European Schoolnet

■ System Change Case Studies **Portugal**

# Portugal's digital transition strategy for education

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# FOREWORD

This case study on the Digital Transition Plan for Education in Portugal is the first in a series of publications that will lift the veil on system change in education, with a focus on digital transformation and related social innovation. After four decades, the transformation of education remains fragmented, in contrast to the speed and scale of change in society. Each year, a case study in the series will analyse a specific country initiative aimed at whole-system transformation. While looking at the final outcomes achieved, the case study will also focus on the processes - the journey - that have been essential in initiating and hopefully consolidating the change.

The case study series is one of the flagship initiatives of the recently launched European Schoolnet's Policy Learning Lab. The Lab is not a new structure or department at European Schoolnet, but a transversal effort and commitment to cross-fertilise policy-relevant learning from the many projects in different areas that the organisation runs each year, from the activities of its specialised working groups, as well as from the results of various other activities and reports. It is also an agile initiative to bring resources policy makers can use to inform their decisions, that will evolve as needed.

The Digital Transition Plan in Education is a perfect case to start the series and to learn from a specific system change experience. Its three pillars - capacity building, school strategy, and learning content and services - cover the main areas that need to be addressed in a systemic approach. It is almost universal in scope because of the number of teachers and schools involved in the plan, and the scale and intensity of the training provided. We are very grateful to the then Minister of education, João Costa, for his confidence and support for this first case study experience. We are also very grateful to Maria João Horta, Deputy Director of the Directorate-General for Education, and the team involved in the preparation of the study visit, for providing the study group with all the necessary information and for the impeccable organisation of the study visit, which met all expectations.

**Jan De Craemer**
Chair of European Schoolnet

# CONTENT

# EXECUTIVE SUMMARY

This case study on the Digital Transition Action Plan for education in Portugal is the first in a series looking at education system change initiatives in countries represented within European Schoolnet. Launched in 2020 by the Ministry of Education and its Directorate-General for Education, the Plan focuses on three key areas covered in the case study: capacity building, school strategy, and digital learning resources. The case study is based on desk research and a study visit to Portugal in October 2023 by a study group, which conducted a series of interviews with various stakeholders and visited schools.

The Digital Transition Action Plan for education in Portugal builds on several previous initiatives targeting school success, student competency profile, citizenship education, autonomy and curriculum flexibility, essential learning, inclusion, and assessment for learning through successive dedicated national programmes and strategies. The implementation of the Plan involves networks of intermediary actors, which provide the link between schools and the central level: Digital Ambassadors, Teacher Training Centres/CFAES and ICT Competence Centres. The broad objectives of the Plan are shared by most, if not all, education systems in the European Union. The way in which the initiators and implementers of the Plan in Portugal are seizing opportunities and adapting plans to overcome obstacles offers an interesting policy learning opportunity for all stakeholders involved in similar system change initiatives in other countries, as the authorities in Portugal begin to prepare the 'what's next' step.

## Key findings

Through the implementation of the Transition Plan, Portugal has made significant progress in supporting schools to integrate digital education. A very large number of teacher trainers and teachers have been trained – and some are still being trained - in a 'pedagogy first' use of technology and their effective progress has been demonstrated according to the DigCompEdu framework and related tools. A large majority of schools' groups (clusters) have developed their digital strategic plan and detailed concrete actions, many of which have already been implemented. Innovative digital learning resources are still being developed. To build on this progress, it will be important to develop a multi-pronged strategy:

- widening the reach and impact of digital transition in more schools, and in those that have been slow to adopt new tools and approaches; identifying the reasons limiting adoption of innovative practice as a way to efficiently tackle them; implementing different sorts of incentives.

- deepening educators' expertise in using digital tools to support pedagogy depending on subject, tools specificities, etc.; supporting learning at whole-system level (not only at school level); and building school capacity to strategically plan training whole-school development.

- sustaining the program to build on investments in infrastructure and capacity building; and consolidating the intermediate ecosystem of CFAEs, EDs, and CCTICs.

### *WIDENING*

- Support schools/teachers that have been slow to integrate digital technologies in classroom teaching, learning and assessment.

- Integrate a qualitative monitoring component into the recently launched mentoring initiative for schools and school groups part of the Digital Textbook Piloting Project /PPMD.

- Implement incentives and provide better technical support.

- Add indicators in official school inspection/ evaluation related to use of digital tools in schools.

- Share examples of best practice on a central database / online seminar among teachers to support professional learning (with a clear lead/structure for the professional learning community).

## *DEEPENING*

- Develop a training offer to support a strong focus on digital pedagogy e.g. understanding affordances and limits of different digital platforms, opportunities for blended learning (e.g. field research in historical sites, museums, science classes, community organisations).

- Include a 'learning' remit (in addition to a support to top-down implementation) to the eco-system of Teacher Training Centres/CFAEs, Digital ambassadors, and ICT Competence Centres.

- Support schools to build training plans from a strategic whole-school perspective that is more than the addition of individual teachers' training needs.

## *SUSTAINING*

- Ensure ongoing financial support for teacher training/ school networking.

- Plan ahead infrastructure update and renewal and next generation digital learning resources.

- Consolidate the eco-system of Teacher Training Centres/CFAEs, Digital ambassadors and ICT Competence Centres in the short and long term.

# INTRODUCTION

This is the first in a series of case study reports by European Schoolnet (EUN) to support "policy learning" within the case study countries themselves, as well as in other countries confronting similar challenges. The aim of the policy learning approach – as opposed to "policy transfer" or "policy borrowing" – is to support mutual learning and knowledge construction within and across systems (Raffe, 2011). The policy learning approach recognises that change processes are highly context-based and contingent (Viennet & Pont, 2017). At the same time, the sharing of experiences can support reflection and anticipation of issues that may arise at different periods of time or in very different country contexts.

The first case study in the series focuses on Portugal's digital transition strategy for education. It addresses challenges that will be familiar to systems that have aimed – with varying levels of success – to integrate digital education in schools and classrooms, and to improve learner engagement and achievement. The move to emergency-remote learning at the height of the 2020-22 COVID-19 pandemic, the increasing sophistication and availability of learning platforms and interactive programmes that can support personalised learning, and most recently, the growing presence of Artificial Intelligence (AI) in education settings, have all contributed to an acceleration of integration of digital education content in schools. Policy learning in this area is extremely timely.

Portugal's digital transition strategy takes a "pedagogy first" approach. This case study has chosen as its main analytical framework Michael Fullan's approach which considers the role of technology in education as a means to catalyse further improvements and innovations in pedagogy (Fullan, 2013). The Fullan analytical model, built on decades of observations and discussions in schools and advice to public authorities, offers the advantage of being clear and accessible to all. It looks at what is happening from three main angles closely articulated together: the pedagogy, the technology, and the change knowledge for successful and whole-system level implementation. This main analytical framework is enriched by evidence from research on issues such as, in the Portuguese strategy, conditions for effective professional development or mechanisms for spreading innovation at whole-system level for example.

The methodology for this case study is based on two main elements: desk research of official documents (laws, decrees), progress reports drafted by public authorities, evaluation reports commissioned to Portuguese universities and grey literature; and a one-week study visit by a study group (Mart Laanpere/Tallinn University, Janet Looney/European Institute for Education and Social Policy/EIESP, Patricia Wastiau/European Schoolnet/EUN) in October 2023 during which interviews, focus groups and visit to schools took place (see appendix for details).

This case study presents the context and overall strategy framing the Digital Transition Action Plan for education and the key elements of the Plan (Chapter 1). It then focuses on the 'pedagogy first' approach of the Plan presenting more specifically its capacity building element and discusses how it is supported by evidence from research and what can be learnt from its implementation to date (chapter 2). Chapter 3 addresses the technology side of the Plan (equipment and connectivity) and discusses its strategy for digital learning resources. Chapter 4 presents and discusses several aspects of the implementation strategy ('Change Knowledge' in Fullan's approach) and proposes learning points for discussion. The sustainability of the Plan is discussed in the recommendations chapter.

# 01. **Portugal's digital transition strategy for education**

Portugal's Digital Transition Action Plan (2020) (Council of Ministers Resolution no. 30/2020) sets out a global strategic vision for digital transition across the State, private sector companies, and citizens in general. The three pillars of the plan are: Pillar I – Training and digital education of the people; Pillar II -- Digital transformation of the business fabric; Pillar III -- Digitalisation of the State.

Education underpins Pillar 1 of the plan. It includes integration of technologies across the curriculum in basic and secondary education. The aim is for "...*the continuous improvement of the quality of learning and the innovation and development of the educational system, providing children and young people with the digital skills necessary for their full personal and professional fulfilment, as well as equal opportunities in access to quality digital educational equipment and resources and investment in the digital skills of teachers and trainers in the context of the training modalities of the National Qualifications System.*"  (Presidency of the Council of Ministers, 2020, p. 15)**.**

Ministry of Education officials describe the Digital Transition Action Plan for education as taking a "pedagogy first" approach. They have taken inspiration from Michael Fullan's work on the role of technology in education: digital education seen not as an end in and of itself, but rather as a way to catalyse further improvements and innovations in pedagogy (Fullan, 2013).

## 1.1 - Recent initiatives that set the context for Portugal's digital transition in education

Portugal's digital transition strategy for schools is one of several recent initiatives introducing significant changes to the content, aims and pedagogy of education. These include:

- The National Programme for Promoting School Success (2016) (Programa Nacional de Promocão do Sucesso Escolar – PNPSE).

- The Student's Profile by the End of Compulsory Education (2017) (Perfil dos Alunos à Saída da Escolaridade Obrigatória). Legislative Order No. 6478/2017, 26th June.

- The National Education Strategy for Citizenship (2017) (Estratégia Nacional da Educação para a Cidadania / ENEC), enacted under Decree Law No. 55/2018.

- The curriculum for primary and secondary education and the guiding principles for learning assessment (2017 pilot) and Decree Law No. 55/2018 (Lei da Autonomia e Flexibilidade Curricular / AFC), Ordinance  n.º 306/2021, management of more than 25 per cent of the basic curricular matrices of primary and secondary education and training programmes; Ordinance no.º 9726/2018, creates a national coordination team, assisted by a technical team and regional teams, with the mission of following up, monitoring and evaluating the application of Decree-Law no. 55/2018, as well as Decree-Law no. 54/2018.

- Essential learning (2018) (Aprendizagens Essenciais) (Legislative Orders No. 6944-A/2018, of 19th July and No. 8476-A/2018, of 31st August).

- The Law for Inclusive Education (2018). Regime jurídico da educação inclusiva). Decree Law No. 54/2018.

- National monitoring, supervision and research in pedagogical assessment project (launched in 2019) (Monitorização, Acompanhamento e Investigação em Avaliação Pedagógica / MAIA.

- The ITENS platform  (launched in early 2024) providing guidance on the development of classroom-based assessments.

These different initiatives – in particular the National Education Strategy for Citizenship and the Law for Inclusive Education - give direction to and are themselves strengthened by the digital transition strategy adopted in 2020. The Students' Profile, which sets out the overall aims and values for education in Portugal, underpins initiatives developed since it was introduced in 2017, and creates a sense of coherence.

- **The National Programme for Promoting School Success** (2016) aims to promote student achievement by reducing grade repetition. The programme promotes cooperation among teachers and highlights the importance of early identification and intervention for students at risk of failure. Early intervention is favoured over remedial strategies.

  The national programme encourages schools to cooperate with local authorities and intermunicipal organisations in support of students. Each school is required to develop its own strategic action plan outlining how it will go about improving student learning, while taking the local context into account. The Ministry of Education has also encouraged exchanges between schools on their experiences, for example through national seminars involving teachers, school leaders, and other staff (European Commission, 2022).

- **The Students' Profile by the End of Compulsory Schooling** (2017) sets out the principles, vision, values, and competence areas (academic and social/emotional) students are expected to achieve on completing compulsory schooling. The initial development of the profile was drafted by a team of experts. Further input was gathered through a national consultation to strengthen the credibility of the reform. In 2018, the Exit Students' Profile was made available to all public and private schools (OECD, 2022).

  The main areas of the profile are: (i) Languages and Texts; (ii) Information and Communication; (iii) Reasoning and Problem-solving; (iv) Critical and creative thinking; (v) Inter-personal relations; (vi) Personal development and Autonomy; (vii) Welfare, Health, and Environment; (viii) Artistic and Aesthetic sensibilities; (ix) Scientific, Technical, and Technological Knowledge; (x) and Awareness and Command of the Body (see Figure 1.1).

  The profile is a core reference document, and frames decisions taken at all levels of the school system (e.g., curriculum implementation, approaches to teaching, learning and assessment, strategies, digital education, etc.).
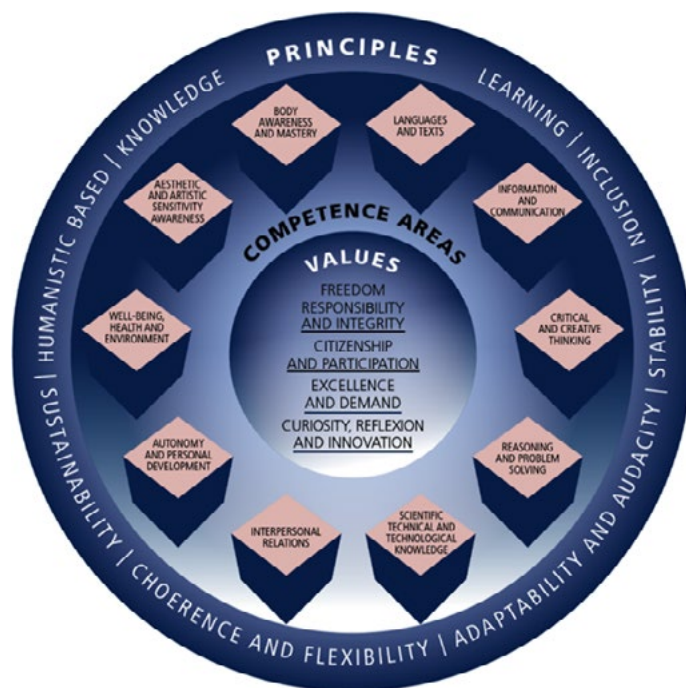


**Figure 1.1 - Conceptual Framework for the Students' Profile by the End of Compulsory Schooling**

*Source:* DGE, Students' Profile by the End of Compulsory Schooling https://cidadania.dge.mec.pt/sites/default/files/pdfs/students-profile.pdf

- **The National Education Strategy for Citizenship** (2017) is linked to values highlighted in the Exit Students' Profile: inclusion, sustainability, responsibility, integrity, curiosity, reflection and innovation, and freedom (OECD, 2022). Teaching on subjects such as democratic institutions, the environment, sustainability, human rights and health are mandated, and partnerships with Non-Governmental Organisations (NGOs) and other institutions are promoted. A training programme on citizenship education for at least one coordinator per school was launched to support broad implementation (OECD, 2018).

- **Curriculum for primary and secondary education and the guiding principles for learning assessment** (2018) allows schools autonomy and flexibility to manage curricula, as well as the design of learning spaces and schedules. Interdisciplinary work, project-based learning, the creation of new subjects to strengthen competences set out in the Exit Students' Profile and the Essential Learnings and pedagogical differentiation to meet varied learner needs are encouraged. The Decree-Law 55/2018 enables a change in organizational and pedagogical practices, supported by curricular documents that define the essential learning to be achieved by all students. According to Ordinance n. ° 306/2021, schools are empowered to modify up to 25% of the curriculum. In fact, schools are required to develop a strategy as to how they will use their autonomy and flexibility to support student competence development, setting out the design, implementation, and evaluation plans for educational activities. Innovation plans must be validated by the Ministry of Education.

  *Autonomia e Flexibilidade Curricular* (AFC) Teams - The Ordinance no. 9726/2018 creates a national coordination team, that gathers high level representatives of several entities of the Ministry of Education, assisted by a technical team and five regional teams, with the mission of following up, monitoring and evaluating the application of Decree-Law no. 55/2018, of July 6, as well as Decree-Law no. 54/2018, of July 6, also defining the territorial scope of intervention of the regional teams.

  The five regional teams integrate representatives of several entities of the Ministry of Education, supported by representatives of the School Association Training Centres (CFAE), developing proximity monitoring, such as visiting schools and promoting network meetings. Moreover, the regional teams identify and disseminate best practises in place in schools and promoting reflection on them.

- **Essential learning** (2018) is the main curricular guidance document for planning, designing, and assessing students' learning. It provides a concrete learning programme for developing the competences identified in the Exit Profile of Students Leaving Compulsory Education (European Commission, 2022).

  An important aim for the development of Essential Learning has been to streamline curricula so that it is based on the core competences all students should learn and allow more space for schools to take advantage of curricular flexibility (as highlighted above).

  The Essential Learning reform was initially piloted in 2017-18 in schools that were participating in the project on curriculum autonomy and flexibility. A survey of teachers' views on content essential for all students was also implemented. Curricular orientations and learning standards for different subjects were developed in consultation with teacher associations or scientific societies. Various stakeholders have also been involved in different stages of implementation of the AE, to ensure broad ownership of the reform.

- **The Law for Inclusive Education** (2018) defines inclusion in the Portuguese education system as "...*a process that aims to respond to the diversity of the needs and potential of all students, by increasing participation in process of learning and educational community life.*" (Ministry of Education, 2022; OECD, 2022). All students have a right to access and full participation in education. The principles of equity and non-discrimination underpin the legislation.

Schools are responsible for identifying and responding to the diverse learning needs of individual students. Differentiated instruction, curricular accommodations, and when necessary, differentiated curricular pathways and adaptations are encouraged. Furthermore, all teachers and staff are responsible to support learner needs, and not just those with specialised training (OECD, 2022).

- **The national project of training, supervision and research in classroom assessment / MAIA project** (2020-2021) – aims to improve assessment, teaching, and learning practices through the continuous training of teachers.

- In addition, the **ITENS platform**, launched in early 2024, was developed by the national Institute of Educational Assessment (IAVE).  It provides guidance on the development of classroom-based assessments in different curriculum and subject areas.  Teachers may refer to the platform as they develop lesson plans, including how they will assess student learning.  The ITENS platform is searchable by curriculum area/subjects, each item providing information on assessment objectives, criteria, cognitive complexity and cognitive abilities used, examples of learning situations to support student improvement, and test characteristics (e.g. format, typology, construction techniques and key psychometric data)[1].

   Other changes to student assessments are ongoing. For example, new national examinations will place a greater emphasis on measuring students' critical thinking competences. These are administered once a year for students in 2nd, 5th and 8th grades (results do not count toward the final grade). Students in 9th, 11th and 12th grades sit final examinations that count toward their final grades – and for students in 11th and 12th grades, which may be used in decisions on university entrance.

The various initiatives outlined above – as well as the digital transition plan -- have taken similar approaches. In the policy design phase, new initiatives have involved some level of expert input and stakeholder consultations. Once launched, several of the initiatives have also introduced teacher training (whether targeted to school-level coordinators or more broadly), the development of school level leadership teams, and requirements for school level plans and school-self evaluations. Research reports have been commissioned to track implementation of the Digital Transition Plan as well. Policy makers have referred to evidence in the design of initiatives, while evaluations allow a view on potential tensions between research and practice, and challenges in implementation in a complex, multi-layered education system.

The Students' Profile has served as the core framework and has helped to ensure that the different initiatives – including digital transition – are all focused on "pedagogy first", and that different initiatives are coherent with each other.

As with other recent initiatives outlined above, Portugal's digital transition plan is underpinned by the Student's Profile. In turn, the digital transition supports aims for inclusion and citizenship, curricular autonomy, and new approaches to student assessment. Stakeholders interviewed noted, for example, that digital tools have allowed them to differentiate the curriculum more effectively, in line with the aims of the Inclusion strategy. Students use digital platforms to collaborate on projects, in line with competence-based curricula. The digital transition plan also places an emphasis on digital citizenship, in line with the National Education Strategy for Citizenship. Media literacy, and the ability to distinguish facts from opinion, to identify and fight fake news, can be highlighted using digital tools. Schools' digital plans also require them to outline plans to protect student health and safety (e.g. screen exposure time, cyber security and other elements relevant to student health and wellbeing).

Stakeholders interviewed have also recognised that there is still work to be done across these various initiatives. Change across education takes time, and all initiatives are still in the relatively early stages of implementation. Importantly, new student assessments have not been fully coordinated with other initiatives. For example, the MAIA initiative and other efforts to align summative assessments more effectively with competence-based curricula and to support inclusion are still under development. Until student assessments are more coherent with other changes, there will continue to be challenges in integrating new approaches.

## 1.2 - The Digital Transition Action Plan in a nutshell

The Digital Transition Action Plan in education (PDE) was adopted in 2020 and started to be developed in the same year, for example, by the preparation and implementation of the teachers' trainers training, the design of the teachers' workshops for digital development, and the first year implementation of the digital textbooks pilot-project. The Plan was developed and is coordinated by several entities within the Ministry of Education: DGE, General Directorate for Schools (*Direção-Geral dos Estabelecimentos Escolares* - DGEstE) and the General Secretariat of Education and Science (*Secretaria-Geral da Educação e Ciência* - SGEC. It is financially supported by the State Budget and by the European Social Fund, and later complemented by funds targeted to the Digital Educational Laboratories (LED), the Digital Educational Resources (RED) within the Recovery and Resilience Facility (RRF), the temporary instrument that is the centre piece of the EU's plan to emerge from the post Covid19 crisis.

### Focus areas

The Plan essentially focuses on three areas: digital professional development for teachers, digital development of schools, and digital educational resources. It is supported by an equipment and connectivity plan - exceptional in size - providing a laptop to every student and teacher in primary and secondary education and mobile connectivity at no cost to students and teachers.

- **Digital professional development for teachers** – The objective is to develop and motivate teachers to improve their digital skills, enabling them to use digital technologies with confidence. Teacher training courses are pitched at different levels of digital proficiency, as are other digital training opportunities. In February 2024, after 3 years of completion of the teacher training program, almost 70% of Portuguese teachers in primary and secondary education have participated (DGE 2024) and completed Level 1 and/or Level 2 and/or Level 3 courses, as well as other digital skills related training courses. This teacher training program held by the CFAE will continue in 2024 and 2025.

- **Digital development of schools** – The objective is to develop and implement a Digital Development Action Plan (*Plano de Ação para o Desenvolvimento Digital das Escolas* - PADDE) as a tool for reflection and change in practices in each school, to serve as a strategic reference to support decision-making and monitoring. These plans were designed by the Digital Development Teams of each school, during a training course created specifically for this purpose, and were based on SELFIE for school's results. The PADDE should cover the pedagogical, technological/digital and organizational dimensions of the school strategy.

- **Digital Educational Resources** (*Recursos Educativos Digitais* - RED) – The first and main objective is to produce digital educational resources adjusted to the entire Portuguese curriculum. Moreover, it is also intended to provide teachers with professional digital competences in the pedagogical use of technologies and digital educational resources supporting the curriculum (by subjects and on an interdisciplinary basis) which enable the creation of digital environments that promote quality and meaningful learning. This action line included a training plan for teachers involved in the Digital Textbooks pilot project (*Projeto-Piloto Manuais Digitais* – PPMD) run in four phases from September 2020 involving in 2023/2024 a total of 103 School Cluster/schools. PPMD aimed to approach differentiated pedagogical models and practices, with an impact on students' learning. This initiative worked towards the identification of potentials and constraints of the transition from paper to digital textbook; to understand the different appropriations of the digital environments created, for students and for teachers; and explore digital educational resources with guided pathways (learning sequences among others). The aim was to monitor the progressive dematerialisation of textbooks and promote the use of digital teaching educational resources in schools. Workshops and other teacher training sessions on teaching practices using digital technologies and textbooks were part of it.
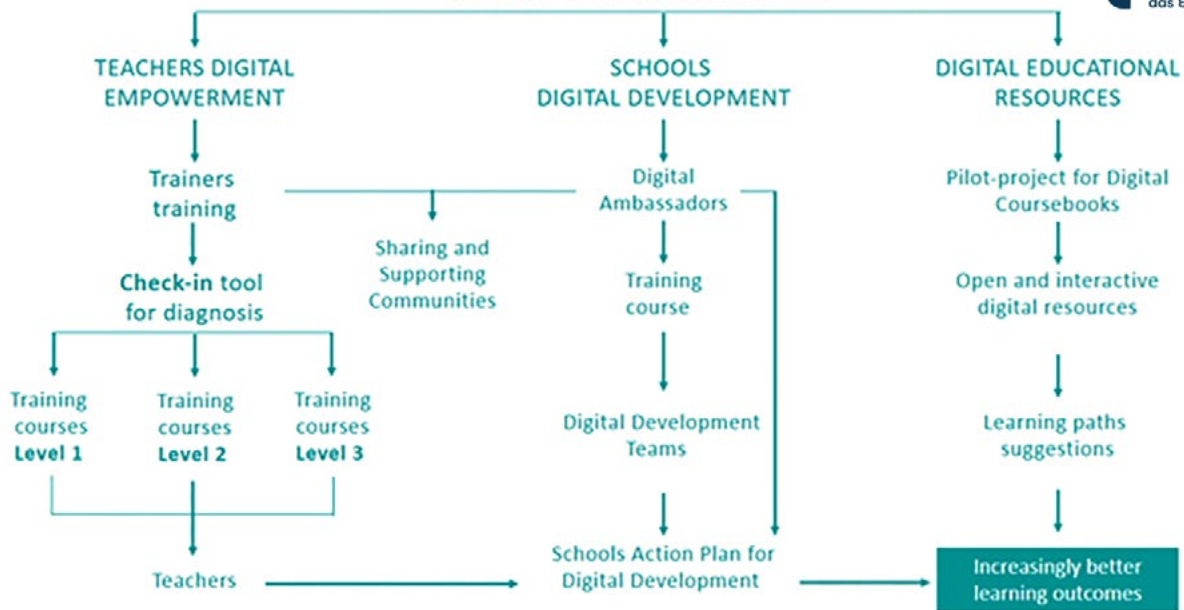
**Figure 1.2 – Scheme of the Digital Transition Action Plan**

*Source:* DGE

## Stakeholders involved

The Plan's implementation is supported by several stakeholders under the leadership of the Ministry of Education. They are mostly the ICT Competence Centres/CCTICs, the School Associated Training Centres/CFAEs and the Digital Ambassadors belonging to them. All three stakeholders develop activities related to capacity building and support for implementation. A detailed description of the role and activities of CCTICs, CFAEs and Digital Ambassadors is provided and discussed under the Capacity Building sub-section in chapter 4 Change Knowledge.

eTwinning and Learning Labs in school networks have also contributed to the implementation of the first phase of the capacity building development focusing on the training of the trainers including Digital Ambassadors and teacher trainers from CFAEs. The CCTICs collaborate in various other actions from the elaboration of CDE benchmarks for teacher trainers /Digital Ambassadors.

## Capacity building

Professional development is an essential element of the Plan. The DigCompEdu competence framework - developed by the Joint Research Centre of the European Commission -, together with the curricula, have been the reference guiding the capacity building part of the Plan.

**Figure 1.3 - Conceptual view of the DigCompEdu framework**

**Training the trainers** - The professional development provision started with a 35-hour training of teacher trainers in different areas. Between October 2020 and May 2023, 926 trainers were trained. This training is detailed and discussed in Chapter 2.

**Training Digital Ambassadors and CFAE directors** - A 15-hour training programme was specifically designed for Digital Ambassadors and directors of CFAEs. Its aim was for them to support schools in two areas: teacher participation in the diagnosis process to self-assess their current level of digital competences, and the preparation of the Action Plans for Digital Development of Schools (PADDE). 174 participants took part in that course, of which 162 were certified. This training path was based on self-learning and autonomous work; each participant managed the tasks by reading, accessing the platform, archiving documents, researching for deeper understanding, elaborating individual and group reflections, participating in forums and attending synchronous sessions.

The training of the trainers was monitored through a Learning Management System (LMS) platform for aggregating content to support training, an animated community of practice, feedback systems and regular meetings in various formats.

Two communities of practice were established, one for Digital Ambassadors and CFAE directors (with 310 active participants), the other for teacher trainers (with 956 participants). The objectives of those communities – run on a platform established by DGE – was to encourage reflection and sharing related to professional development in digital skills and the evolution of schools' digital maturity. Providing a broader view in real time at national level, the platform made possible timely intervention in areas that are more challenging and support for the CFAE and the Digital Ambassadors in the implementation and monitoring of the PADDEs.

Through the reports produced by the platform database, analysis and reflection also support the CFAE to be able to understand the priority areas of intervention more easily in terms of training.

**Training the teachers** - Between October 2021 and December 2023, 7,540 training courses for teachers were organized across Portugal. The content and organization of the training is detailed and discussed in Chapter 2. This program, as already mentioned, will continue in 2024 and 2025, with the necessary adaptations.

The training has had a positive effect on the development of teachers' digital competence as measured by the University of Aveiro (see below and in Chapter 2). A survey carried out by the same university addressed the perceived quality of the training organized, according to four dimensions: articulation between theory, practice, content, and activities developed; focus (pedagogical potential for changing practices, experimentation and reflection); suitability (to the needs and specificities of the area of knowledge and the professional context); and trainer (pedagogical-didactic knowledge and capacity for differentiation). The survey results reveal that quality was perceived in all four dimensions.

## Monitoring

To enable data collected by the CFAE to be registered, a platform was built by DGE to monitor the teacher training and the PADDE development in each school. The flow of communication is developed more widely for example in the Digital Ambassadors' Community of practice. The bidirectional movements of information and action created within the different stakeholders regarding the school´s digital development contribute to promote practices that respect the specific circumstances of each context, while simultaneously aligned with the national goals and principles as illustrated by the figure below.
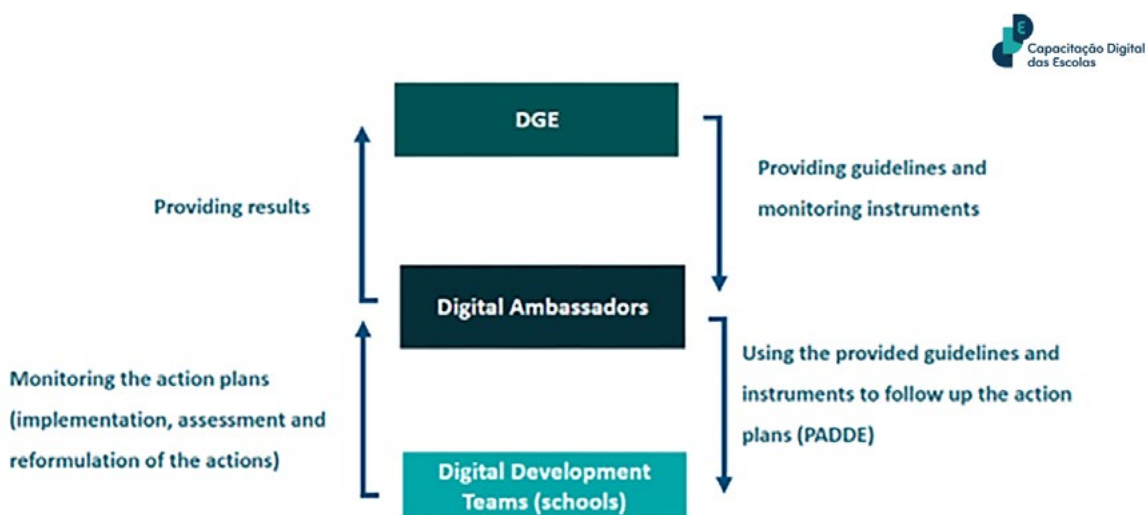


**Figure 1.4 – Communication flow between stakeholders for monitoring**

*Source:* DGE

Several reports were produced as part of the monitoring of the Digital Schools Empowerment initiative (CDE), and have been made public (or will be soon for the most recent ones):

- Two studies commissioned by the Directorate-General for Education (DGE) to the University of Aveiro (mentioned above) on the level of digital competences of teachers in public primary and secondary schools in mainland Portugal. Data from the longitudinal study of the Universidade de Aveiro (sample of 1074 teachers) highlights the progression reported in the table below for teachers who underwent training as part of the Digital Teacher Training and who completed the Check-In in the 1st (pre) and 2nd (post) phases:

|  |  | Year | |
|---|---|---|---|
|  |  | 2021 | 2024 |
| Níveis de proficiência | A1 | 1 % | 0.5 % |
|  | A2 | 15.7% | 6.5 % |
|  | B1 | 38.1 % | 29.7 % |
|  | B2 | 29.3 % | 35.8 % |
|  | C1 | 13.5 % | 21.2% |
|  | C2 | 2.3 % | 6.3 % |

- A report on teachers' confidence in using digital in the transition to distance learning produced by the Directorate General for Education (DGE) in the context of the remote teaching emergency phase arising from the Covid-19 pandemic. It analyses the degree of teachers' confidence in

the use of digital in different dimensions: (i) assessment, (ii) pedagogy, (iii) methodology and (iv) planning (*Estudo sobre o nível de competências digitais dos docentes do ensino básico e secundário dos Agrupamentos de Escolas e das Escolas Não Agrupadas da rede pública de Portugal Continental, Ministério da Educação, Direção-Geral da Educação, 2021*[2].

- Another report by the Directorate General for Education (DGE) provided an impact assessment study of the pilot project of the Digital Textbooks (nearing completion), as part of the Digital Textbooks Pilot Project (PPMD) (*Projeto-piloto de desmaterialização de manuais escolares e de outros recursos educativos digitais*, 2021, Ministério da Educação, Direção-Geral da Educação, 2021[3].

## Communication and dissemination

In order for the Plan's implementation to reach the educational communities and the general population in an effective way, several communication actions were implemented. These include a website[4], a video with the main actions to be developed[5], and a brochure[6].

In order to promote a joint reflection on the actions carried out and debate the main challenges facing the work of Digital Ambassadors, the ministry/DGE organised two online events and one face-to-face event. The first online event was about the PADDE and was attended by more than 3,000 participants and a recording of the event on You Tube received more than 20,000 views[7] in April 2021. The second online event concerned the digital capacity building of teachers. It attracted 1,000 teachers and the recording was viewed by more than 9.000 users[8].

In order to create a continuity of collaborative work between CFAEs, schools and teachers, the DGE also encourages regional events to share practices and disseminate scientific and pedagogical knowledge, complementary training activities and reference practices in the preparation and implementation of the PADDE.

In order to support schools at regional level, the DGE, in close collaboration with the ICT Competence Centres (CC TIC), the Training Centres for School Associations (CFAE) and their respective Digital Ambassadors (ED), organised two cycles of events, each comprising 14 Regional Events (RE), aimed at school leaders and members of the Digital Development Teams (EDD) during the school years 2022/2023 and 2023/2024. The objectives of these Regional Events were to ensure the sustainability of the Digital Transition Plan, to stimulate joint reflection on the digital development of schools, to involve the DGE-CC ICT-CFAE-ED-EDD network; and to make the reference practices of the organisational units visible.

The first cycle of regional events in 2022/2023 was organised over half a day and promoted reflection on practical cases in parallel rooms with the subsequent presentation of conclusions in plenary. The Programme of the 2nd cycle of Regional Events in 2023/2024 has been extended to full-day sessions with: a thematic session with a panel of guests; dialogue labs with discussion scenarios; and school practice sharing sessions. Based on of the needs and potentials of each context, the CC TIC, the ED and the CFAE Directors have selected the topics to be discussed, from of a list defined by the DGE[9].

There were also three face-to-face events, the first two of which were specifically designed for Digital Ambassadors and the third which was open to School Directors and other participants. They included:

- November-2021 Digital Empowerment of Schools - Support and monitoring of ongoing work (*Capacitação Digital das Escolas -Apoio e Monitorização do trabalho em curso*) with 85 ED.

- November 2022 -Digital Empowerment of Schools -Act to Change Schools with 79 ED.

- October -2023 -Digital Empowerment of Schools -Reconfiguring Learning Spaces, with more than 1.000 participants.

Additional information can be found on: https://digital.dge.mec.pt/agenda.

# 02. The "pedagogy first" approach

Portugal's "pedagogy first" approach to digital education has included national support for and significant investment in teacher professional development in digital education (aided by post-pandemic Recovery and Resilience funds). Key elements to support teaching, learning and assessment with digital tools are:

- A professional development programme to build teachers' and school leaders' digital competences, including the use of digital tools to support pedagogy. Given the plans to provide laptops and connectivity to all learners and teachers, the training programme has aimed to ensure all school leaders and teachers are reached.

- Support for "whole school" approaches to integrating digital tools. The School Digital Development Action Plan (*Plano de Ação para o Desenvolvimento Digital da Escola* / PADDE) and the development of school-level digital teams are an important part of this.

- Monitoring and evaluation of the digital transition, including commissioning evaluations by universities.

Portugal's emphasis on "pedagogy first" is also well-supported by empirical studies. A 2006 European Schoolnet literature review by Balanskat, Blamire and Kefala, for example, found that the impact of ICT on student learning is highly dependent on the teacher's capacity to "…exploit it efficiently for pedagogical purposes." (p. 5). Timotheou (2022) highlights several studies underscoring this point (Box 2.1).

**Box 2.1: Empirical evidence on digital education that emphasises "pedagogy first"**

In their recent review of the literature on the impact of digital technologies on education (Timotheou et al., 2022) identify several empirical studies highlighting the importance of a "pedagogy first" approach to digital education, alongside effective teacher professional learning. Selected literature included in the review underscores key elements:

- Li and Ma (2010) and Hardman (2019) showed that the positive effect of technology on students' achievement depends on the pedagogical practices used by teachers.

- Schmid et al. (2014) found that learning was best supported when students were engaged in active, meaningful activities with the use of technological tools that provided cognitive support.

- Garzón and Acevedo (2019) found that the success of a technology-enhanced intervention is based on both the technology and on the pedagogical strategies teachers choose to implement. Their results indicated that the collaborative learning approach had the highest impact on students' learning gains among other approaches (e.g., inquiry- based learning, situated learning, or project-based learning). Ran et al. (2022) also found that the use of technology to design collaborative and communicative environments showed the largest moderator effects among the other approaches.

- Hattie (2008) reported that the effective use of computers is associated with training teachers in using computers as a teaching and learning tool.

- Zheng et al. (2016) noted that in addition to the strategies teachers adopt in teaching, ongoing professional development is also vital in ensuring the success of technology implementation programs.

- Friedel et al. (2013) found that providing training and support to teachers increased the positive impact of the interventions on students' learning gains. Fu (2013) reported that the lack of teachers' knowledge and skills on the technical and instructional aspects of ICT use in the classroom, in-service training, pedagogy support, technical and financial support, as well as the lack of teachers' motivation and encouragement to integrate ICT on their teaching were significant barriers to the integration of ICT in education.

Digital tools can also facilitate formative assessment to track student learning and adapt teaching (see Box 2.2 for evidence on the impact of digital formative assessment on student learning), and this is an area where teachers interviewed noted progress. For example, the use of tools such as Kahoot, Padlet, CANVA and new digital textbooks and other digital tools provide instant feedback. Collaborative platforms such as TEAMS and Google Platform allow teachers and peers to provide written comments and feedback on student work, with reference to common rubrics setting out criteria for assessment. While digital formative assessment may support student motivation and learning, its effectiveness depends on how it is used (see Box 2.2).

**Box 2.2: Digital formative assessment**

Research finds that digital learning and assessment has the potential to support more powerful student learning. Hattie (2008), for example, in his widely cited analysis of meta-reviews in education research finds significant effect sizes for a range of formative assessment methods in ICT-based environments (intelligent tutoring systems, formative evaluation, and so on). Digital technologies used in education include student e-portfolios, social media, digital textbooks, mobile learning, classroom polling, digital games and integrated formative and summative assessment.

While digital formative assessment may have a significant impact on student motivation and learning, its effectiveness also depends on how it is used, and how it is integrated with teaching and learning aims. This includes how teachers design lessons to support learning aims, elicit evidence of student understanding, respond to identified learning needs, and support student reflection and progress.

As teachers integrate digital technologies, they may create digital learning environments to support learning. In other words, they decide how to use digital platforms and tools to structure learning and content aims, to guide and sequence activities, and to elicit evidence of understanding. This may involve a combination of technologies as well as face-to-face interactions. The specific approach will vary by subject area and learning aims but needs to be grounded in theories of learning and to support learning through interaction (whether with fellow learners, the teacher, or with learning objects in the digital environment).

Learners may also be encouraged to work independently and collaboratively. For example, a variety of Web 2.0 tools may embed assessment (e.g. through quizzes embedded in e-textbooks) or students may use platforms to design their own multi-media projects. Assessment may also draw on non-digital tools such as rubrics that set out standards and criteria by which they can assess the quality of their own work. E-coaches and other digital monitoring tools may help students to track their progress toward learning goals, provide automated feedback and/or scaffold activities for learning based on prior responses. Learners may also benefit from online peer feedback (e.g. through online discussion platforms), or in collaborating to address complex problems, with assessment grounded in the problem-solving activity itself.

At the same time, summative assessments have not been fully adapted to the new curricula. School leaving examinations, for example, have high stakes for students, and as several case study interviewees noted, upper secondary schools are largely focused on helping prepare learners for these examinations. For students in upper secondary education innovations, including integrating digital technologies to support competence-based curricula, may thus be undermined.

The following section outlines key elements that have contributed to the use of digital tools to support pedagogy, and to build competences of teacher trainers and teachers over time.

## 2.1 - Teacher professional development approach

Portugal's digital transition strategy was developed following the Prime Minister's decision to provide all students and teachers with a laptop and connectivity. Determined to avoid the mistakes of initiatives focused primarily on digital infrastructure, a decision to ensure all teachers were provided with effective professional development was made. Although officials briefly considered training via an empowerment of teacher trainers[10], a more substantial professional development programme that could be tailored to school-level needs was developed. It is a training model that promotes autonomy, adaptation, and decentralisation of the training process, where trainers are encouraged to develop their own training process based on the knowledge acquired, the aims of the workshops of level 1, 2 and 3, and the specific characteristics of their training context. Research also supports this more intensive approach to teacher professional learning, given the high-level of complexity involved in integrating digital tools in teaching, learning and assessment (see Box 2.1).

The training of trainers was considered a key component of the digital empowerment plan for teachers. In other words, only trainers appointed by the CFAE with a high level of digital literacy and trained in the appropriate pedagogical integration of digital technologies in teaching and learning are qualified to promote the development of teachers' digital literacy, as specified in the different areas of the DigCompEdu reference tool.

The training frameworks developed have been theoretically supported by DigCompEdu and DigCompOrg. All the frameworks were submitted to the Conselho Científico-Pedagógico da Formação Contínua (the Scientific and Pedagogical Council for Continuing Education) for accreditation and were duly approved.

The course had the following specific objectives: to raise awareness of policy frameworks in relation to the digital transition in education; to enable trainees to mobilise teachers to adopt active methodologies; to promote reflection on face-to-face and distance training strategies; to contribute to reflection on teacher training methodologies and their operationalisation; to outline innovative strategies for approaching the DigCompEdu areas to develop digital activities in an educational context; and to promote the involvement of teachers in knowledge-sharing communities to stimulate reflection, collaboration and the critical use of digital technologies in an educational context.

To train these trainers, the DGE has streamlined the course "Training Trainers for the Teachers' Digital Literacy" course, and there are currently a total of 926 certified trainers.

The professional development programme starts with a diagnosis of the school and teacher needs for digital competence development. The Check-in tool (available at the time and based on the European Joint Research Centre's DigCompEdu) was used by the CFAEs to place teachers in one of the three levels of digital literacy. The SELFIE tool has been used by many schools, teachers, and students to assess the use of digital technologies in different areas. The tools examine school strategies, teaching practices, digital infrastructure, pedagogy, and students' experiences of how technology is used to support teaching and learning. The results can be used to diagnose strengths, weaknesses, and potential areas for improvement.

A questionnaire designed by the University of Aveiro has invited teachers to share socio-demographic

data (5 questions on gender, age, recruitment group, teaching experience); to reflect on their digital competences (22 questions of the Check-in tool); their experience and comfort levels with emergency remote learning at the height of the COVID-19 pandemic (8 questions); The questionnaire, hosted on the LimeSurvey online platform via the University of Aveiro, was made available in January (1st phase) and February/March (second phase) 2021 . Participation in this survey was voluntary and the purpose of the study was fully disclosed. It was shared with the Portuguese School Association Training Centres (CFAEs) and five Portuguese Schools Abroad.

99.760 teachers - responded to the survey (following the data scrubbing). More than half of respondents were 50 years of age or older and with 21 or more years of service[11].

The survey results (based on teacher self-reports) showed that teachers' digital competences were low. Indeed, while DigCompEdu places the level B2 Expert as the foundation for digital transformation and critical, effective, and innovative use of digital technologies, the average level reached by respondents corresponds to B1 – i.e. inconsistent integration of digital technologies. At this level, teachers need support to improve their understanding about which tools work best in which situations of professional activity and about the appropriateness of digital technologies for pedagogical methods and strategies.

## 2.2 - Teacher professional development provision

The training design follows three proficiency levels[12] (although teachers at different levels of proficiency may participate in the same training sessions).
Level 1 promotes the development of teachers' digital competences in the six areas of the DigCompEdu reference framework, i.e. carrying out activities with digital technologies in different teaching methods; meaningfully using digital environments and tools and defining diversified strategies to be integrated into the educational context; implementing activities that promote learning and the development of students' digital competences.

Level 2 promotes the development, deepening and densification of teachers' digital competences, considering the 6 areas of the DigCompEdu framework; carrying out activities with digital technologies in different teaching methods; implementing activities that promote learning and the development of students' digital competences; stimulating reflection, sharing and critical use of technologies in an educational context. Level 2 requires participants to develop a learning scenario at the end of the course; it also focuses on tools and apps to support student-centred pedagogies, and how they may be used in class.

Level 3 is designed for school leadership and for innovative teachers, experienced in carrying out digital projects in schools (early adopters). Participants are required to design a digital project for their school, and to show evidence that it is being implemented with students. Training workshops are 50-hours. This includes 25 hours of instruction, and an additional 25 hours of autonomous work. Participants are invited to reflect critically on training and provide feedback at the end of a course.

Based on the Check-In result, 26% of respondents were placed at the first level of training (low proficiency), 65% at training level B (intermediate proficiency) and 9% at training level C (most proficient).

Trainers have access to training modules in eight different areas, including transversal skills, sciences, languages, arts, and other areas. It was clear that trainers needed to adapt these models, and it was noted that approaches to training vary by region. For example, some trainers interviewed said that they prefer to bring together teachers working in different subject areas. The variety of views on pedagogy can be enriching. Other trainers noted that they shape training so that teachers learn how to use digital content specific to their subject (e.g. how to use simulations in physics or chemistry, learner collaboration for project-based work).

Teacher trainers are available before, during and after training courses. They are usually master teachers with a specialty in ICT and can support subject area teachers. They are supported by the CFAEs, ICT centres and the Digital Ambassadors (see also section 1).

In the first phase of the digital transition, around 822 teacher trainers participated in three editions of the training courses. Only teacher trainers with high digital proficiency and previously trained to properly integrate digital technologies for pedagogical purposes in teaching and learning (in the different areas of the DigCompEdu framework) were involved. Details of the course design are set out in Box 2.3.

**Box 2.3: Training teacher trainers**

A 35-hour train-the-trainer course was developed in collaboration with higher education specialists.

The course is both synchronous (ZOOM video conferencing system) and asynchronous (using an LMS platform) and comprises six modules:

- Module 1: **The Digital Transition Plan** (purpose, relationship with other initiatives, DigCompEdu).
- Module 2: **Digital in Education** (historical and educational perspective, potential, role in changing organisations).
- Module 3: **The potential of Digital in Changing Organisations** (change in educational context, resistance to change, change management methodologies).
- Module 4: **Methodologies for teacher training in educational integration of technologies** (21st century teacher competencies, principles and strategies for teachers' professional development using technologies, teacher's competencies in the teacher professional development framework).
- Module 5: **Hybrid Learning Environments** (different pedagogical approaches and digital technologies, hybrid teaching and learning models, planning and configuration of physical and virtual training environments).
- Module 6: **Structure, contents and methodologies of the training within the PTD** (planning of training and development of teaching materials, pedagogical approaches to DigCompEdu).

In the first edition, 926 teacher trainers completed the training courses, (822 in the first phase, and 104 in the second phase), Between the first and second edition, some modules were slightly reformulated, considering the feedback provided by trainees and trainers in the evaluation.

The trainers interviewed for the study said that they find the training process to be enriching and that they learn something with each group, such as how to support interdisciplinary learning, how to support special needs using digital. They also keep up to date with new tools and projects.

In addition to participation in teacher training centre courses to support teachers to develop their digital competences (aligned with DigCompEdu), schools may request bespoke workshops and seminars to address specific areas of interest. These sessions can reinforce teachers' new digital competences and learn how to work with digital tools in context.

Box 2.4 shares research on elements of effective continuing professional development, including bespoke and cascade models of training. The existing model incorporates several elements of effective CPD within a bespoke model (e.g. collaboration in a job-embedded context, expert support, and so on).

**Box 2.4: Research on effective continuing professional development**

A 2017 study by Darling-Hammond and colleagues identified elements of CPD – that is professional development - that had had a positive influence on teachers' classroom practices and on student learning outcomes. The researchers identified 35 studies which had used a careful experimental or comparison group design, or had analysed student outcomes, controlling for context variables and student characteristics. The team identified seven widely shared features of effective CPD. Effective CPD:

1. **Is content focused** – professional development is focused on teaching strategies that may be used with specific curriculum content and in the teacher's own classroom contexts.

2. **Incorporates active learning utilising adult learning theory –** teachers have opportunities to design and practice new teaching strategies. Professional development courses may integrate the same strategies teachers are learning to use, including the curriculum, student work assignments and instruction methods.

3. **Supports collaboration, typically in job-embedded contexts -** teachers share ideas and collaborate, often in job-embedded contexts, integrating new instructional strategies. Collaborative work may support the development of professional learning communities that work within and across schools,

4. **Uses models and modelling of effective practice –** Modelling may involve analysis of case studies developed by other teachers; teacher collaboration in analysis of lesson plans and student work; and reflection on classroom strategies and student outcomes. Teachers are thus able to understand what good practices look like and how they might use them in their own classrooms.

5. **Provides coaching and expert support -** Experts may work with teachers one-on-one or in group workshops or as remote mentors to support teachers as they integrate new strategies.

6. **Offers opportunities for feedback and reflection -** feedback from experts and peers, and time for reflection allow teachers to consider what might be working well in their practice and should be retained, what might be improved.

7. **Is of sustained duration** – effective **CPD programmes will engage teachers over weeks, months or academic years.**

**World Health Organisation guidelines suggest when** cascade training is an appropriate approach to capacity-building, and when it is not. Cascade training, the guidelines note, may be more appropriate in cases where:

- Content is not significantly beyond the target audience's current competency.
- The target audience is geographically dispersed.
- There are sufficient master trainers to cover the geographic area.
- Content is straightforward, such as new policies or technical skills.
- The content can be taught in 2-3 days. (e.g. 4 weeks' content is difficult to teach in cascade training).
- Trainers can be supported via relief from their regular duties and via technical assistance by more experienced trainers.

**However, cascade training is not appropriate when**:

- The content requires substantial feedback between the expert and the learner, such as with soft-skills or highly complex technical skills.

- There is no infrastructure to support the trainers as they deliver training to lower levels.

*Sources:* Darling-Hammond, L., Maria E. Hyler, M.E. and Gardner, M. and Espinoza, D. (2017). Effective Teacher Professional Development. Research Brief (May). Learning Policy Institute. https://learningpolicyinstitute.org/sites/default/files/product-files/Effective_Teacher_Professional_Development_REPORT.pdf;

https://www.linkedimmunisation.org/wp-content/uploads/2021/01/4_BestPractices_Cascade-Training.pdf

Trainers and teachers interviewed noted that moving from learning about how to use digital tools to how to use them in different teaching and learning situations is still a challenge. Indeed, the Check-in tool was readministered, and results indicated a need to continue improvements in the use of technologies in all areas, including: i) professional interaction, (ii) creating and adapting educational resources, (iii) improving and strengthening teaching and learning practices, (iv) diversifying assessment approaches and promoting (v) empowerment and (vi) supporting students' digital competence.

The post-test revealed that level of proficiency was particularly low in two of the four areas corresponding to the (pedagogical) core of DigCompEdu: competence areas 3 - Teaching and learning, and 4 - Assessment. The same is true for Competence Area 6 - Promoting learners' digital competence learners.

At the same time, the findings of the analysis should take into account the complex and multidimensional nature of digital competence. Variables related to the availability of equipment, infrastructure, school leadership, teacher gender, time elapsed between initial training and current levels of confidence in using digital technologies, (Engen, 2019; Lucas et al, 2021) also need to be considered. The questionnaire itself is based on teachers' self-reports rather than on objective observations of teachers' practice.

## 2.3 - School-level change

School leaders play a key role in setting directions for their school's digital transition. As one school leader interviewed noted, while digital education can catalyse changes in pedagogy, without clear aims, schools are unlikely to integrate new tools effectively. School leaders need to think about how digital tools can be used to create learning environments. Indeed, research points to the importance of a school climate that supports cooperation and trust among teachers (Li et al., 2016); and provides time for teachers to reflect on their practice and collaborate with colleagues (Evers et al. 2016).

There is a strong emphasis on a whole-school approach to change. In each school, there is a digital teacher team, so that leadership is distributed. Team members may include the school's ICT teacher, the e-Twinning coordinator[13], and other teachers. These team members can be effective in reaching teachers who are less confident in the use of digital tools, or in orienting teachers new to the school (and there can be significant turnover, as teachers in earlier stages of their careers are regularly reassigned to new schools). In schools visited, teacher teams said that they have observed that teachers are getting more confident in the use of technology, and in how they use it to collaborate, organise co-teaching, work with school librarians, and support student collaboration.

As is the case with other recent initiatives, schools are required to develop plans – in the case of digital education, for how they will integrate tools to support learning, and then track progress, including successes and challenges. The plan – known as the Action Plan for the Digital Development of Schools, is widely referred to as the PADDE (*Planos de Ação de Desenvolvimento Digital das Escolas / PADDE*). The headmasters/top leaders together with the members appointed to be part of the School Digital Development Teams (*Equipas de Desenvolvimento Digital das Escolas*- EDD) receive training to help them develop their school PADDE with the whole school community.

Each school's PADDE is based on the same report template, which aligns with areas covered in DigCompEdu around three main areas: pedagogy, technology and organizational capacity. The plans address national goals for digital education as well as the goals each school sets for itself. Each school sets out its overall objectives and how the school's digital action plan fits within this; the school vision and characteristics; the school's digital history and its objectives; pedagogical and organisational dimensions for digital education; activity planning and timetable; its communication plan; and community monitoring and evaluation. The process of developing the PADDE is supported by the school's Digital Development Team (EDD)[14]. In some cases, they work with other schools in

their region, providing opportunities for peer learning and exchange across schools.

At the time of writing this report, the platform only provides data concerning the foreseen and concluded action of each PADDE under each dimension (see Box 4.5). In the meantime while school clusters concluded their initial PADDE and are in the process of designing a new one.

DGE indicates that out of the 809 school clusters at national level, 806 have designed and implemented their PADDE.

**BOX 2.5: PADDE Actions by Dimension**

| Dimensions | PADDE Actions | |
|---|---|---|
| | Foreseen | Concluded |
| Organizational | 8012 | 5039 |
| Pedagogical | 9192 | 5657 |
| Technological/Digital | 6007 | 3643 |
| **Total:** | **23 211** | **14 339** |

*Source:* DGE, April 2024.

Whole-school change is also supported through online communication within the school. Shared platforms are used for school-level communication. Teachers and other school staff are able to collaborate with each other and students are able to collaborate with their peers. Collaboration within and among schools has given rise to communities of practice – an extremely effective form of continuing professional learning, as outlined in Box 2.6 (see also Darling-Hammond et al., 2017; Stoll et al., 2012; Lee et al., 2011).

**Box 2.6: Communities of practice**

Wenger-Trayner, E. and Wenger-Trayner, B. (2015) define communities of practice as "…*groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.*" Communities of practice, they note, may be intentional or an incidental result of individuals' interactions. The identity of the community is defined by a shared domain of interest. Members build relationships, discuss, share information, and learn from one another. Over time, members construct a shared practice. Communities of practice may also be referred to as learning networks, professional learning communities, or similar.

Communities of practice are most effective when there is a culture of trust, communication and critical (self-) reflection. Effective learning within the community of practice depends on mutualism and shared goals.[15] Pyrko and colleagues (2017), in their study of a community of practice in the UK National Health Service, observed that effectiveness depends on development as "…*an emergent and continuous process where people think together regularly about real-life problems*" [16].

Students, teachers, and other school staff may use Google Workspace or other platforms such as Teams, Moodle, to share information and classwork, or access tools that can help with learning (e.g. concept maps, mind maps, YouTube videos, and so on). Feedback from teachers in the different schools visited for the case study reported different levels of use of data gathered in platform-based learning management systems to support planning. In one school visited, teachers said they prefer to develop their own systems to monitor student progress. Another school visited relies on both the platform data as well as other data gather separately.

## 2.4 - Support for longer-term teacher and school development and innovation

Three years into the Digital Action Plan, various stakeholders have noted significant areas of progress. There has been near universal participation in the teacher training programme and all schools have developed their PADDE. The study team heard good examples of how digital tools are being used to trigger changes in classroom practices. For example, teachers interviewed said that digital tools allow them to differentiate learning to meet diverse student needs more effectively. This is particularly important for ensuring inclusion. Teachers may also devote more time to one-on-one discussions or discussions with smaller groups of students when one portion of the class is working with digital tools (either individually or with classmates), and another is engaged in offline project work or discussions. They are increasingly able to regulate their own learning; they identify learning resources and set their own pace for their schoolwork.

Other external researchers commissioned to evaluate the implementation of the digital action plan note progress as well as areas for improvement. More time is needed for schools to deepen practices, with greater attention to how digital tools may be used not only to motivate students, but also to support specific learning aims, and to assess student learner needs and progress.

In developing their lesson plans, teachers need to consider how different digital tools may be used to support different learning aims, and how they will elicit evidence of student learning. For example, published case studies have highlighted how teachers may adapt commercial off-the-shelf-digital games to support specific learning aims in their classes. They may, for example, observe how learners work individually and collectively to solve complex problems in a game-based situation. Programmes developed for mobile learning may allow learners to interact with digital materials and the environment around them and get real-time feedback (for example, in support of field work in a biology class). Students may also develop their own learning materials using digital media. Web 2.0 platforms support learner collaboration and provide opportunities for online dialogue and for peer and self-assessment. Attention to learning analytics underpinning tools such as Kahoot may complement the various ways in which teachers track student performance and help identify patterns (Looney, 2019).

More time is also needed to bring on schools and teachers who have been more reluctant to embrace digital education. School inspectors interviewed noted that many schools use digital tools occasionally at best. While they attribute this, in part, to the high average age of the teacher workforce in Portugal (55 years), it is important to hear concerns of late adopters and develop appropriate strategies.

Given the need to continue investments in teacher training, new digital education content, and new infrastructure, convincing evidence of the impact of digital education will be important at the policy level. The Ministry has invested in studies and evaluations on the design and implementation of the digital action plan. For example, one study has analysed 800 school PADDE to learn more about school level change. On a scale of 1 to 5 (5 as the highest ranking), stakeholders have rated the policy as having a positive impact. At the same time, researchers note that students' academic results have not improved since the digital action plan was initiated (and indeed, it would be difficult to isolate the impact of the digital action plan on learners' academics results across the system). However, there is evidence that the majority of students find that learning with digital tools is more engaging.

### Learning points for discussion

*What are cost-effective approaches to providing high-quality training for teachers to deepen competences to integrate digital tools to support teaching, learning and assessment, and to keep up to date with new technologies (including A.I.) over the long-term?*

Portugal drew on resources from European Social Funds and European Recovery and Resilience (R&R) funds made available post COVID-19 to support the Digital Transition Plan. Among other

investments, the European Social Funds and funds have supported investment in system-wide continuing professional development – including training for trainers and for teachers throughout the system. In addition, financial funds also come from the State Budget (for example, the costs of training teachers in the Lisbon area and the costs of teachers in mobility in the CCTIC and CFAE). State Budget also supported the digital ambassadors, who played an important role in strengthening digital education within schools and across school networks. The R&R funds are available until 2025. While resources have been identified to support digital education after 2024 – including for continuing professional development funds will be maintained to ensure the continuity of teacher training in the digital area.

It will be important to identify cost-effective approaches to high-quality teacher continuing professional development. How can Portugal build on progress made in building teachers' digital capacity thus far to support teachers to their deepen practices, and to reach schools and teachers where less progress has been made? Based on empirical research on effective CPD (see Box 2.4), what modes of continuing professional development are likely to be most effective – both in terms of teacher development and cost-effectiveness?

### What type of research on "what works" - that can be adapted in different learning contexts - is needed?

Controlled studies on the impact of digital tools in classroom settings can provide insights on effective pedagogies, including in different subject domains. Nevertheless, practices need to be adapted by teachers to their own contexts and needs.

Might the development of scenarios on how different tools be used support the use of good practices support take-up of different tools? Given the fast-changing digital landscape – particularly the use of Artificial Intelligence – should teachers be encouraged to engage in action research (with university-based partners) to integrate new approaches in their regular practice?

### How to incentivize slow adopters to integrate new practices?

A significant number of schools and teachers in Portugal still do not regularly use digital tools to support teaching, learning and assessment. Individuals interviewed for the case study frequently cited the country's ageing teacher workforce as a barrier to system-wide digital transition. Nevertheless, the research team encountered a number of "older" teachers who were enthusiastic and creative users of digital tools. Indeed, several factors may create barriers to wider take-up of digital tools, and should be considered:

- To what extent has poor digital infrastructure created barriers to integration of digital tools?

- Have some school leaders resisted digital transition? What kind of support and incentives might need to be considered at this level?

- What tools, guidelines, training, or other strategies might influence resistant teachers to integrate digital education into their regular practices? Are digital textbooks under development an effective introduction to digital education for resistant teachers?

- Might an emphasis on schools' and teachers' use of digital tools to promote learning in school inspection and teacher appraisal incentivize change?

# 03. **Digital infrastructure, services, and content**

While some researchers have been questioning the positive impact of digital technology in the context of educational change (Hattie, 2009; Cuban, 2013), Fullan sees it as necessary means for making a shift towards making the new pedagogy happen (Fullan, 2013). However, Fullan contrasts two types of technologies that have different uses and outcomes in pedagogical process:

- technologies that enhance consumption of pre-packaged information: portals and web sites with digital documents, textbooks, presentation devices (e.g. data projectors).
- technologies that enhance active knowledge creation by students: interactive learning resources, collaboration tools, simulations, multimedia authoring tools, coding, and robotics platforms.

Similarly, Jonassen (1999) has differentiated three approaches to the use of technology in education:

- learning **about** technology, where computers become an object of study (mostly in the specialised subject called Computer Science or Informatics.
- learning **through** technology, where technology is used as a delivery channel for distributing educational content.
- learning **with** technology, where the wide range of interactive technologies will become "mindtools" that are actively used by students for meaningful knowledge creation in collaboration with others.

While both Fullan and Jonassen promote those technologies that support active knowledge creation by students, schools also need the digital devices such as laptop/tablet computers and digital screens for accessing and presenting educational content, and for learning about the technology itself.

## 3.1 – Overview of the strategies adopted in Portugal

OLPC (One Laptop Per Child) was the first global initiative to design a low-cost and durable educational laptop for one-to-one use on a large scale. The Inter-American Development Bank's final report on piloting OLPC in 66% of all schools of Peru was somewhat disappointing, as the impact of the technology was limited (Crista et al, 2012): while the OLPC program dramatically increased children's access to computers over a relatively short period of time, there was no evidence of improvement in students' Math or Language skills, just some benefits on their cognitive skills. Although the results presented in this report were found controversial by some authors (Trucano, 2012; Villanueva-Mansilla, 2016; Salas-Pilko, 2014), it had a significant negative impact on policy decisions: many countries, states and regions that had been planning to introduce 1:1 computer use in schools have changed their mind and scaled down investments in school computers. For instance, the national Strategy for Lifelong Learning in Estonia (MoED, 2014) took a BYOD (bring your own device) approach, relying upon the use of students' own smartphones, tablets, and laptop computers in schools and at home. Scandinavian countries and Finland have different approaches, as the schools and municipalities are expected to provide equal access to technology for all students on a school or municipality level. Only a few EU countries (such as Austria and Poland) have taken – in the context of the COVID pandemic --a similar approach to personal laptop purchases for students.

In general, there are four potential strategies for implementing one-to-one computing that can be implemented at national/regional level (see Table 1 below). The first strategy relies on centralised purchasing of standardised laptops, including licensing of operating system and basic office software. The second strategy might look similar at the first glance, but as the Chromebook is essentially a physical web browser, offline use of Chromebooks is very limited and various educational software solutions cannot be installed on. Although Chromebooks have also many advantages (such as

pricing, replaceability, data security), the biggest disadvantage is their tight integration with Google Suite services that are considered incompatible with European General Data Protection Regulation (GDPR) by some national authorities. The third strategy is one tablet computer per child, which has been widely implemented across Europe at school or municipality level, but Malta is the only country that made it happen at national level. The fourth strategy (Bring Your Own Device) has been officially applied only in Estonia between 2014-2020, but even there it was discontinued due to its negative effect on equity, interoperability and technical challenges.

**Table 3.1. Alternative approaches to purchasing digital devices for students**

|  | **National 1:1 policy and funding** | **Ban on the national level** |
|---|---|---|
| Laptops | Portugal 2007, 2020<br>Poland (in progress)<br>Austria (family contributes 100 EUR)<br>Spain/Catalunya 2012 | None |
| Chromebooks | None | Denmark[17] (banned Google Suite in 2022)<br>Norway (is considering, in progress) |
| Tablets | Malta[18] 2020 | None |
| BYOD | None (Estonia dropped this policy in 2021) | France (2018)<br>Sweden (2022) |

Based on the interviews with DGE, the Digital Empowerment Strategy for schools in Portugal considered initially only the two first strategies from Table 3, purchasing either laptops or Chromebooks, but decided to go for the first strategy. The rational was the Chromebooks' requirement for high-quality internet connectivity and this cannot be guaranteed for all Portuguese students in school and at home. Chromebooks cannot really be used offline or can only in a very limited way. There was also a pending issue of potential conflict between Google Suite services and European GDPR regulation - the reason behind the decision to ban Chromebooks in Danish schools. The table 3.2 below compares the advantages and disadvantages of alternative technology configurations.

**Table 3.2. Advantages and disadvantages of alternative technology configurations**

| **Technology configuration** | **Pros** | **Cons** |
|---|---|---|
| One laptop per student | Good affordances, expandable, familiar | Expensive, expected upgrade in 4-5 y, tech support |
| Chromebook per student | Cheap, flexible, durable, easily replaceable, seamless integration with Google Suite | Permanent Wi-Fi connectivity needed, offline textbooks/apps cannot be used; stuck with Google (GDPR) |
| BYOD | Cheap, personalised, responsibility on families | Chaos, poor interoperability, technical support issues |
| Mobile laptop/tablet racks | Easy to purchase and manage centrally, upgrade | Limited access to all students and teachers |
| Desktop computer labs | Familiar solution, easy to purchase and manage centrally, cheap | Even more limited access than with mobile racks |

Another factor that influenced the choice of the one laptop per student (OLPS) strategy in Portugal was a previous experience of one-to-one laptops purchase within the e-Escolinha project in 2008-2009. Back then, 500,000 Portuguese-made laptops were delivered to elementary school pupils (grades 1-4), but the devices were owned and managed by the families (with financial support from the state, as is the current strategy in Austria). The lessons learned in e-Escolinha project influenced some aspects of technology procurement in the new programme in 2020. For instance, the laptops are owned and managed by the schools in the current program, and teacher training has been organised differently from e-Escolinha, as it was more focused on classroom pedagogy and less on technology handling skills.

**Table 3.3. Layers of technological infrastructure for schools**

|  | **Students** | **Teachers** | **Classrooms** | **Labs** | **School** |
|---|---|---|---|---|---|
| End-user devices | Laptops | Laptops | Projectors | Desktops |  |
| Network connectivity | 4G | 4G | Wifi | Wifi | WAN |
| Digital services, software | Microsoft | Microsoft |  |  |  |
| Digital educational content | e-textbooks | e-textbooks |  |  |  |

The 2020 strategy of Digital Empowerment of Schools (DES 2020) involved purchases of three types of laptop computers:

- Computer A - 322,069 units of low-cost Intel Classmate PC for primary school students (grades 1-4).

- Computer B - 394,172 units of mid-range Lenovo laptop for lower-secondary school students (grades 5-9).

- Computer C - 333,759 units of upper-mid-range Lenovo laptop for upper-secondary school students and teachers in all education levels.

All laptops were equipped with a 4G modem to ensure mobile data connectivity, as some families still did not have internet at home and high-speed Wi-Fi did not yet cover all schools. Furthermore, all laptops came with a pre-installed and licensed Microsoft operating system and MS Office 365. The logistics of the purchase (in 2020, at the height of COVID19 pandemic) turned out to be a major challenge, involving direct flights by military transport planes to the computer factory in China. Redistribution of computers to schools around the country was handled by DGEstE, within a specific platform, coordinated by the headmasters and specific teams at school level and technological support is provided by several IT hardware companies. A small replacement set of laptops was given to every school in case some were sent to repair. Some schools complained that the need for replacement computers was higher than estimated and repairs took a long time. As student numbers in schools and classes change every year, the need emerged for moving up to 20,000 computers every year between schools to ensure every student had a laptop after changing his/her school. Some families declined the offer of a laptop provided by the school as their child already had one at home and preferred to use it. There are no plans in place how and when the laptops will be replaced by new ones, as this will be out of the scope of the current strategy. The expected life cycle of student laptops is four years for the cheaper version used in primary level and five years for the others.

No extra funding was provided by the state to prepare classrooms for the arrival of computers, so the schools within their autonomy had to find the best ways to address the need for charging the laptops, as the battery did not last for the whole school day. Parents were also advised to charge the computers at home, daily.

In parallel with laptop procurement, other technologies were purchased centrally for schools when implementing the Digital Empowerment strategy: data projectors and desktop computers for administrative staff.

The program funded by the Resilience and Recovery Fund from 2022 onwards aimed at equipping the schools with three types of Digital Science Education Labs[19] (LED):

- LED 1 set included: Common equipment (laptops and 3D-printers), Programming, Electronics and Robotics kits (Arduino, Raspberry Pi, robotics sensors, actuators), digital STEM kits (scientific sensors, cameras, microscope, energy station).

- LED 2 included: Common equipment, Programming, Electronics and Robotics kits, Arts and Multimedia kits (audio-video studio equipment).

- LED 3: Common equipment, Programming, Electronics and Robotics kits, Arts and Multimedia kits.

Altogether 1.300 Digital Science Education Labs will be set up by the end of 2024.

As all laptops arrived with 4G modems, it gave more time for the General Secretariat for Education and Science to upgrade internet connectivity in schools - a challenging procurement that takes a lot of time and is still in progress. However, the 4G mobile data network providers in some areas were not prepared for such an increase of mobile data traffic. As a result, some teachers interviewed reported unstable quality in mobile data connection in their school. The General Secretariat for Education and Science is planning to address this issue on the final stage of the program's implementation by installing mobile signal boosters in larger schools in parallel with upgrading wireless coverage and " last mile" external WAN (wide area network) connection in schools.

Technical support at school level seems to be one of the bottlenecks in the Portuguese model of OLPS. As most schools have no professional IT support specialists in-house, they must rely on IT companies for troubleshooting, repairs, and replacement of laptops. Several teachers interviewed reported their frustration at the slow tech support service, while in other schools a local solution was developed using IT teachers and vocational technology students who provided first-level IT support. In a few regions, entry-level IT support services are provided by the local municipality. Under the new strategy for Digital Empowerment, every school was expected to form a "digital team" of teachers who coordinate the development and implementation of school-level digitalisation strategy (PADDE), but they also solve any technical issues that occurs. The situation is like Estonia, where many schools have formed a network of well-prepared IT-helper students (4-5 in every class) who are able to solve up to 60% of technical issues immediately on the spot.

When it comes to digital services (Layer 3 of the digital infrastructure in the Table x3), few are provided centrally through the Digital Empowerment strategy. The main new services that appeared in schools were Microsoft Office 365 and online learning platforms such as MOODLE or others provided by the e-textbook publishers (such as Escola Virtual and Aula Digital). The ecosystem of digital educational services is still at an early stage of development in Portugal, and the integration and interoperability of various services has not been systematically addressed by the ongoing strategy. Although the free Moodle instance has been provided by DGE for any school that needed it since 2003, uptake has been slow (universities are the exception here). Many schools use the free version of Google Suite for Education, including Google Classroom. The first step towards integration of online services is usually a shared Single Sign-On (SSO) service that has been implemented in Portugal using Microsoft and Google OAuth login. Some European countries (e.g. Estonia, Finland) have developed specific educational ID for cross-platform Single Sign-On, to keep the login data securely under their own control.

When planning the next steps after completing the current Digital Empowerment strategy, the Ministry of Education would need to make the following decisions:

- how and when to upgrade or replace the laptops, considering a potential switch to some alternative model described in Table x1 (BYOD, tablets). With this in mind, the Council of Ministers Resolution no. 56/2024, authorizes the purchase of new computers by school clusters and non-grouped schools.

- provision of technical support at local/school level needs to be improved.

- as service integration will become increasingly important, the development and enforcement of interoperability framework/standards should be considered.

- data protection needs to be improved without sacrificing the potential of cross-platform learning analytics that will become the basis for building next-generation adaptive learning systems.

## 3.2 - Digital textbook piloting project - PPMD

Until 2019, the textbooks were purchased and owned by the students (families) in Portugal, then the Ministry of Education decided to switch to a new system: lending and reusing the free textbooks

that were purchased and (re)distributed centrally by the IGEFE (Institute of Education Financial Management). To qualify for the free textbooks, parents must register on the MEGA platform and enter personal details, as well as those of their children. Both parents, IGEFE and Schools (school leaders and administrative school departments), have access to data on the MEGA platform. The schools that joined the digital textbook piloting program (PPMD) in 2020 had to stop using printed textbooks for the pilot classes and they had to commit to using one of the e-textbook platforms. The two largest publishers are Porto Editora and LeYa, but there are also 15 smaller publishers. All are offering their digital textbooks under the same conditions. The schools could use textbooks provided by different publishing companies within the same class according to subjects.

The PPMD project was initiated in 2020 as one of the three major programs of the Digital Transition Strategy. The goals of PPMD were[20] to:

- modernize the education system by a paradigm shift towards more student-centred learning responding to current and future societal challenges.
- improve students' learning by offering diversified learning paths.
- promote the development of students' key competences, focusing on multi-literacies, digital competence and 'learning to learn' competence.
- promote the development of teacher training on digitisation of education.

The schools and teachers who participated in the PPMD piloting could decide how to combine digital and analogue (notebooks, books, writing material, drawing material, etc.) resources in classrooms. The autonomy of teachers was encouraged, to explore how digital textbooks and other digital educational resources can enrich learning environments and improve students' learning.

Decisions regarding the transport, storage, duration and frequency of use of the digital equipment in the classroom (and computer and Internet connection hotspot) were made by pilot schools themselves, according to their local conditions. Schools are not allowed to keep the state-provided laptops on school premises only, students have the right to take them home.

The Digital Textbooks were made available to pilot school students and teachers at pilot schools on multiple platforms and devices, such as desktop and tablet computers, as well as smartphones, both in online and offline mode. Online access and an Internet connection was needed only for the initial activation of the digital textbook user account and downloading the textbook; after that it could be used offline on the preferred personal device.

The digital textbook piloting process was planned in multiple stages. The first phase of the PPMD pilot project (2020/2021 school year) involved nine school clusters with a total of 48 classes, 213 teachers and 1050 students. In the second phase (2021/2022), an additional 24 school clusters joined the pilot, involving a total of 189 classes, 1034 teachers and 3753 students. In the third phase (2022/2023), 68 new school clusters joined, involving a total of 575 participating classes, 2254 teachers and 11.437 students. The fourth phase of the pilot (2023/2024) added a further 35 school clusters in a total of 103 school clusters with more than 23,000 students and 3827 teachers, covering all regions of Portugal.

Schools have showned interest to take part to take part in piloting and could decide which grade levels and classes to involve in piloting the digital textbooks. The school leader of a pilot school or school cluster was responsible for organising the pilot at local level, they were expected to appoint one of their teachers as a pedagogical-technological coordinator, the contact person liaising with DGE. The school leader was also required to form a digital team to support the pedagogical-technological coordinator in operational tasks while planning and implementing the pilot.

School Cluster/schools involved in the digital textbook pilot were advised to participate in several side activities that contributed to awareness raising and wider uptake of this innovation at scale, such as:

- A Digital Academy for parents[21] aimed at upgrading their digital competence so they could be more involved in supporting their children in this new way of learning.

- The SeguraNet project[22] addressed students' safe and critical use of digital technologies.
- Four-hour workshops to share best practices between pilot schools.
- A MOOC entitled "Active learning with the use of digital technologies and e-textbooks".
- Dissemination resources: short and complete[23]versions of an executive summary.
- Research into the implementation and results of the PPMD pilot project.

The training initiatives to support the PPMD promoted by the DGE and offered throughout each school year, focus on active methodologies, using digital technologies, digital textbooks, and other digital educational resources (DER).

The following actions have been carried out:

- A series of workshops dedicated to the exchange of practices between the teachers and directors of the School Cluster/schools involved in the pilot project. The workshops, which were developed in the form of a four-hour Short Term Training Course (STTF) cover the following topics: active learning; innovative learning environments; digital portfolio creation; discussion strategies for dynamic classes; personalised learning; flipped learning; and PPMD integration practices.

- MOOC "Active Learning with Digital Technologies and Handbooks": 25-hour e-learning course, with all sessions in an asynchronous online format, developed on the NAU platform. It covers the use of digital technologies in education, active methodologies and strategies for implementing digital portfolios. It shares practices implemented by schools participating in the PPMD since 2020/2021.

- "Active Learning and Innovative Teaching in Flexible Learning Spaces":  E-learning course, with all sessions in asynchronous online format, developed on the NAU platform. This course is an adaptation, for the national context, of the course "Active Learning and Innovative Teaching in Flexible Learning Spaces", organised and launched by the European Schoolnet Academy (EUN) in 2022. It addresses the topics of active methodologies and flexible learning spaces.

- Training  Course "Digital Handbooks using Active Methodologies": B-learning workshop, accredited by the CCPFC, 50 hours. Organised by the DGE, it is developed by the interested CFAEs, on loan from An2.

- Training Course "Mentoring and collaboration between schools: transforming contexts with digital": B-learning workshop, accredited by the CCPFC, 50 hours. Organised by the DGE and developed by interested CFAEs, on loan from An2.

- Technical training (publishers): In addition to providing training for teachers, publishers also organise training sessions for students and parents/carers , at the request of the School Clusters/ Schools. With this training, the publishers aim to facilitate the use of their digital textbooks and their respective platforms.

- Digital Academy for Parents: The Digital Academy for Parents programme is an initiative of E-REDES in partnership with the DGE, which gives parents/EEs of primary school children and young people the opportunity to participate in training sessions to promote digital literacy. Most of the School Cluster/schools who are part of the PPMD participate in the "Digital Academy for Parents". The aim is to provide families with basic digital skills that will make it easier for them to keep up with their children's schoolwork and to provide them with integration tools that are essential today.

## 3.3 - Digital textbooks involved in the PPMD pilot: platforms and contents

As mentioned above, there are 15 publishers involved in the PPMD pilot project, and there are two major online learning platforms maintained by Porto Editora and LeYa. Not all the digital textbooks are in these platforms.

Porto Editora is the largest educational publisher in Portugal. The company was founded in 1944 by a group of teachers and is currently led by a grandson of one of the original founders. Porto Editora initiated its own e-textbook platform development as long ago as 2008, targeting mostly those private schools and parents who wanted personal tutoring for their children. In the early versions of digital textbooks, most of the content was taken from the traditional printed textbooks, the level of interactivity was relatively low. Between 2008 and 2018, an increasing quantity of original interactive content was added to digital textbooks by Porto Editora, although the business model for the return of this significant investment was not clear. In essence, the development of digital textbooks was funded by the company's profit made in other, more traditional sectors (printed textbooks, literature, children's books). Some of the interactive content (simulations, interactive laboratories, math editors) are purchased or licensed from other companies - a single publisher cannot build every kind of specialised content from scratch, although Porto Editora has a large team of multimedia content editors and well-equipped digital production studios. Porto Editora's digital textbook platform Escola Virtual[24] offers a large variety of additional content on top of the digital textbooks themselves, such as workbooks, presentations, quizzes and printable worksheets. While the publisher is traditionally strict about their intellectual property rights regarding the content of the main digital textbooks and accompanying interactive workbooks, their approach is notably different when it comes to presentations and worksheets that are distributed in the same space as digital textbooks. Teachers can download, modify, and share on other platforms the presentations and worksheets, or upload their own original digital presentations to Escola Virtual platform for personal use, while both publishers seem to be relaxed about their content escaping their control (potentially even travelling even to their competitors in some modified form).

Although non-educational books published by Porto Editora are also sold in other Portuguese-speaking countries (Brazil, Mozambique, Cape Verde), the textbooks are produced only for the home market in Portugal - the dialects, and also curricula and school systems in other countries are too different and would require too much effort to adapt textbooks, both printed and digital.

Another platform and content for digital textbooks were made available to Portuguese PDDM pilot schools by LeYa founded in 2008 as a holding company that incorporated several previously independent educational publishers. LeYa is active not only in Portugal but is also one of the leading educational publishers in Mozambique. In 2022 LeYa became part of the Dutch group Infinitas Learning, one of the leading publishing companies in the European educational sector. LeYa has built its own online learning platform that makes their digital textbooks accessible by students and teachers, it is called Aula Digital[25] and it looks like Porto Editora's Escola Virtual. This similarity is good for end users, as some are using both platforms in parallel. Also, on the Aula Digital platform students must first secure the license and user account (single sign-on with multiple OAuth and OpenID technologies is possible), after that they can download an e-textbook to their device and use it offline. Teachers can download, modify, upload and share the accompanying resources such as presentations, quizzes and worksheets. Both platforms, Escola Virtual and Aula Digital have multiple e-textbook series available for all school subjects from 1st to 12th grade. While first-generation digital textbooks looked similar to their printed counterparts, the current versions of e-textbooks published by LeYa and Porto Editora belong to the second generation, designed from scratch for digital platforms, making use of the affordances of the specific online/offline learning platform, for the various screen sizes and interactive features of desktop, laptop and tablet computers, as well as smartphones.

The PPDM pilot teachers interviewed expressed a strong preference for keeping to the same textbook series or publisher that they have been previously using - switching to another series/publisher does not seem to happen. Several teachers said that the digital textbooks are used as a supplemental resource usually used by students as a reference source while doing their homework assignments. Schools that are pedagogically innovative and have radically restructured their teaching and learning process (such as Boa Agua school) tend to rely on teacher- and student-generated digital resources, while still accessing a digital textbook on a daily basis for reliable basic knowledge such as: definitions, explanations, examples, practice tasks.

The emergence of two large digital publishing platforms has radically restructured the educational publishing market, leading to mergers of numerous smaller publishers with either LeYa or Porto Editora, or use of their online platforms (Aula Digital or Escola Virtual, respectively) for distributing digital textbooks. Similar processes are seen in many European countries, as the smaller publishers are unable to invest in developing their own online authoring and publishing platforms, also taking into account the race towards the third generation of AI-powered personalised learning platforms in the near future. Most likely, the next generation of digital textbooks will not be linear compilations of learning resources, rather they will take a form of large pools of interactive tasks at a range of complexity levels and supportive multimedia content organised on the go by machine learning algorithms into adaptive learning paths for personalised learning.

Interesting dynamics can be observed between DGE and the textbook publishers in Portugal, because of our interviews with different stakeholders. On the one hand, there is a high level of interdependence, as both sides depend on each other: DGE needs the commitment of publishing companies to a common vision to achieve the goals of the Digital Transformation strategy, while the publishers need to ensure a stable income to maintain the funding needed for the rapid development of their platforms and digital educational content. However, interaction and cooperation between DGE and two publishers seems to be quite limited, probably owing to the high level of trust from both sides. The DGE has not interfered with the pedagogical design of the digital textbooks (e.g. to align these better with the "pedagogy first" ambition as defined in the strategy and teacher training programmes). The teacher training programmes are agnostic regarding the platforms and content of either publishing company, and specific digital textbooks are rarely mentioned by teacher trainers. This has resulted in both publishing companies organising their own platform- and textbook-specific training courses for teachers who have already chosen their platform (as is common also in other European countries). With similar caution (or trust), both DGE and the two main e-textbook platform providers are considering the potential use of the wealth of data that can be gathered by both digital textbook platforms for learning analytics, research and monitoring purposes. There are no plans in DGE to seek access to this data (not even within the monitoring study of the digital textbook pilot carried out by the Catholic University), while both publishers seem to avoid collecting and using the fine-grained data on learner interactions with digital textbooks even for their own quality assurance and learning analytics purposes. However, the limited set of statistics on learners' access to digital textbooks and the results of automatically graded tasks are used by most teachers and ways of making use of this data have been addressed in teacher training courses. European Commission's General Data Protection Regulation (GDPR) seems to have a somewhat negative impact on the development of personalised learning technologies, not only in Portugal. Next-generation adaptive and AI-enhanced digital learning platforms require access to large amounts of fine-grained data for learner modelling purposes, while not sacrificing privacy and personal data protection. This is a challenge that remains to be addressed by the upcoming educational innovation strategies in all European countries.

One domain where DGE could have taken a more active approach towards influencing the didactical design of digital textbooks used in the PPDM pilot is certification of these textbooks, but for now the decision has been made to certify only the printed textbooks, as their fast-evolving digital counterparts cannot be evaluated using the same methods and criteria. However, DGE has analysed the digital textbooks involved in the PPDM pilot, using an assessment rubric with three quality levels. The situation is similar in other European countries that still have either committee-based accreditation or expert reviews of textbooks to ensure their alignment with curriculum standards. Looking ahead, the third generation of AI-enhanced adaptive learning resource collections will require a radically renewed approach to the validation of the educational content. Most likely, the solution will take the form of specially trained AI agents that make the work of the reviewers easier.

To address such challenges within the current Digital Empowerment initiative, DGE has also invested in procuring Open Educational Resources (OER)[26] for all subject areas, where they have significant control over the platform and content development, as well as the innovative uses of the learning analytics data.

The Learning Ecosystem (LE) is a strategic and innovative response to the need for an educational platform that is both comprehensive and integrative, covering all subjects and levels of education. The acquisition and integration of OER is of strategic importance, in order to enriching and diversify the educational environment available to students and teachers. This strategy foresees that the OER produced for all the subjects in the curriculum, selected and integrated into the LE, will serve as flexible and easily accessible tools that promote meaningful learning in a variety of contexts - from distance learning, for students who are unable to attend classes in person, to meeting the need to consolidate or deepen knowledge. This project reflects a commitment to adapting the education system to today's complex and unpredictable realities, characterised by complexity and unpredictability, making a decisive contribution to the development of essential learning and the competences set out in the Profile of Students Leaving Compulsory Schooling. In this way, the integration of the OER into the LE not only responds to the immediate needs of the education system but is also in line with a future perspective for education, preparing students to face the challenges ahead with resilience and adaptability.

With the support of the Recovery and Resilience Plan (RRP), the LE reaffirms its commitment to implementing best practice in relation to the security and protection of personal data, paving the way for educational transformation that meets both current needs and future aspirations.

OECD has defined Open Educational Resources (OECD, 2007) as "*digitised materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research*" and many European countries interpret this definition as teacher-generated, editable lesson plans, presentations, learning games, quizzes and so on that are stored and distributed in centralised OER repositories with rich metadata, such as KlasCement[27] in Belgium, eSchoolbag[28] in Estonia or Scientix[29] at European Schoolnet. However, because of previous failures, teachers' unwillingness to share and experts' disappointment with the low quality of teacher-generated resources, the Portuguese Digital Transformation strategy has focused on a limited number of professionally developed Open Educational Resources that cannot be modified by teachers - openness here simply means open access and open licensing of specially procured innovative educational content. This approach ensures both high quality and the pedagogical alignment of the OER to the learner-centred "pedagogy first" paradigm of the strategy. The main platforms in the Portuguese OER programme have been:

- **Milage Learn+[30],** a gamified learning application (Windows, MacOS, IOS, Android) developed by the University of Algarve since 2018 and used by hundreds of schools in Portugal and some other European countries.

- **Periscope island[31],** a browser-based learning platform containing interactive mini-games in mathematics, experimental science and Portuguese for grades 1-4. These resources were produced by teaching specialists in the aforementioned scientific areas, based on existing analogic educational resources, through an action coordinated by the DGE. There were more than 120,000 unique visitors to the Periscope Island in 2022-2023.

## Learning points for discussion

Lessons learned in digital infrastructure and digital learning resources within the Digital Empowerment strategy can be summarised as follows:

- Portugal has implemented a systemic, well-designed multi-perspective approach to the digital empowerment of schools, significantly improving all layers of the digital infrastructure of schools: end-user devices, internet connectivity, digital services and educational content.

- The current strategy has a high level of sustainability, building on previous strategies and programs, learning from previous mistakes and success factors, and making use of previously established competence centres.

- The guiding "pedagogy first" principle has been successfully supported by the infrastructure developed but a long-term sustainability or exit strategy is needed for upgrading or replacing students' laptops within the next three years.

- The speed of producing platform and content for high-quality digital textbooks has been impressive; it has resulted in deep restructuring of the educational publishing market yet maintaining an opportunity for smaller publishers to join the digital transformation process.

- In addition to commercial digital textbooks, development of high-quality Open Educational Resources has been supported, although the definition of OER seems to be slightly different from that in other European countries.

- An original (and effective) approach to digital textbooks and OER production has clearly been a success in Portugal, but the global trend towards AI-enhanced adaptive learning systems might require exploring alternative approaches in the future.

- Tech support at local level did not always work as expected in some schools and might require rethinking.
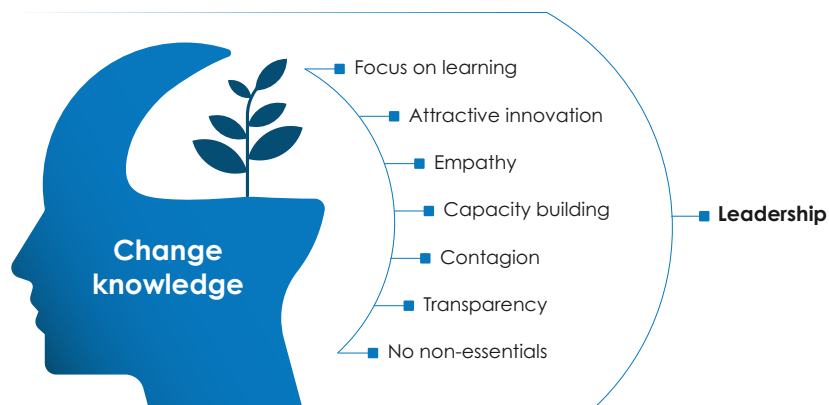
# 04. **Change knowledge**

In this section, we discuss the Digital Transition Action Plan for Education from the perspective of the *change knowledge* component of Fullan's model. The relationship between this component and the previous chapters in this report is clear from Fullan statement that: 'Pedagogy and technology provide the directional vision; change knowledge helps us achieve it, learning while we go.' (Fullan, 2013, p.66).

*Change knowledge* focuses on implementation that is putting something new into practice. It is a key aspect of successful whole-system change, yet an often neglected one.

According to Fullan, there are eight interconnected aspects to implementing meaningful change at whole-system level: (1) a clear *focus* on active and deep learning for all learners; (2) *innovations* supported by technology to make them engaging, efficient, ubiquitous, and aiming at real-life problem-solving; (3) *empathy* among people involved in the change of practice, helping and respecting each other; (4) *capacity building* focusing on knowledge, skills, and dispositions of individuals and groups, in a continuous learning mode; (5) *contagion* through group dynamics and teachers acting as change agents; (6) *transparency* of results and practice, non-judgmentalism and collaboration; (7) *elimination of non-essentials* aspects such as external accountability and individualistic solutions; and (8) educational *leadership* as a cohesive driver to orchestrate the seven previous aspects and including the monitoring by the stakeholders involved.

Figure 4.1. represents the eight aspects for successful whole system change implementation according to Fullan.



**Figure 4.1 – Fullan's change knowledge aspects for successful whole-system change** (figure from the present report's authors)

We discuss below how the implementation of the Digital Transition Action Plan maps on the approach suggested above. We start by discussing that four aspects that are particularly interesting in terms of learning about system-level change in the case of the Portuguese Plan, i.e. the *focus on learning*, the capacity building effort, the opportunities for contagion, and the leadership of the whole approach. We then more briefly look at the attractivity of the innovations, empathy, transparency, and the elimination of non-essentials.

## 4.1- Focus on learning: digital teaching competence to support the Student's Profile

The Student's Profile to be achieved by the end of compulsory schooling acts as a clear and explicit overarching *focus* of the Plan as has been the case in all initiatives in the last few years. To support the emergence of this Student Profile, the Plan specifically focuses on digital teaching competence, schools' digital strategy and digital learning resources – the three main pillars of the Plan - required

for that purpose. This is clearly stated in the policy documents framing the Plan (see the Resolution of the Council of Ministers no. 30/2020, 21 April 2020). It is also what the interviews conducted during the study visit suggest. Most digital ambassadors, teacher trainers, teachers and school leaders interviewed perceive such a connection and alignment between the Plan, its training provision, and the Student's Profile. Such shared stakeholder understanding of how the Plan, its training provision and the Student Profile are aligned deserves to be underlined and can be seen as an achievement of the Plan's implementation. The gap between policy intentions and their understanding by ground level implementers (Weiss, 1982; Lacasse, 1995) is indeed a frequent obstacle in policy reform that seems to be overcome in this case. Several interviewees spontaneously even pointed out an extended alignment between the Plan and several previous DGE initiatives like those concerning curricular flexibility, inclusive education, and the MAIA formative assessment project.

The central role of DigCompEdu in the implementation of the training provision element of the Plan reflects and enhances the *focus* on the teaching digital competence supporting the emergence of the Student's Profile. DigCompEdu indeed intrinsically and explicitly relates student/learners' competence to teachers' professional and pedagogic competence, as illustrated in the Figure 4.2.
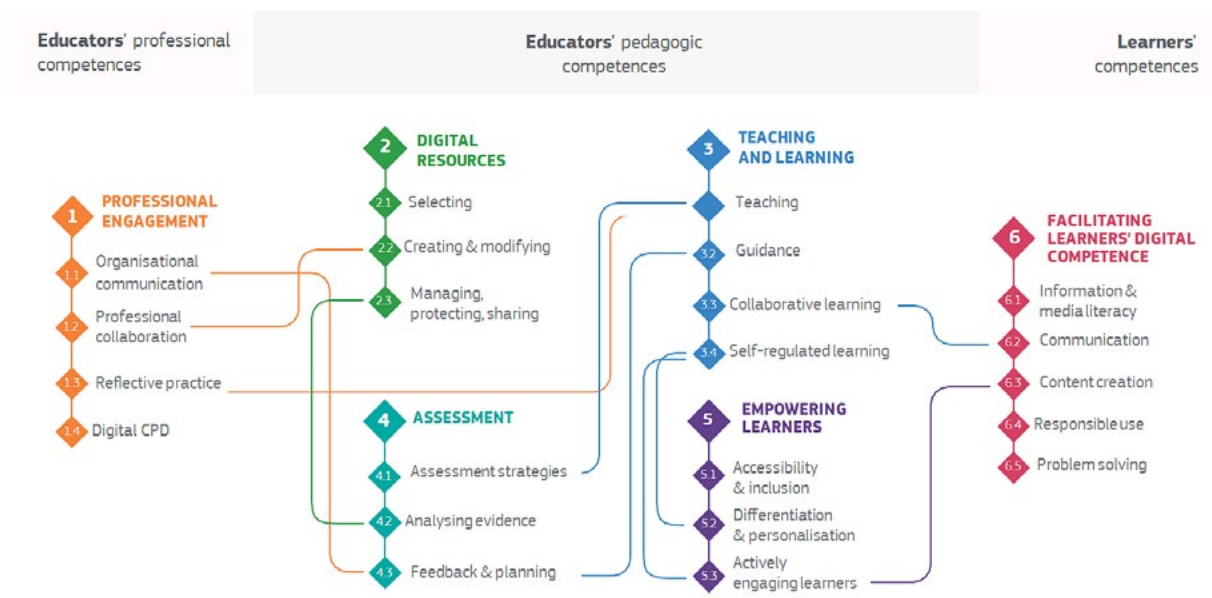


**Fig.4.2 – The DigCompEdu framework**; Redecker C., Punie, Y, (2017) European Framework for the Digital Competence of Educators DigCompEdu JRC SCIENCE FOR POLICY REPORT, Join Research Center, European Commission; figure taken from theJRC report)

Finally, the *focus* on active learning and the Student's Profile is clearly reflected in documents guiding the design and implementation of the training provision to be offered to teachers. Whether differentiated by subject or for common themes across subjects (e.g. gamification), the training modules systematically relate teaching scenarios, activities for teachers and students, digital tools to be used, and pedagogical orientation to student learning objectives.

The centrality of the Student's Profile in the design of the training provision and the use of DigCompEdu to guide that upskilling effort appear to be the two main explicit priorities – i.e. *focus* of the Plan. In that sense, the first criterion in Fullan's *change knowledge* approach - a clear *focus* on learning – should be met by the Plan's implementation when it ends in 2025. The analysis of school level strategic plans (their PADDE) by the University Institute of Lisbon (ISCTE) will reveal to what extent that focus is effectively reflected at school level.

### Learning point for discussion

During the study visit, interviewees in different roles (CFAE directors and teacher trainers, digital ambassadors, ICT competence centre directors and teacher trainers, and DGE managers) raised the question of the possible, unintentional, prominence given to the practical use of digital tools during the training sessions rather than to how different digital tools may be used to support teaching, learning and assessment. If confirmed (to our knowledge, no evidence about that aspect is currently available), such 'deviation' from a strong *pedagogy first focus* might indeed be detrimental to the type of teaching practice necessary to support the aims of the Student's Profile and the curriculum. As illustrated by many examples of how digital tools are misused, a tool is simply a tool. It brings educational value only when it is intentionally well chosen and used to support a specific learning purpose, which requires different (and more advanced) competences than those required for practical use.

Those asking this question might consider the extent to which the training provision designed by the Plan has explicitly addressed the **change of role** of both teacher and student in the learning/pedagogical process. Could the change of roles have been more deeply covered by the training provision and discussed with participants? Would an increased focus on the change of respective roles have reinforced the existing 'pedagogy first' character of the training provision offered by the Plan? How and to what extent? Could the change of role be considered more deeply in future training provision? If yes, how could it be integrated into it and explicitly related to learning objectives, teaching scenarios, and learning activities? Should the change of role of teacher and student be discussed through public debate involving all stakeholders including parents for example?

Fullan explicitly refers to the importance of putting the *focus* about 'getting the roles right, especially by recasting those of student and teacher' (Fullan, 2013, p67). He advocates integrating pedagogy and technology around those roles.

At a more fundamental level, Shulman & Shulman (2004) and Timperley (2008) highlight the importance of teachers' beliefs - about what is important to teach, how students learn, the teacher's role, and how to meet policy demands – in what they take from professional development and decide to change practice, or not. From that point of view, involving the beneficiaries of the training provision in discussion about the change of role required as teachers take on new practices would more effectively engage their beliefs.

During the study visit, one teacher trainer interviewed mentioned that she organised professional discussions about DigCompEdu itself as part of a training activity. She reported that participants actively engaged in the discussion and the respective benefits both sides (trainer, trainee) got from it. Could a similar experience be integrated in future professional development opportunities, this time specifically about the change of role of teacher and student in digital learning processes and environments?

## 4.2 - Capacity building: developing the professional capital of multiple stakeholders

In Fullan's model (2013) – and in joint work developed by Fullan and Hargreaves (2012) - *professional capital* is the phrase used to reflect the complexity of teaching. In their view, *professional capital* partly comprises the talents of the individual teacher, i.e. the skills, qualifications, capabilities brought to teaching, known generally as 'human capital'. Beyond that individual level, teachers are brought together as a group or a community within and across schools and develop the skills, values and attitudes associated with and allowing the functioning of such a group or community, including the cooperation and trust required. That is 'social capital', a particularly important asset to enact change faster and more effectively. Finally, during their careers, teachers further develop their competences

and capacity to judge depending on situations and circumstances, improvise action depending on contexts, efficiently differentiate teaching, mentoring, or training others, etc. Hargreaves and Fullan refer to this as 'decisional capital'. All three -- human, social and decisional capital – contribute to creating *professional capital* as illustrated in the Figure 4.3.
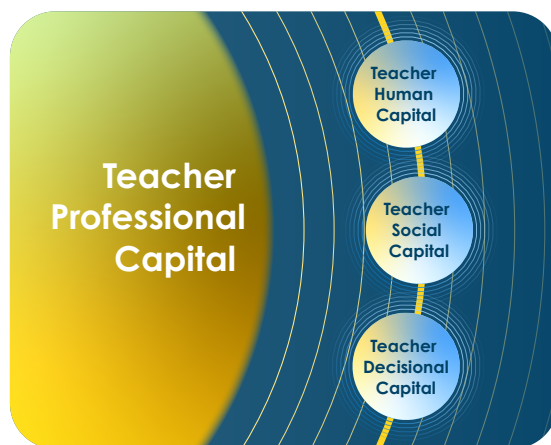


**Fig.4.3 – The components of teacher professional capital as defined by Fullan and Hargreaves**

(figure from the present report's authors)

The large-scale training for teacher trainers, teachers and school leaders as foreseen in the Plan has effectively reinforced their individual knowledge, skills and attitudes concerning the purposeful use of digital in teaching and learning. The University of Aveiro undertook a longitudinal analysis and found that the overall average digital competence score - measured at the start of the Plan's implementation - rose from 48.6 points, corresponding to a B1 Integrator proficiency level, to 55.6, corresponding to a B2 Expert proficiency level. There was a significant reduction in teachers classified as low levels (A2 and B1) between the pre- and post-training periods, and a significant increase in teachers classified as higher levels (B2, C1 and C2). The increase in score and level of proficiency from B1 to B2 was seen in all areas of competence and was significantly greater in teachers who attended training workshops. That increase of individual competence (i.e. 'human capital') could in theory contribute to some increase in the decisional capital of those involved. Any change in that competence area requires a long time to develop, primarily resulting from classroom practice rather than from training.  At this stage of the plan's implementation, it is expected that teachers will continue to be trained to keep pace with evolving technologies and teaching methods; new technologies will be explored and integrated to enhance the learning experience; digital assessment methods will be developed and implemented to effectively assess students' performance in digital environments; measures to ensure the privacy and security of students' data in digital systems will be strengthened; digital well-being and safety online will be promoted; and collaboration between units of the Ministry of Education, other educational institutions and other stakeholders will continue to align efforts and resources to achieve the goals of digital education.

For this reason, we won't discuss the possible effect of the Plan on the decisional capital of the training beneficiaries here.

On the other hand, opportunities provided by the Plan implementation for developing *social capital* deserve attention. The training workshops (50 hours) have offered opportunities for the development of *social capital* of teachers at level 1 and 2, The workshop of level 3 was designed to contribute to the promotion of teachers' and school leaders' decisional capital regarding the use of digital technologies in school from different schools and education levels, brought together to learn and interact and mixed in groups based on their starting digital competence level (measured by the Check-In tool; see the chapter about Pedagogy first). The school digital plan (PADDE) has also provided opportunities for *social capital* to be nurtured through cooperation between teachers (whether or not they belonged to the digital team) and school leaders for the implementation of

that plan in their own school. Interviewees during the study visit underlined the fact that exchanges, cooperation, and networking have effectively developed thanks to the implementation of the Plan, suggesting that it has facilitated the development of *social capital*. Some interviewees said they would like to have even more dialogue between practitioners and to do so upstream of implementation. Several interviewees have also reported that learning communities have been created at school cluster level for example by subject to discuss the daily implementation of teaching with digital technologies in very practical terms (e.g. how to use a specific digital tool for a particular learning purpose, how to react when the internet is down, tools and/or pedagogical approaches not working well). Professional learning communities at school/cluster level are encouraged by the Plan but are not mandatory; their appearance is a positive sign of *social capital* effectively developing.

*Social capital* nonetheless may also develop beyond professional learning communities through collaboration with schools and across school clusters. *Social capital* is also – especially when it aims at whole-system change - about inter-school and inter-school cluster and system-wide collaboration. For that reason, we discuss below the potential increase of *social capital* of actors intervening at intermediate/horizontal level in the education system - i.e. those 'in-between' in both top-down and bottom-up approaches, also called 'the mediating layer' (Fleish et al., 2010) – who are also key players in the implementation of the Plan.

## The intermediate level players between the ministry and the schools

The leadership of the Plan from its design phase is ensured by the Portuguese Ministry of Education, more particularly its General-Directorate of Education (DGE) and its Educational Resources and Technologies Team (ERTE).

Between the ministry and schools, three actors play an important role in general and in relation to the Plan's implementation. They are the ICT Competence Centres (*Centros de Competência TIC/ CCTIC*), the Teacher Training Centres (*Centros de formação de associação de escolas/ CFAE*) and the Digital Ambassadors (DA) attached to them. The ICT Competence Centres and the Teacher Training Centres have been in place for several years (decades for some before the Plan was adopted. The role of Digital Ambassadors (attached to CFAES) was created in 2020 to facilitate the implementation of the Plan.

The specific ecosystem created by those three players, the schools and the ministry are illustrated in Figure 4.4.
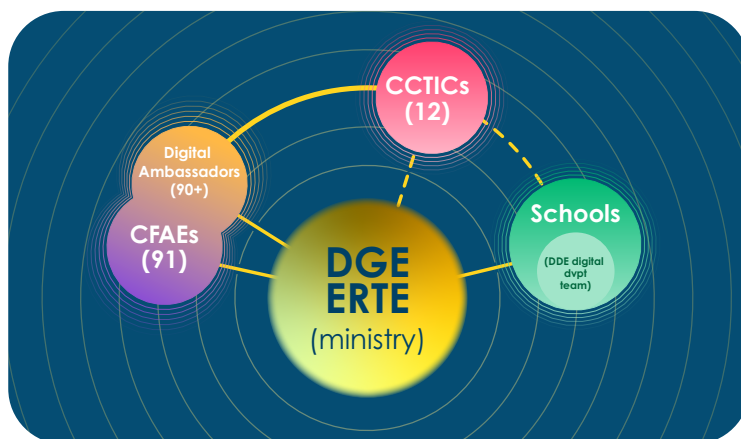


**Fig.4.4 – The ecosystem involving the intermediate level players** (figure from the present report's authors)

- **ICT Competence Centres (Centros de Competência TIC/ CCTIC)** – There are twelve (12) CCTICs in total. In close collaboration with DGE, they are responsible for supporting schools to integrate ICT in the curriculum, thus contributing to the development of digital competences in education. CCTICs were established through protocols between the Ministry of Education and the entities where they are based such as universities, Educom (Portuguese Association of Educational

Telematics) and Teacher Training Centres (see below). The CCTICs offer specialised expertise and proximity and they can respond quickly to specific schools' needs. Each centre supports the schools in its geographical area, and sometimes beyond, whenever the projects and activities are directly related to the areas of expertise of the Centre of Competence.

- **Teacher Training Centres (Centros de formação de associação de escolas/ CFAE)** – There are ninety-one (91) CFAEs in total. They ensure for implementing the national priorities for continuous training and respond to training priorities of their associated schools, including but not exclusively digital education.

- **Digital Ambassadors (Embaixador Digital/ED) - /** There are 89 Digital Ambassadors (school year 2023-2024), 50% of their timetable is allocated to this task and they provide the link between the DGE and schools. Each ambassador is associated with a specific CFAE and supports the Digital Development Teams (DDE) in place in the school they work with (there is one DDE in each school); this role covers school involvement in the preparation and implementation of its own Digital Development Action Plan (i.e. the PADDE; see the previous chapter about 'Pedagogy first'). The Digital Ambassadors also provide technical and pedagogical advice in the organisation of teacher training to fulfil the specific needs identified in schools.

## Learning point for discussion

During the study visit, discussions with interviewees, participants in focus groups and staff in schools visited conveyed a sense of effective and willing cooperation - even in some cases a culture of cooperation, during the Plan's implementation between the CCTICs, CFAEs, Digital Ambassadors and schools and school's clusters. Might these interactions contribute to provide the missing link between participation in training and changes in practice?

Research highlights the fact that teacher training – especially regarding teaching innovations - doesn't automatically translate into changes in practice (Cros, 2022). Innovating practice requires post-training support for teachers to discuss doubts, obstacles, failures as much as successes, and students' reactions they encounter in their attempts to implement new practices in the classroom. They need professional discussions in a safe (non-judgmental) context, and they need time. This condition needs to be in place for teachers to learn from their attempts to change and stabilize new practices once they are convinced about their value and feel able to justify them.

Discussions during the study visit suggest that the cooperation between CCTICs, CFAEs and Digital Ambassadors certainly has the potential to reduce the gap between training about digital use in teaching and its translation into practice, which frequently is a significant obstacle to whole-system change. During the study visit, teacher trainers and digital ambassadors shared examples of such post-training support provided on a regular basis in short and medium term. These stakeholders have the capacity and expertise to address a vast array of challenges faced by teachers and schools in the implementation of the Plan thanks to their diverse areas of expertise. They will also be in place once the Plan ends (in 2025) thus ensuring sustainability. Their horizontal positioning as mediating layer, between the ministry and the schools and schools' clusters, is another asset to be considered in addition to supporting the implementation of top-down initiatives. Their position enables them to provide feedback from practitioners (bottom-up) on what works and what is still to be fixed, adjusted, added, or possibly abandoned in centrally designed initiatives. The question here is how to capture the learnings within those organisations themselves and build on them to increase the effectiveness of existing practices at school and system levels. We refer here for example to the interest expressed by several CFAEs and CCTICs in supporting schools to define their training needs from a more 'collective and organisational' standpoint and less as the total of individual teacher needs.

Interviews and focus group discussions reveal that the Plan has had a 'momentum effect' and

played a catalytic role for those intermediate level players. How could that catalyst effect be sustained once the Plan ends? How to facilitate in a structured way their contribution to reduce the gap between training and change in practice at school level? How to benefit from their own learning throughout the implementation process of the Plan and discuss – even possibly test – the suggestions for improvement they might have? More generally, what could be the mechanisms – and type of leadership at central level - to develop further the progress achieved through the Plan? How could the learning of those stakeholders facilitate the adoption of new changes that might be needed in the future?

## 4.3 - Contagion

In Fullan's model (2013) *contagion* represents the strategy to accelerate change by using the group and players' social capital (see previous sub-section addressing *social capital* among other types of *professional capital*). In that strategy, teachers who have already introduced innovation in their own routine practice act as change agents and reach out to other teachers to improve their use of digital technologies in their teaching practice. In some cases, those change agent teachers are trained for that specific purpose and become ambassadors for example. *Contagion* is thus about the strategic use of peers that research has documented as a particularly effective source for innovation at system level (Fleisch et al., 2010). The role of *leadership* (discussed in the next sub-section) remains critical for large-scale innovation adoption, but Fullan sees it serving *contagion*.

As with the capacity building provision (see previous sub-section), mechanisms in place before the implementation of the Plan which were likely to spread contagion were fully activated. These mechanisms included the digital team within each school, and the school's access to related Digital Ambassador, CFAEs and CCTICs, i.e. what we call the intermediate/horizontal or mediating layer. As observed internationally (Fleisch et al., 2010), education systems that have progressed on their improvement journey have increasingly come to rely upon this mediating layer between central level and schools for sustaining improvement and innovation. The implementation of the Plan illustrates such an approach in which Digital Ambassadors, CFAEs and CCTICs provides three key inputs to the system: it provides targeted hands-on support for schools, it acts as a communications channel between the school and the ministry, and disseminates successful innovative practices across schools. Even without being able to evaluate the extent of contagion during the Plan's implementation, we can assume that at least those innovations adopted by teachers contaminate others through direct exchanges between peer teachers or via teacher trainers and/or digital ambassadors across schools. Participants in focus groups and interviews during the study visit referred to that type of peer learning leading to the adoption and finetuning of new teaching practices including between teachers from different education levels in some cases.

The organisation of Portuguese schools in clusters – i.e. groups of schools within the same geographical location, for economic, pedagogic, administrative, and political purposes - is another mechanism possibly conducive to contamination, for example through the professional learning communities established by clusters on a voluntary basis during the Plan's implementation.

At intermediate, horizontal level (between the ministry and the schools) cooperation between Digital Ambassadors, CFAEs and CCTICs during the Plan, is another potentially powerful and large-scale support for *contagion* between these organisations. That *contagion* has the potential to reinforce the consistency of the vision about technology, its use for learning at whole-system level and its alignment with the Student Profile. In the discussions with some of those stakeholders during the study visit, they mentioned frequent exchanges between those three groups of players up to a level not necessarily existing before the plan.

An additional mechanism is starting to be implemented at this stage of the Plan's implementation as a pilot project. Since the beginning of the school 2023/2024, a mentoring and collaboration process has been launched for schools and clusters currently taking part in the Digital Manuals Pilot Project

(PPMD). This initiative has been initiated by the Directorate-General for Education, in partnership with the ICT Competence Centres (CC TIC). The main objectives are to promote the sharing of experiences; support teacher capacity building; facilitate mutual assistance in problem-solving; develop practical recommendations and guidelines; and to contribute to the development of a learning community that favours pedagogical innovation, with the integration of digital technologies, digital textbooks, and other digital educational resources. Following specific criteria, there are currently 21 groups of schools, each typically comprising five schools (one mentor school and four mentee schools), forming micro-networks within the PPMD schools.

To effectively monitor and oversee the project within schools organized into 21 mentoring groups, three working groups were established. These groups consist of members from the ICT Competence Centres (CC TIC) who are geographically close to each other.

In order to facilitate interaction between members of the mentoring groups, schools have established a central group (comprising three or four individuals) that plays an active role in organizing sharing and reflection sessions between schools, as well as in implementing and promoting project practices within their own school. The central group typically includes technical-pedagogical coordinators of the project, Digital Ambassadors, the Principal or other members of the school leadership team, as well as other experienced teachers, trainers, or leaders.

The activities planned by the initiative consist of preparatory online sessions with participating schools to provide an overview of the work to be done and address mentoring-related questions, online and/or in-person follow-up sessions by the CCTIC; sharing and reflection sessions within the mentoring groups; two sessions led by the mentor school (at the beginning and end of the academic year); and one session led by each of the mentee schools, involving all schools. A final PPMD assessment session involving the participating schools (ERTE/CCTIC) marks the end of the school mentoring process.

The collaborative network of Digital Ambassadors, CFAEs and CCTICs, the learning they have themselves experienced through the Plan's implementation (explicitly highlighted by several during school visits and interviews) their reflective attitude during the interview, and the recent monitoring initiative all represent favourable conditions to support the contagion process advocated by Fullan.

The identification of reference practices developed by schools and shared between them, as an initiative of DGE in collaboration with the intermediate layer, or as an initiative of schools between them are efficient ways of contagion. They provide ideas to put into practice, promote a sense of belonging and raise awareness of the schools and teachers' educational values. DGE promotes online workshops to share this practice within the scope of the Pilot Project for Digital Textbooks and the interest of the more than 500 teachers normally attending the sessions and the feedback on the chat are testimony to the importance given to these moments of collective intelligence construction.

## Learning point for discussion

The tight network of stakeholders surrounding the schools with the explicit aim of supporting practitioners' capacity building has also supported *contagion* in several cases during the Plan's implementation. How could they continue to do so - possibly even at a larger scale – after the end of the Plan? What have been the specific conditions that enabled *contagion* in some cases but not in others? How could that *contagion* effect be better appreciated in terms of scale, effectiveness, and sustainability? How would that analysis feed future policy initiatives building on the achievements of the Plan?

Researching the level, spread, timeline and mechanisms of contagion between schools as the Plan is implemented would be useful to identify which type of actions could follow-up the current plan. Researching that issue a posteriori, i.e. for contagion that has happened until now, is one possibility. A second or complementary approach could be to integrate within the mentoring scheme begun in 2023-2024 between schools a component enabling such an analysis. It would

offer the advantage of looking at contagion mechanisms from the start of the new scheme, so that contagion can only be the key element at stake. Should there be interest to design such analytical component, Rogers' diffusion of innovation theory (2003) could serve as a guiding framework. Its five stages of diffusion (awareness, interest, evaluation, trial, and adoption) and the attributes of the innovation practice under consideration (relative advantage, compatibility, complexity, testability/experimentality, and observability) could provide a lens to effectively identify and interpret the *contagion* mechanisms taking place between mentoring and mentored schools.

The sustainability of the multistakeholder cooperation (digital ambassadors, CFAEs, CCTICs) that plays such an important role in the capacity building process (see previous sub-section) and can facilitate contagion at whole-system level, remains a challenge, however. Many trainers working for the CFAEs and partly the CCTICs - and all the Digital Ambassadors - are teachers still teaching at school part-time. As in most other EU countries, notably Greece, the Baltic countries and Hungary (Education and Training Monitor, 2023), Portugal faces a lack of attractiveness to the teaching profession; the shortage of teachers is already observed in several subjects and increases the number teachers available to teach. The school hours of Digital ambassadors are reduced by 50% and trainers accumulate these hours and receive additional pay. The added value of teachers who are still teaching in schools (unlike professional trainers out of school) is difficult to replace as they have expertise in teaching and school organisation and are particularly credible to their peers. How could technology contribute to reducing teacher workload, for example in repetitive activities and in administration, as a way to decrease the tension on teacher shortages?

## 4.4 - Leadership

Leadership is the cohesive driver that orchestrates the other elements covered by the Change Knowledge in Fullan's model (2013), i.e. focus, capacity building, and contagion as discussed earlier in this chapter; as well as innovation, empathy, transparency, and elimination of the non-essentials that will be more briefly addressed later in this section.

The leadership of the Plan from its design phase to the end of its implementation is ensured by the Portuguese Ministry of Education, more particularly its General-Directorate of Education (DGE) and its Educational Resources and Technologies Team (ERTE).

**Leadership for** *focus* - Leadership starts with a vision (Sashkin, 1986) for the orchestration referred to by Fullan to be meaningful and purposeful. The vision behind the Plan, and its ultimate *focus*, is the Student Profile adopted in 2017. Since then, that Student Profile has been the explicit - and stable - reference point for subsequent thematic reforms (citizenship education, curriculum flexibility, inclusive education for example) adopted by the Portuguese education system. It has become the 'universal' point of reference for subsequent laws, initiatives, and pilot projects not only in official documents but also in the mindset of most stakeholders and practitioners. Teachers, teacher trainers, digital ambassadors and school leaders have placed the Student Profile – and its connection with other policy priorities such as inclusive education and digital citizenship - as the heart of public initiatives for education (as far as we can determine through discussions during the study visit to schools and stakeholders' interviews. Political stability (there have been two ministers of education from 2015 to 2024), consistent and related educational policies during this period, and the capacity of public authorities to effectively communicate the pivotal role of the Student Profile in a broader context for change suggest that an effective leadership is in place to promote a clear focus for the Plan.

**Leadership for** *capacity building* - This effective but nevertheless still top-down, leadership in defining the vision behind the Plan and its core content has adopted a more bottom-up strategy for its implementation. The *capacity-building* pillar of the Plan is implemented in close cooperation between the ministry (DGE and ERTE) and a diversity of stakeholders (CCTICs, CFAEs, digital ambassadors, and universities to some extent). Clear guidance from the central level – including an anchor into the DigCompEdu framework - still prevails. It nonetheless offers room for flexibility benefit from the

expertise accumulated over years of use of digital technology for pedagogical purposes by digital ambassadors, teacher trainers and CCTICs, and for that expertise to infuse elements of the training programme for classroom teachers. This move towards a more bottom-up approach is also illustrated by the strategy implemented for training the trainers at the start of the capacity building phase. Instead of opting for a cascade model - in which trainers first receive the same training as the one they will replicate with teachers later – they have been involved in a more reflective approach. This approach offered teacher trainers some flexibility to finetune and adjust the training programme for teachers to teaching subjects, education levels, the diversity of schools' contexts and popular technologies in schools. Both our analysis of official documents and intermediate reports about the implementation produced by university researchers, and the discussions during the study visit to schools support the existence of a certain balance between top-down and bottom-up leadership during the implementation of the Plan for a relevant *capacity building* provision.

**Leadership for** *contagion* – Balancing central leadership with unleashing the contagion potential of groups of practitioners requires a challenging dosage. As mentioned in the previous sub-section about *contagion*, it's about a leadership that operates in the service of social *contagion*. Interviews and school visits discussions substantiate the view that central leadership – while indicating a clear direction on where and how to go - provides room for effective and collaborative leadership by digital ambassadors, CFAEs and CCTICs teacher trainers to fulfil the aim of the Plan's implementation and reach out school leaders and teachers with innovative practice. We have heard about individual initiatives taken by some CCTICs, CFAEs or digital ambassadors to accompany schools more closely than expected for example through setting up additional professional communities of practice at school or cluster level or providing complementary training sessions responding to specific needs. Inevitably, the level of leadership and initiative on the ground varies depending on the context. The close relationships between the ministry on the one hand and the network of digital ambassadors, CFAEs and CCTICs respectively on the other hand, facilitates the implementation of a multiple level leadership (central, intermediate, institution levels) in the service of *contagion*.

**Leadership for innovation, empathy, transparency, and elimination of non-essentials** – In Fullan's model (2013) *innovations* refers to teaching and learning practices integrating technology and pedagogy in a way that is 'irresistibly engaging', easy to use, ubiquitous and 'steeped in real-life problem solving' (p.33). *Empathy* relates to understanding and supporting others, those less ready to innovate for example, and avoiding judgmental behaviours. *Transparency* refers to transparency of practices and results as well as collaboration again in the absence of judgmental behaviour. *Elimination of non-essentials* means avoiding external accountability, individualistic solutions, casting technology in a starring role, ad hoc policies (versus systemic ones) and other wrong drivers (Fullan, 2011).

The desk research analysis and the eight-day study visit of four schools and interviews with stakeholders on site - that led to the present case study have their limitations. One is appreciating the 'irresistibly engaging' characteristic of the teaching and learning practice at the crossroad of technology and pedagogy that the Plan aims for, within the many practices depending on subject, education level, competences to be developed, etc. We can only report the many times teachers and students in focus group discussions mention technical problems related to devices and connectivity. Nevertheless, students participating in focus groups in the four schools visited attested that they enjoy using technology for learning in most cases, and mention solutions improvised by schools to overcome issues when possible (for example, moving lessons to the better-connected school library where all devices – although sometimes old – are operational).

Observing *empathy* was also beyond the scope of this case study. We can only report the sense of *empathy* present in all focus groups discussions and school visits, including in meetings involving stakeholders not directly part of the school staff visited, such as digital ambassadors, trainers from CFAEs and CCTICs representatives. The fact that all or almost all these stakeholders– as already mentioned elsewhere in this report – are also teachers, probably contributes to conveying that sense

of *empathy*. Focus groups with students, sometimes from different age groups, mirror a similar sense of *empathy*.

*Transparency* of results and practices and peer-collaboration is another aspect beyond the scope of this case study. We can only refer to meetings and conferences organised at different scales (schools clusters, geographical and central levels) to share inspiring practices. The study group participated in only one of them, the *Digital Transition Plan* national event organised in Santarem by DGE on 11 October 2023, attended by more than 1,000 participants (directors of schools' clusters and schools, directors of School Association Training Centres, teachers, technicians directly involved in the Digital Transition in Education and students).

Concerning the *elimination of the non-essentials*, also largely outside the scope of this case study, we did not notice, for example any tendency for individual solutions or ad hoc policies (instead of systemic ones) in our desk research and study visit. Neither did we note any tendency to place technology in a starring role, although this could still happen in daily practice on the ground or even during training sessions (see one of the 'Learning points for discussion' under the section about the Focus).

## Learning point for discussion

Given such a whole-system change ambition -as in this Plan and reflected in its implementation strategy – the capacity to capture and understand the conditions, dynamics and mechanisms leading to change in daily practice is essential for the system leadership to learn from the Plan's implementation and understand what should come next. The ministry has commissioned several universities to investigate, for example, participation in the capacity building provision and its effect on the participants' level of competence, the content of the school digital strategic plans (PADDE), and the pilot about digital textbooks for example. The study group has had access to the studies completed before the drafting of the present report and reading them has been extremely useful. The very existence of these reports also demonstrates a system leadership that seeks independent evidence and evaluation. Because of the complexity of spreading change in schools at whole-system level, could there be a way to capture the learning acquired throughout the process by the stakeholders involved? While it is important that knowledge flows vertically from the key stakeholders up to the political level and vice versa, it is equally important that knowledge moves horizontally between key stakeholders at intermediate level. Could for example regular exchanges between digital ambassadors, CFAEs and CCTICs be structured and turned into sustainable peer learning processes after implementation of the Plan?  What could this mechanism look like?

# 05. **Recommendations**

Portugal has made significant progress in supporting schools to integrate digital education. To build on this progress, it will be important to develop a multi-pronged strategy:

- widening the reach and impact of digital transition in more schools, and in those that have been slow to adopt new tools and approaches; identifying the reasons limiting adoption of innovative practice as a way to efficiently tackle them; implementing different sorts of incentives.

- deepening educators' expertise in using digital tools to support pedagogy depending on subject, tools specificities, etc.; supporting learning at whole-system level (not only at school level); and building school capacity to strategically plan training whole-school development.

- sustaining the program to build on investments in infrastructure and capacity building; and consolidating the intermediate ecosystem of CFAEs, EDs, and CCTICs.

## 5.1 - WIDENING

### 1. Support schools/teachers that have been slow to integrate digital technologies in classroom teaching, learning and assessment (Short- and medium-term)

Most teachers and school leaders (92%) have participated in training on digital education, and almost all (99%) of schools in Portugal have action plans outlining how they are integrating tools to support learning and tracking their progress (the Action Plan for the Digital Development of Schools, or PADDE - *Planos de Ação de Desenvolvimento Digital das Escolas* / PADDE). Nevertheless, as noted by school inspectors interviewed for the case study, the degree to which schools and teachers have integrated digital education in regular practice varies widely. Barriers to take-up may include poor digital infrastructure and connectivity (particularly in rural areas), and low teacher efficacy regarding digital education.

A first important step will be to develop a better understanding of the different reasons why teachers and school leaders may be reluctant to integrate digital education content in their school and classroom practices, and to find ways to address concerns. Significant changes in practice – not only in the use of digital education content but in the shift to more learner-centred approaches to practice – may require school leaders and teachers to also shift beliefs and mindsets about teaching and learning. DGE may consider working with a university-based research team to develop a more in-depth understanding of these different concerns and if – in addition to further training and reinforcement – it will be important to develop other strategies to influence teacher practices. (see also below the recommendation about adding a qualitative monitoring component to the mentoring scheme)

In addition, ongoing investments in teacher training for teachers and school leaders will be important to support schools and teachers that have been slow to integrate digital technologies in teaching, learning and assessment. Integrating new practices takes time. Follow-up with teachers in their school and classroom contexts can support them to bridge theoretical learning with practical approaches to digital education. School-level digital team leaders can support teachers' ongoing learning through mentorship and in professional learning communities where teachers collaborate to develop their competences in digital pedagogy.

In addition, diverse opportunities, including online and face-to-face workshops and seminars, "bespoke" training in schools (i.e. in response to school requests to develop their teachers' digital competences to support school priorities) may help to reinforce initial training in which almost all teachers and school leaders have participated.

Training centres can ensure that resources and support are prioritized for schools/teachers that have been slow to take up new practices. A specially designed "whole-school accelerator" format for school staff along with school mentoring model might be more impactful in these schools than the traditional generic training provided in the first phase (see the recommendations from iHUB for Schools project where three different models were developed and piloted for a similar purpose [https://www.ihub4schools.eu].

This is both a short- and medium-term priority (assuming that over the next decade, a majority of schools will be using digital tools in their lessons)

### 2. Integrate a qualitative monitoring component into the recently launched mentoring initiative for schools and school groups part of the PPMD pilot project. (short- and medium-term)

The main objectives of this initiative - established by the Directorate-General for Education in partnership with the ICT Competence Centres (CCTICs) – are to promote the sharing of experiences, support teacher capacity building, facilitate mutual assistance in problem-solving, the development of practical recommendations and guidelines, and to contribute to the development of a learning community that favors pedagogical innovation, integrating digital technologies, digital textbooks, and other digital educational resources.

The schools and school clusters involved in the PPMD pilot project represent a small sample of all the schools and schools' groups in Portugal. This group of schools nonetheless offers an interesting and tangible entry point - through its focus on digital textbooks and other digital educational resources – to investigate and better understand the reasons why in some cases the use of digital learning resources fails to translate into truly innovative pedagogical practices, i.e. understanding the process leading to transforming practice rather than looking at the use of digital resources as such (i.e. the practice itself).

The involvement of the ICT Competence Centres with their expertise and critical distance, the 21 groups each comprising one mentor school and four mentee schools, and the several sessions for exchange, discussion and learning between schools that are part of the monitoring initiative, offer as many opportunities as possible for a qualitative analysis of the reasons why the use of digital learning resources does not always result in innovative practices. DGE might consider benefiting from the opportunity offered by the monitoring initiative to commissioning a university to investigate that specific question (through observation during sessions, bilateral interviews with participants, written questionnaires, etc.). Obstacles related to teachers' professional beliefs cannot be addressed by a training action in the same way as a lack of operational competences to use digital resources. In that sense the findings of a qualitative analysis might produce useful results for shaping further capacity building actions for larger groups of schools, considering and building on the understanding of the obstacles to the adoption of innovative pedagogical approaches in practice empirically identified by the research. The final PPMD assessment planned at the end of the pilot might not address that question unless it is not explicitly part of its assessment framework and might understandably be more focused on the resulting practices rather than on the process.

As the mentoring initiative has just begun, qualitative analysis such as this would be a short-term action to be launched as soon as possible and running to the end of the PPMD pilot project.

### 3. Implement incentives and provide better technical support (short- and medium-term)

Regarding wider uptake of the digital infrastructure and digital learning resources in schools, incentives to set up local/regional subject-specific teacher networks might be considered. The teachers who are more concerned with letting go of traditional teaching methods and printed textbooks might be more open towards learning from best practice shared in an informal manner by innovative teachers in their own subject domain.

There is a clear need to improve the technical support services for student laptops. In many schools the students with good IT-skills might be able and willing to provide such services at the first level

(which is up to 60% of cases/incidents), if their activities are well coordinated at national, regional and school level. These IT-student networks should also be supported by a qualification framework and procedres, regular upskilling events and an online troubleshooting (incident management) platform.

**4. Add indicators in official school inspection/ evaluation related to use of digital tools in schools** (short- and medium-term)

School inspector teams in Portugal visit around 100 schools/school clusters each year with a team that integrates two inspectors and one external expert, usually a teacher or researcher in higher education Inspectors state that they do not currently evaluate whether and how schools are integrating digital education. Nevertheless, they have made informal observations that a majority of schools have not fully integrated digital education in their regular practice.

Given Portugal's significant investment in digital education tools and content and in teacher capacity building, inspection teams may also consider commenting on schools' progress in this area.  School inspection teams could be expanded to include experts in digital education, to advise school leaders and teachers on how to improve their digital pedagogy.  The inspector teams could also provide feedback to policy makers on strengths and weaknesses across the system, and where additional training, resources, and other types of support are most needed.

**5. Share examples of best practice on a central database / online seminar among teachers to support professional learning (with a clear lead/structure for the professional learning community)** (medium- to long-term)

Teachers benefit from concrete examples of good practice.  An online repository with a broad range of scenarios illustrating how teachers in different subject areas have integrated digital education content to support student learning can inspire teachers to try new approaches. Scenarios setting out how different resources can support teaching, learning and assessment may also help teachers navigate options.

As the publishing companies currently have  no incentives to share with competitors, schools and DGE best practices in using digital textbooks and supplemental resources created/modified by teachers, collecting and sharing innovative pedagogical scenarios could be organised jointly by DGE and publishers - for instance, through a competition or awards for authors of outstanding digital resources and their pedagogical implementation scenarios in every subject area and grade level (separately for teachers, students and third-party authors). If such a competition is organised first at school/ cluster level, then regional and finally at national level, it could result in a fast-growing repository of excellent resources that can be used in training, mentoring and development processes. Most likely it would require a dedicated portal/repository that provides easy access to the collected resources.

## 5.2 - DEEPENING

**6. Develop a training offer to support a strong focus on digital pedagogy e.g. understanding affordances and limits of different digital platforms, opportunities for blended learning (e.g. field research in historical sites, museums, science classes, community organisations)** (ongoing – short to long-term)

While in the near-term, priority for teacher training should be given to teachers/ schools that are currently only making limited use of digital education tools and content, it will be important over the medium and long-term to develop more advanced courses for the early adopters.

At more advanced levels, teachers may begin to deepen their digital and learner-centred pedagogies in their subject areas. For example, they may consider how different digital tools may be used to promote specific learning aims. 'Serious games' may be adapted to support learners to develop higher order thinking skills in different subjects. Mobile tools may support learners interacting with learning materials while visiting off-campus sites (e.g. a biology field trip to study plants in a

nearby park, or a museum visit to learn more about local history). Web 2.0 technologies provide platforms for learners to develop online portfolios – including individual and team projects, with opportunities for peer- and self- assessment. As more AI tools for education emerge, teachers may develop new ways to use AI to enhance student learning. Teachers may also develop a more in-depth understanding of ethics involved in using different digital tools (e.g. privacy, potential bias of algorithm-based programmes).

Teachers may also deepen their capacity to work with learning analytics. They may track learners' progress over time, identify patterns in their learning or specific areas for improvement. Learning analytics may also help shape school improvement strategies.

Finally, teachers may develop their capacity to engage in action research regarding innovative and effective uses of digital content to support student learning. In this way, teachers may deepen their competences in digital pedagogy and also help build the evidence base on effective digital education. They may also work in ppartnerships with university-based or other experts to develop digital pedagogies.

Involving innovative teachers and teacher educators in practitioner research could improve data-informed decision making in digital transformation and inform new approaches to teacher education. The use of the SELFIE tool for school/cluster level digital transformation plans (PADDE) has been the first and important step, but there is a need for more in-depth, school/subject specific data on success factors, barriers and other aspects of innovative digital practices that take place in schools. Data warehousing and a long-term applied research program on impact and success factors of the digital transformation program might boost not only high-quality educational research, but also assist in smarter decision making in the next stage of digital transformation at system, regional and school levels.

### 7. Include a 'learning' remit (in addition to a support to top-down implementation) to the eco-system of CFAEs, Digital ambassadors, and ICT Competence Centres. (medium - to long-term)

These three groups of stakeholders have the capacity and expertise to address a vast array of challenges faced by teachers and schools in the implementation of the Plan, and beyond, thanks to their diverse and complementary roles and areas of expertise. Because they remain in contact with schools after and/or in between training actions, they can potentially help them to translate more effectively what they have learnt during the training action into innovative classroom practices. Such 'transfer' is anything but automatic or systematic and represents a significant obstacle to whole-system change. Because of this specific relationship with schools and schools' clusters, CFAEs, Digital ambassadors, and ICT Competence Centres are in principle well positioned to identify specific needs - depending their context - and gaps for schools to move forward in the use of digital technologies for better teaching and learning.

For the time being, these three groups of stakeholders mostly act as intermediate, mediating players, between the ministry and the schools/school clusters, to support the implementation of top-down initiatives. They also provide feedback from practitioners at the central level – in a more bottom-up process - on what works and what is still to be fixed, adjusted, added, or possibly abandoned in centrally designed initiatives.

Through their proximity to schools, the three groups of stakeholders acquire a deep contextual understanding of the diversity of gaps and needs of schools/school clusters. That knowledge can potentially overcome the limitation of 'one size fits all' approaches, another challenge faced by centrally initiated system change initiatives. The learning taking place at the level of the intermediate eco-system comprising CFAEs, EDs, and CCTICs could be a source if inspiration more explicitly and formally organized (through different mechanisms such as annual 'learning' events or workshops, a digital learning platform, a dedicated learning community, etc. targeting specifically those three players) for it to feed – in a more bottom-up way - future initiatives from their design stage (the next recommendation below is an example of that).

Taking such learning into account as a kind of 'strength of proposal' could be the focus in the short term, (still part of the Transition Plan, then nurtured and sustained in the long term to facilitate the adoption of new changes inevitably needed in the future.

**8. Support schools to build training plans from a strategic whole-school perspective that is more than the addition of individual teachers' training needs.** (ongoing – short to long-term)

Through the PADDE, the Transition Plan has already addressed the need to reinforce schools' strategic capacity to integrate technology at whole school level through a pedagogy first approach. Almost all schools have submitted their PADDE, which can be seen as a sign of successful achievement of the Plan.

The existence of a PADDE for most schools doesn't necessarily means that schools are fully able to translate their PADDE into a whole-school training plan aiming at developing the school's collective capacity, i.e. articulating individual needs into a bigger objective serving the school development plan as such. Such a challenge has been highlighted in discussions with CFAEs, EDs, and CCTICs during the study visit.

This is the kind of 'learning' experienced by the intermediate eco-system thanks to its closeness to schools/schools' clusters that is worth collecting, discussing at central level, and possibly acting upon and even testing in real contexts. For example, part of the training provision still to be delivered under the Transition Plan could be dedicated precisely to further developing the schools' capacity to translate their PADDE into a training plan strategically balancing individuals training needs with a whole school strategic approach set out in their PADDE.

## 5.3 - SUSTAINING

**9. Ensure ongoing financial support for teacher training/ school networking** (ongoing – short- to long-term – noting that it will be more costly if there is a gap in attention to capacity development)

Large-scale change initiatives such as digital transition take time to be widely implemented. Portugal has made significant investments in digital transition, and it will be important to build on early gains.

Progress made thus far can be sustained not only through continued investments in digital tools and content and in capacity building, but also in continuing to take a strategic approach. Portugal has introduced several changes in recent years but has been careful to ensure coherence. Strategies for digital education, inclusion, the introduction of competence-based curricula and new approaches to assessment are not only aligned but also may be mutually reinforcing. For example, digital tools may support more effective approaches to inclusion as teachers are able to adapt teaching and learning for individual needs more easily, digital tools may support learners to develop competences through simulations that require them to use knowledge to solve problems.

This emphasis on policy coherence and on building on existing system strengths will also be important as policy makers introduce new initiatives and priorities for schools.

Additionally, Portugal could emphasise the importance of digital pedagogy in initial teacher education. A strong foundation in digital pedagogy will help teachers to develop and deepen these competences throughout their careers.

Sustaining changes is a long-term priority (assuming that over the next decade, a majority of schools will be using digital tools in their lessons)

Finally, it will be important to engage stakeholders (school leaders, teachers, parents, students, employers, community organisations, etc.) in change processes. Their engagement from the early stages of policy development to supporting implementation and evaluation are important to the success of the transition and to ensuring that stakeholders' voices are included in securing changes.

**10. Plan ahead infrastructure update and renewal and next generation digital learning resources** (medium - to long-term)

There is a need to plan ahead the next wave of laptop replacement, as the hardware will age in 4-5 years. Potential alternative solutions for the next phase might be:

- A1-to-1 laptop replacement schedule, spread over a longer period to avoid the logistical challenges of the previous procurement. The advantage of this approach is that a familiar mechanism for laptop purchase and use is retained, but the main disadvantage is the cost and risk of potential stagnation (loss of the innovative push).

- Switching to family-owned laptops or tablets supported partially by vouchers. The advantage of this approach is flexibility and increased responsibility of families and students, while the disadvantage is previous negative experience with Magalhaes computers and loss of control over the equipment.

- Moving back to 1 computer per 3-4 students (accessible on roller-shelves in every part of the school building, but not at homes). The advantage is the cost and control, but the disadvantage is clearly the decrease in access to digital learning.

The next phase of the OER development program could consider micro-grants and building a market for high-quality teacher generated educational content on certified platforms (Periscope Island, Milage, e-testing platform etc.). However, it will require a significant investment in OER authoring tools and a repository as well as a costly quality assurance system.

The next phase of the digital science labs could include technologies such as drones, Virtual Reality, Augmented Reality, and the Internet of Things along with well-designed learning resources and teacher education.

The next generation of digital textbooks should aim at increasing interoperability, improved learning analytics (with AI-enhancements), teacher and learner agency in adapting/personalising the learning resources and learning pathways. More innovative digital learning resources might be needed for formative assessment and inclusive education, not only as specially developed separate services, but also as extensions of existing mainstream digital textbooks.

An ambitious goal for the sustainable development of a smart digital education ecosystem in the next phase of digital transformation could focus on integrating digital content, assessment and learning services, privacy-preserving learning analytics in distributed (cross-platform) learning system, AI-enhanced recommender systems and other services that move data-informed decision making in schools, clusters and DGs up to the next level.

A next-generation quality assurance framework for digital education resources would be an important aspect of sustainable development of a digital education ecosystem. In such a vast and distributed system, one cannot rely on human evaluators; there is a need to invent new, semi-automated procedures and tools for continuous monitoring and improvement of the quality of educational content.

**11. Consolidate the eco-system of CFAEs, Digital ambassadors and ICT Competence Centres in the short and long term.** (ongoing – short to long-term)

The sustainability of multiple stakeholder cooperation (digital ambassadors, CFAEs, CCTICs) plays an important role in the capacity building part of the Plan. It also facilitates contagion at whole-system level through the many exchanges and connections between the three main stakeholders and schools/school clusters. The added value of such an intermediate eco-system for whole-system change is evidenced by research and our observation during the study visit (as described in more detail previously in this report).

The study visit has however highlighted a challenge. A large number of trainers working for the CFAEs and Digital Ambassadors in particular are teachers still teaching at school part-time. Their added value

by remaining practicing teachers (unlike professional trainers external to the school) is irreplaceable. They bring real context expertise about teaching and school organisation and are highly credible to their peers. Digital ambassadors are relieved of 50% of their teaching load to assume these additional guidance and training roles. Discussions during the study visit made constant reference to the fact that this 50% reduction in teaching workload in no way equates to the workload associated with activities as ambassadors. Teacher trainers do not have reduced working hours but are paid for accumulating duties. This challenge is reinforced by the fact that Portugal, like most EU countries (Education and Training Monitor, 2023), faces a lack of attractiveness to the teaching profession, and a shortage of teachers is already observed in several subjects. The margin of manoeuvre to address the workload challenge of digital ambassadors and trainers seems to be very tight if increased pressure on the lack of teachers available to directly teach is to be avoided.

Portuguese public authorities in education could therefore investigate how digital technology could contribute to reducing teacher workload, in particular for repetitive and administrative activities, as a way to decrease teachers' workload. Cross-country cooperation projects, country level pilot projects, technical support provided by EU funding scheme to modernize public action such as the Technical Support Instrument/TSI implemented by DG reform, could offer opportunities to progress in that direction.

The added value of the CFAEs, EDs and CCTICs ecosystem in whole- system change deserves to be consolidated in the short and long term. Participation in such an eco-system also offers opportunities for teachers to develop their professional competence in different career pathways (mentoring, training others, etc.). In that sense, sustaining the eco-system could also increase retention in the profession as teachers considering leaving the profession often complain that they have insufficient opportunities for progression and diversification.

# NOTES

1. https://iave.pt/

2. https://digital.dge.mec.pt/sites/default/files/documents/2021/151-0f6b2a588a71312d0d4fc3bd7395705e.pdf

3. https://digital.dge.mec.pt/sites/default/files/documents/2022/167-af05a3c2702de99460a5c6dc46562f36.pdf

4. https://digital.dge.mec.pt/

5. https://www.youtube.com/watch?v=FOsgysQ2iPU

6. https://erte.dge.mec.pt/sites/default/files/diptico_-_cde.pdf

7. https://www.youtube.com/watch?v=1LaL9LR9xVs

8. https://www.youtube.com/watch?v=nbLxJZ97wJ0

9. Namely: PADDE as a school digital development strategy; developing the curriculum digitally; digital Textbooks Pilot Project: building autonomous and differentiated learning paths; active learning methodologies: how to make the most of them through digital; recovering learning: the role of digital; assessment and feedback with digital; promoting interdisciplinarity with LED; the importance of collaboration in schools and between schools; reconfiguring learning spaces with digital; artificial intelligence in the teaching and learning process.

10. https://www.linkedimmunisation.org/wp-content/uploads/2021/01/4_BestPractices_Cascade-Training.pdf

11. Lucas, M., & Bem-haja, P. (2021). Estudo sobre o nível de competências digitais dos docentes do ensino básico e secundário dos Agrupamentos de Escolas e das Escolas Não Agrupadas da rede pública de Portugal Continental. Aveiro: Ministério da Educação, Direção-Geral da Educação.

12. The JRC sets out six proficiency levels, which follow the same format as the Common European Framework of Reference for languages (CEFR): A1, A2, B1, B2, C1 and C2. Portugal's 3 level training streamlines this taxonomy, setting out initial, intermediate and advanced levels.

13. eTwinning is a European platform for school teachers, leaders and other staff to communicate, collaborate, develop projects, share via an online professional learning community. It is co-funded by the Erasmus+, the European programme for Education, Training, Youth and Sport.

14. The EDD should include the school director, a teacher with extensive knowledge of technological infrastructure, and a teacher with mid-level leadership responsibility and a high-level of digital competences, and who can mobilise peers and promote collaborative work to engage in debate and discussions on the best approach for their school

15. ET 2020 Working Group Schools. (2018). European ideas for better learning: The governance of School Education Systems. Brussels: European Commission.

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20. https://digital.dge.mec.pt/projeto-piloto-manuais-digitais

21. https://www.dge.mec.pt/academia-digital-para-pais-4a-edicao

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30. https://sapientia.ualg.pt/handle/10400.1/18830

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# ABBREVIATIONS AND ACRONYMS

**AFC** - *Autonomia e Flexibilidade Curricular* [Autonomy and Curricular Flexibility]

**CCTTICs** - *Centros de Competencia TIC* [ICT Competence Centres]

**CFAE** – *Centros de formação de associação de escolas* [schools clusters' training centres]

**Check-In tool** - The CheckIn testing tool – developed by the Joint Reserch Center/JRC, European Commission, and based on DigCompEdu - has been discontinued as of 31 January 2022 and replaced by the SELFIEforTeachers self-reflection tool.

**DGE** - *Direção-.Geral de Educação* [General Directorate for Education]

**DigCompEdu** - European Framework for the Digital Competence of Educators (Joint Research Center/JRC, European Commission)

**DigCompOrg** - DigCompOrg provides a comprehensive and generic conceptual framework that reflects all aspects of the process of systematically integrating digital learning in educational organisations from all education sectors. It has been developed by the Joint Research Centre/JRC, European Commission.

**EE** - *Parents and carers*

**ED** - *Embaixadores digitais* [Digital Ambassadors]

**EDD** - *Equipas de Desenvolvimento Digital* [Digital Development Teams]

**ERTE** - [Educational Resources and Technologies Team*, part of DGE*]

**OER** – Open educational resources

**PADDE** - *Plano de Ação para o Desenvolvimento Digital das Escolas* [Action Plan for school digital development]

**PPMD** - *Portuguese Projeto-Piloto Manuais Digitais* [Digital Textbooks Pilot Project]

**SELFIE** - (**S**elf-reflection of **E**ffective **L**earning by **F**ostering **I**nnovation through **E**ducational technology) is based on the DigCompEdu framework (see above) to help schools to exploit the opportunities digital technologies offer to education.

**Student Profile** - abbreviation used in the report for 'The Student's Profile by the End of Compulsory Schooling, 2017

# APPENDIX – Study visit, interviews and schools visited

The study group was made up of Janet Looney, Director of the European Institute of Education and Social Policy based in Paris, Mart Laanpere, Professor of Mathematics and Computer Education at the University of Tallinn, and Patricia Wastiau, Principal Advisor for Research on Innovation at EUN based in Brussels.

In addition to the desk research (see References section), the study group undertook a study visit to Portugal from 11 to 18 October 2023 to interview several stakeholders involved in the implementation of the Transition Plan and to visit some schools to get their feedback on their experiences with the Plan. In total, about 25 interviews and about ten focus groups took place.

Through preparatory online meetings with DGE, the study group identified stakeholder groups that they would like to interview in person during the study visit to Portugal. The study group also provided the DGE with criteria to ensure a diversity of contexts in the four schools to be visited (mainly urban/suburban/rural; school/cluster size; socio-economic background).

In each school, the study group met with school leaders, teachers, teacher trainers from the CFAEs, Digital Ambassadors associated with the schools and directors of ICT Competence Centres. In each case, a focus group with students was organised.

The programme of the study visit to Portugal is summarised below.

| | |
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| **Wednesday** <br> 11th October | 07:30: Study Group transfer from Lisbon to Santarem <br><br> 09:00 - 18:00 - **Digital Transition Conference** in Santarem (CNEMA). <br><br> Fifteen 30-minute interviews with conference participants from all parts of Portugal, mostly Digital Ambassadors, Directors of ICT Competence Centres and teacher trainers. |
| **Thursday** <br> 12th October | 9:00 – 10:00 – **Interview** at the ministry/DGE in Lisbon with the **Director General for education**, **Pedro Cunha**. <br><br> 10:00 - 12:00 - **Interviews and focus group** at the ministry/DGE in Lisbon with Digital Ambassadors and Directors of Teacher Training Centres (ANTÓNIO SÉRGIO; BARREIRO E MOITA; CENFORMA, Montijo). <br><br> 13:00 – 18:00 - **Visit to school "AE de Carcavelos"** (Lisbon area). Interviews and Focus Groups with school leaders, teacher trainers, teachers, Digital Ambassador, School Digital Development Team. Focus Group with students. |
| **Friday** <br> 13th October | 09:30 – 10:45 - **Interviews/Focus Groups** at the ministry/DGE in Lisbon on **Digital Teacher Empowerment** with Digital Transition Team at DGE, teacher trainers and training modules authors. <br><br> 10:45 – 11:45 - **Interview** at the ministry/DGE in Lisbon with the **Minister of education**, **João Costa**. <br><br> 11:45 – 13:00 - **Interviews/Focus Groups** at the ministry/DGE in Lisbon on **Digital Textbooks Pilot Project** with Digital Textbooks Pilot Project Team at DGE, school cluster directors, and Digital Textbooks Pilot Project school coordinator. <br><br> 13:00 – 14:30 – **Pavilion of Knowledge, Science Centre** (Lisbon). <br><br> 14:30 -16:30 - **Interviews** at the ministry/DGE in Lisbon : on **interoperability and sustainability of publishers' platforms** – Porto Editora publisher. |

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| **Saturday**<br><br>14th October | 07:30: Study Group transfer from Lisbon to Setubal<br><br>08:30 – 12:30 - **Visit to school "AE Luísa Todi"** in Setubal. **Focus Group** with school cluster director, Teacher Training Centre director, CFAE ORDEM DE SANTIGO, Digital Ambassador, School Digital Development Team, Digital Textbooks Pilot Project, and ICT Competence Centre. |
| **Monday**<br><br>16th October | 07:30: Study Group transfer from Lisbon to Salvaterra de Magos<br><br>09:30 – 14:30 - **Visit to School "AE da Salvaterra de Magos"** in Salvaterra de Magos. Interviews and Focus Groups with school leaders, teacher trainers, teachers, Digital Ambassador, School Digital Development Team and ICT Competence Centre. Focus Group with students.<br><br>16:00 – 17:30 - **Interviews** at the ministry/DGE in Lisbon on digital content and services with the Digital Educational Resources (DER) Team at DGE, publishers and digital educational resources enterprise.<br><br>17:30 – 18:30 - **Interview** at the ministry/DGE in Lisbon with **Patricia Avila**, **Professor at the University of Lisbon.** |
| **Tuesday**<br><br>17th October | *07:30: Study Group transfer from Lisbon to Quinta da Conde/Sesimbra*<br><br>10:00 – 14:30 - **Visit to School "AE da Boa Água"** in Quinta do Conde – Sesimbra. Interviews and Focus Groups with the school leader, teacher trainers, teachers, Digital Ambassador, School Digital Development Team and ICT Competence Centre. Focus Group with students.<br><br>16:00 – 18:00 - **Interviews** at the ministry/DGE in Lisbon with representatives of **Ministry of Education entities, i.e.** DGEstE, DGEEC, IGEC, IGeFE, SGEC, ANQEP, and the General Director of Education.<br><br>Discussion continued online on 27/10/2023 with **Helena Fonseca** and Maria Leonor Duarte from **IGEC** (inspection).<br><br>18:00 – 19:00 – **Interview** at the ministry/DGE in Lisbon with **Professor João Filipe Matos**, University of Lisbon. |
| **Wednesday**<br><br>18th October | 9:00 – 11:30 – **Debriefing meeting** at the Ministry/DGE in Lisbon with **Maria João Horta, Deputy Director of the DGE**, and DGE colleagues involved in the preparation and organisation of the visit, i.e. **Carla Lourenço, Paula Martins, Ioana Moreira and Fernando Franco.**<br><br>12:00: Study Group leaves to the airport. |

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