality of education, leading to increased standardisation and a reduction in the human dimension of teaching - a field that fundamentally relies on long-term thinking, understanding individual backgrounds and taking into account a variety of parameters for accurate assessments. Automating such tasks requires providing organisations with relevant data that is often missing from internal systems.

Based on the findings of this report, several key conclusions emerge that could guide decision-makers. Rather than implementing recommendations wholesale, it is advisable to selectively adopt them based on local self-assessment diagnostics (See Annex).

In terms of project and resource management, it is crucial to build on the foundations of existing successful initiatives and resources, rather than starting from scratch. Regular evaluation of the implementation process and a thorough mapping of staff potential are essential to optimise human resources. A balanced distribution of tasks within teaching teams, with rotation to avoid fatigue, is recommended. The focus of education should shift from a consumer-oriented system to one that promotes shared values and the well-being of the entire educational community. In addition, assessment methods need to evolve to become more flexible, holistic and inclusive, moving away from traditional academic evaluations.

In the context of time management and learning environments, it is essential to re-conceptualise time as an investment in the quality of teaching, allowing for the inclusion of projects, field trips and training. More attention needs to be paid to timetabling to ensure efficiency and balance for all educators. The digital transition should be inclusive and address potential digital divides. Educational institutions should consider reorganising time and space, drawing on lessons learned from the pandemic, such as hybrid teaching and flexible schedules. Collaboration with local socio-economic contexts and European partners will provide a broader perspective, while management should promote original, interdisciplinary projects that address local needs and contribute to the identity of the institution. Achieving an optimal balance in technology investment, promoting open-source licences and ensuring rapid response to technical issues through risk mitigation plans are also paramount. Community support remains crucial; students cannot fully grasp the importance of digital transition and sustainable development if these principles are not reflected in their home environments, media, and social activities. The project has highlighted a significant lack of evaluations, with some initiatives serving more as greenwashing than substantive progress.

It would be prudent to exercise caution when using the term 'twin'. While it offers the benefit of viewing the two dimensions – digital and green– as balanced, it also carries the risk of isolating this approach, which must be integrated into the broader economic framework of education. We are in fact witnessing a triple, quadruple or even multiple transition, which necessitates a global rather than a partial reorganisation of EU education systems.

ANNEX. TABLE. POLICY RECOMMENDATIONS

CHALLENGES	RECOMMENDATIONS
Project management	
Wipe the slate clean and developing the twin transition from scratch.	Build on what already exists by identifying successful projects, available resources and failures.
One new project after another	Carry out a rigorous and regular evaluation of implementation.
Management of resources	
Recruit on the basis of new positions by imposing a geographical rotation of staff.	Map existing resources and staff potential to make the most of them.
Only rely on the specialist for digital questions.	Ensure an egalitarian division of tasks at the beginning of the year based on level and interest, in order to engage all teaching teams. Ensure a rotation of teams to avoid fatigue and better distribute tasks over 2/3 years.
A system increasingly focused on the needs of student and consumer parents	Educate citizens who live together and share values. Rebalance the objectives to ensure the well-being not only of students but also of teachers and managers, even of the entire educational community.
Adopt a strictly egalitarian and blind approach to the teaching profession.	Take account of each person's profile and strengths, encourage training and personal development, make it possible to read and do research.
Recognise and reward teachers individually.	Collective prize
Continue to assess the more discriminating aspects of twin transition in the traditional, academic way.	Continue to assess the more discriminating aspects of twin transition in the traditional, academic way. Prefer instead more flexible, global and inclusive forms of assessment.
Management of schedules	
Import an external and inappropriate accounting philosophy (Amazon).	Change your concept of time. As an investment in quality teaching (time for projects, for trips, for outings, for training). Teachers must be judged on their yearly global achievement.
Neglect the design of timetables.	Devote more time and ensuring that all teachers have an efficient and balanced **timetable**.
Fill all time slots.	Plan synchronisation periods with partner establishments for projects.
Management of the learning environment	
Consider digitalisation as a given for digital natives.	Make sure that the twin transition does not exclude anyone. Pay particular attention to the **digital divide**.

Excessive sharing of rooms and rotation of teachers instead of students	Provide a dedicated main room where most of the teacher's lessons take place, a desk or physical drawers. Pre-configuration of the IT environment with a shortcut to the drive.
Forget the lessons learned from the COVID-19 pandemic and maintain rigid, traditional school structures. Disregard opportunities for hybrid teaching, autonomous learning, and flexible schedules.	Reorganise school time and space in the twin transition, considering opportunities related to **hybrid teaching**, autonomous learning, and flexible schedules, as well as the impact of travelling.
Stop the implementation of transition at the boundaries of school walls.	Take account of the local socio-economic context and environmental problems, and work with public authorities and community groups.
Consider the local educational community as an unsurpassable horizon.	Promote European collaborations, initially time-consuming, but which allow for broad and stimulating sharing of experiences over several years.
Leave the digital and green projects to a few teachers so that they attract the best students.	Carry out yourself, as management, original **projects** that make up the DNA of the establishment. Choose interdisciplinary subjects that meet the most important local needs.
Underinvest/Overinvest in technologies.	Find the right level of equipment within a realistic budget. Promoting free licenses, cutting costs, and repurposing resources.
Place full-price orders for equipment at school level.	Consult teachers on their needs and group together by school networks and local authorities to place orders for equipment with specifications and software. Choose the companies with the most responsive customer service.
Let teachers get on with maintenance.	Ensure that teams can respond rapidly to technical problems through risk mitigation plans.
Embark on long, expensive green investment projects, difficult to maintain.	Consult the teachers to define the most useful arrangements, which allow teaching out of class, without nature/botanical output.
Management of extra-time	
Overwhelm students with homework, which are increasingly likely to be plagiarised.	Allow a relative part of **self-assessment or easy assessment** of digital and green skills, which easily reward students and lighten the workload and refocus on fundamental skills. Allow computer-based evaluations.
Increase the number of additional, standardised and restrictive compulsory training courses.	Encourage the use of independent training sites and courses leading to diplomas.
Leave it up to individual teachers to prepare all their lessons, especially new teachers.	Ensure that a user-friendly, accessible local server is set up to share key project resources and store archives.

Pay for overtime.	Reduce workload/ Workload relief.
Increase the number of resources on digital or sustainable development by using the many and varied online materials to save time in teaching, at the risk of getting lost and wasting time.	Ensure the certification and approval of content, training, workshops, courses, green and blue classes in line with official digital and green programmes. Facilitate the recognition of this content in order to offer useful, time-saving resources.

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ANNEX. USEFUL WEBSITES

Additio	*Next-generation school management platform*	https://additioapp.com/en/
AI4T	*European project to introduce AI to teachers, including a MOOC and textbook*	https://www.ai4t.eu/teacher-training/
BIK Portal	*European and local resources for a safer internet use*	https://www.betterinternetforkids.eu/resources
Bonzo	*Interactive games and competitions based on 21st c skills*	https://bonzo.knowledgeplatform.com/
Brisk	*AI-powered extension that helps automate the workload*	https://www.briskteaching.com/
Coursebox	*Automated course creation, tutoring and assessment*	https://www.coursebox.ai/
Digilead	*Strategy Toolkit on digital transformation for School leaders*	https://digilead-project.eu/toolkit/
Getclockwise.com	*AI scheduling and calendar automation*	https://www.getclockwise.com/
HARNO	*HARNO's channel (webinars, lessons, teaching methods)*	https://www.youtube.com/c/HaridusjaNoorteamet
EduPills	*Micro-learning app for teachers (*	https://edupills.intef.es/
Jibble	*Time tracking software*	https://www.jibble.io/
Magicschool	*AI toolkit for teachers*	https://www.magicschool.ai/
Nolej	*automatic creation of teaching materials*	https://nolej.io/
(Notion)	*Resources for sustainability in digital education (EDEH)*	https://choice-awareness.notion.site/Resources-for-sustainability-in-digital-education-15f5d7ba004e4a50aec8ef9cacb60615
OCE	*Resources for climate education*	https://www.oce.global/en
Sustainability Accelerator Programme	*Self-evaluation tool for sustainable policies at school*	https://docs.google.com/forms/d/e/1FAIpQLScyu_LROkYJtnKcxzX_JG

		DOfy9J1TNZvTBAsW1R3YyoCUIU5A/viewform
Schoolai	*conversational robot on questions seen in class, adjustable to specific teaching needs*	https://schoolai.com/
Senckenberg Museum	*Presentation of a sustainable VR experience*	https://vr-bodenleben.senckenberg.de/
Slido	*To carry out local surveys*	https://www.slido.com/
SMK Connect	*educational project to support teachers at the SMK Danish Museum*	https://www.smk.dk/article/smk-connect/
Socrat.ai	*conversational robot on questions seen in class, adjustable to specific teaching needs*	https://socrat.ai/
Socrative.com	*facilitates the creation of quizzes, which are automatically graded in real time*	https://www.socrative.com/
TeachMateAi	*AI toolkit for teachers and schoolheads. Claims to save teachers 10 hours a week*	https://teachmateai.com/
Teacher Academy TAP-TS	*Quick resources and training on sustainable development for teachers*	https://tap-ts.eu/
Tutor.ai	*Create a custom learning pathway to help achieve more in school*	https://tutorai.me/

ANNEX. LIST OF SCHOOLS AND CASE STUDIES

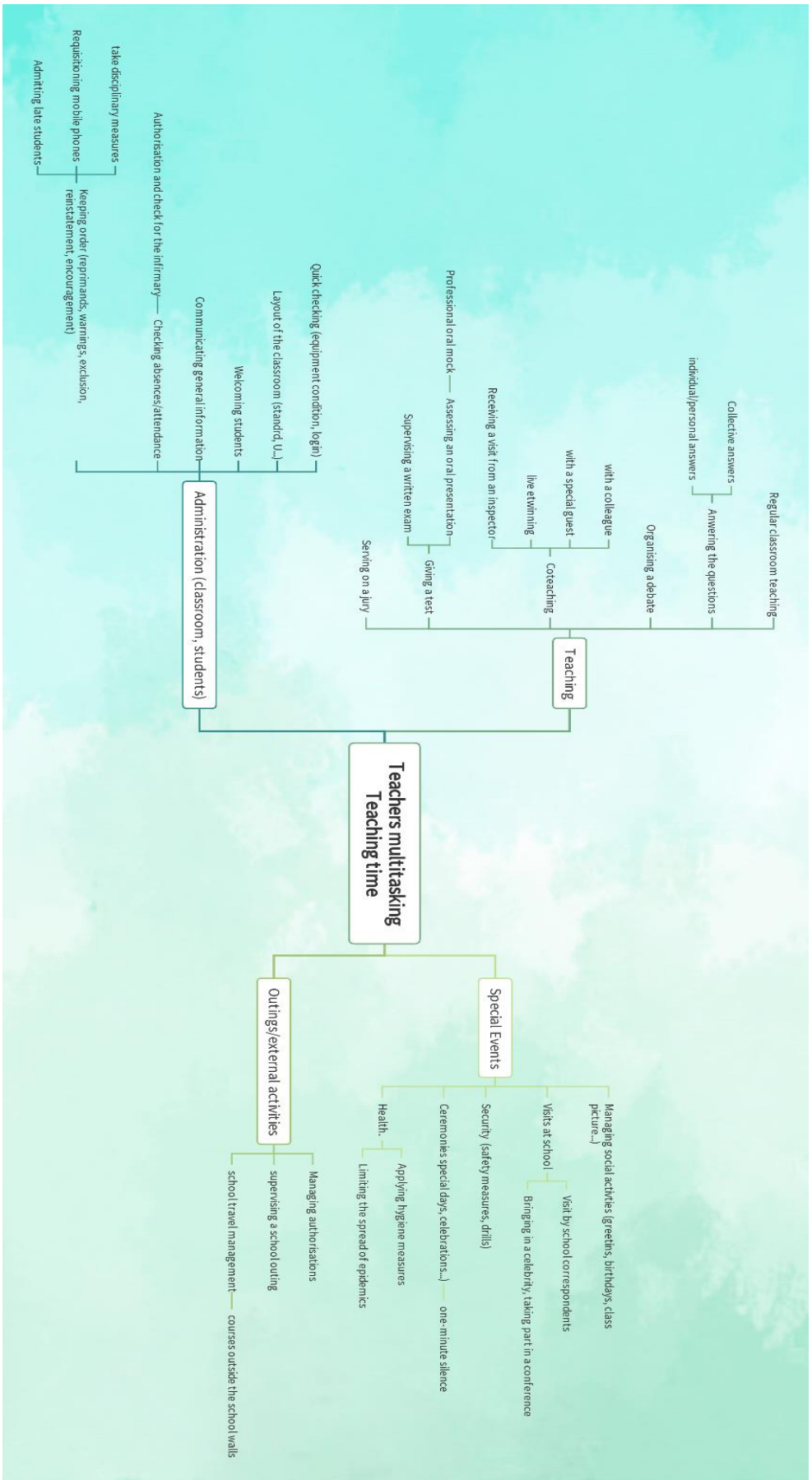
	Survey	**Oral Presentation**	**Interview**	**Visit**	**Desk**
AT					
Schulzentrum HTL HAK Ungargasse, Wien	**X**				
BE					
European schools, Brussels			**X**	**X**	**X**
GO!	**X**	**X**	**X**		
GO! Maseik, campus van Eyck	**X**				
GO! Technisch Atheneum Zavelenberg	**X**				
Enseignement catholique	**X**				
Saint-Paul school, Kortrijk					**X**
BG					
Bulgarian Association of Private schools		**X**			

CZ					
Association of Private schools of Bohemia		**X**			
Gymnázium, Praha 6, Nad Alejí 1952	**X**				
CY					
Avgorou technical school		**X**			
Pervolia Primary School		**X**	**X**	**X**	
A Geroskipou Elementary School					**X**
DE					
IGS List, Hannover	**X**				
IGS Büssingweg, Hannover					
DK					
Køge Gymnasium					**X**
Rygaards International School, Heelerup	**X**				
EE					
Tartu Hansa Kool	**X**				
EL					
Hellenic Association Of Independent Schools (HAIS)	**X**				
Ellinogermaniki Agogi, Pallini			**X**		**X**
FI					
Lintumetsän koulu, Helsinki					**X**
Terälahti primary school, Tampere					**X**
FR					
Lycée professionnel les Jacobins, Beauvais	**X**				
Collège Saint-Joseph, Plouescat	**X**				
Lycée Feyder, Epinay sur Seine					**X**
HR					
Upravna škola, Zagreb	**X**				

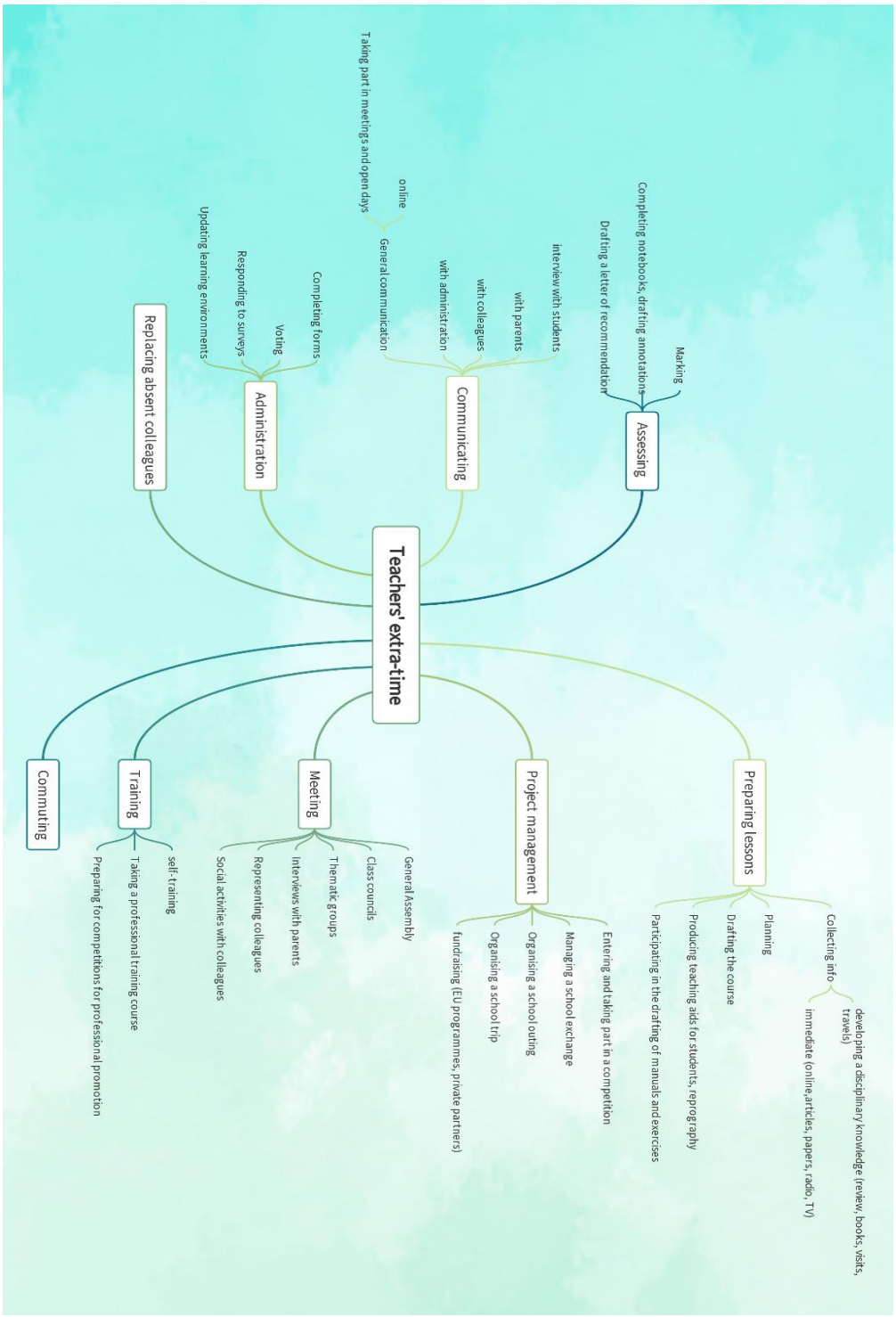
HU					
AME -Hungarian Independent Schools		**X**			
A Jövő Iskolája Általános Iskola Veresegyház	**X**				
REAL School, Budapest					**X**
IE					
ETB		**X**		**X**	
Piper's Hill school, Naas			**X**	**X**	
Kingswood Community College, Dublin		**X**			
Kinsale Community School	**X**		**X**		
IT					
RiGenerazione Scuola					**X**
LT					
Kauno Taikomosios Dailes Mokykla	**X**				
Marijampolės Sūduvos gimnazija					
LV					
Rīgas Valsts 3. ģimnāzija	**X**				
NL					
MBO Raad		**X**			
Jac. P. Thijsse College, Castricum	**X**				
PL					
VI Liceum Ogólnokształcące, Toruń	**X**				
2 Społeczne Liceum Ogólnokształcące z Oddziałami Międzynarodowymi im. Pawła Jasienicy STO, Warsawa	**X**				
PT					
Forave	**X**				
Zendensino	**X**				

Escola Profissional Vale do Tejo, Santarém	**X**				
Escola Profissional ALSUD, Mértola	**X**				**X**
Externato Santa Clara, Porto	**X**				
Escola Profissional de Loures	**X**				
ESB Mario Fonseca, Nogueira					**X**
Romania					
IDEES, Bucarest					
SI					
Head Teachers Association of Slovenia	**X**				
Gimnazija Bežigrad		**X**		**X**	
Gimnazija Jožeta Plečnika Ljubljana			**X**		
SP					
CEIP JJ Rebollo, San Juan del Puerto					

ANNEX. DIAGRAM. TEACHING HOURS



ANNEX. DIAGRAM. NON-TEACHING HOURS



ANNEX. FORM I. TEMPLATE FOR GREEN/DIGITAL DIAGNOSIS.

Obstacle	Description	Example	*Self-Assessment*
Lack of equipment	Insufficient number of computers, tablets, laptops, interactive whiteboards, and inadequate internet bandwidth and speed[2.2.1a]	*Sharing of equipment, slow connections and lack of access to the Internet means that teachers still waste a lot of time*	
Dependence on foreign technology	The digital transition has deprived Europeans of the instruments of their knowledge, placing them under the technological, operational and social dependence of Asia and the United States[2.2.1b]	*N/A*	
Isolation and disconnection from nature	Digitisation artificializes and virtualizes, presenting a significant risk of being cut off from nature[2.2.1d]	*Teachers and parents have been calling for a "return to nature", and for school space to be reused and made more profitable*	
Time constraints	Overloaded curriculum and additional responsibilities due to the pandemic leading to time constraints for teachers[2.3.2a]	*Global polls indicate that the primary cause of teachers reporting time constraints as a hurdle is an overloaded curriculum with multiple other responsibilities*	

Resistance to change	Resistance from parents, teachers, and lack of perceived benefits in using ICT for teaching[2.2.3]	*Digitalisation was quickly perceived as a time constraint without proper regulation and oversight of the education community*	
Lack of resources	Coordination issues, insufficient evaluation mechanisms, funding deficits, and lack of expertise and personnel[2.3.1a]	*The UN reported the main challenges as coordination between stakeholders, lack of evaluation mechanisms, funding deficits, and deficits in expertise and personnel*	
Materialistic obstacles	Lack of concrete implementation of the green transition in school spaces and infrastructure[2.3.1b]	*The implementation of the ecological transition has been limited by material obstacles that reduce it to the transmission of theoretical principles without concrete changes in school spaces and infrastructure*	
Pedagogical obstacles	Insufficient time allocated to implement the green transition, overloaded curriculum[2.3.2a]	*Insufficient time is outlined as an obstacle to implementing the green transition due to an overloaded curriculum and additional responsibilities*	
Digital individualism	Lack of collaboration and sharing of digital	*Teachers try to maintain the integrity of their course content instead of sharing*	

	resources among teachers[2.2.1d]	*resources through common drives*	
Security and technical issues	Frequent login processes, bugs, and cybersecurity threats limiting the use of digital technologies[2.2.1c]	*Digitisation exposes establishments to cyberattacks, and frequent login processes waste instructional time*	
Conflicting objectives	Contradictions between the digital and green dimensions of the twin transition[2.3.2]	*International evaluations like PISA do not account for the efforts made in the green transition, penalising schools that prioritise it*	

ANNEX. FORM II. TEMPLATE FOR SELF-EVALUATION IMPLEMENTATION SURVEY AT SCHOOL BY SKILLS AND TOPIC

	Digital transition	**Hours allocated**	**Green transition**	**Hours allocated**
Projects				
_Existence of an action plan and clear goals				
_Number of projects				
_Individual/collective projects				
_Resources allocated				
Professional development at local level				
_ Awareness				
_Citizenship				
_Career/vocational guidance				
_Collaborative skills				
By subject/grade				
_All departments are involved				
_Maths				
_Natural sciences				
_Computer sciences				
_Geography				
_Economics				
_Languages				
_History				
Buildings, learning environments				
_sustainable transport				
_garden, green spaces				
Fair working hours, good distribution of workloads, decent wages				
Collective implementation				
_local stakeholders				
_exchanges (schools, students)				

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