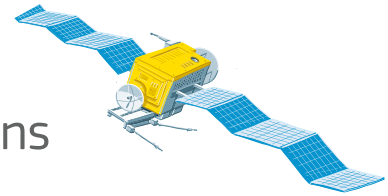
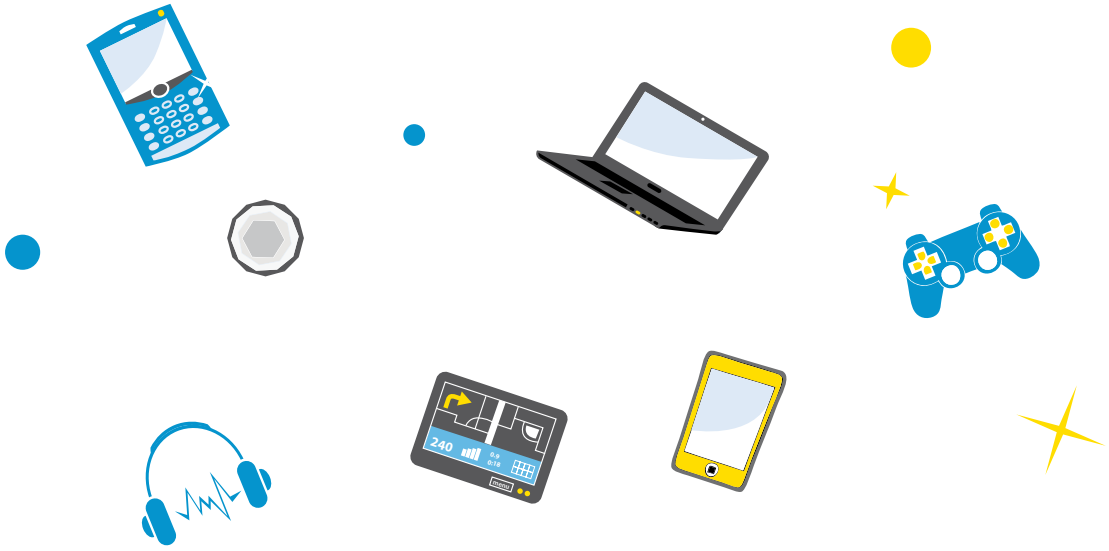
Formal and Non-formal Educational Programmes on Digital Skills and Competences



Best Practices and Recommendations



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1. Introduction

In order to cope with the shortage of digital skills and competences affecting the European social and economic context, a wide variety of initiatives involving public as well as private sector actors have been developed and implemented. These initiatives have already achieved considerable results in training and educating pupils, students, young people and adults in ICT.

The aim of this publication, developed within the context of the Secretariat of the Grand Coalition for Digital Jobs, is to present a summary of the best practices among formal and non-formal educational programmes in Europe with the purpose of identifying recommendations for replicating or upscaling these initiatives on a local, regional or national level.

It is intended to serve as a guiding and inspiration document to stakeholders willing to develop and roll out their own educational programmes.

The work, the results of which are presented in this document, started from a reflection on training for digital jobs as the process of acquiring the right skills and competences for being able to successfully take up a profession in the ICT sector as well as more broadly in a digital economy.

These competences go under the umbrella denomination of e-skills, which encompass a broad set of skills necessary in the modern workplace. These skills are closely related to the professional context they refer to and are very rapidly changing due to the advancement and the development of ICT itself. The lack of an univocal and fixed definition of which are the skills needed by the labour market does not allow the education sector, normally responsible to equip young people with the needed knowhow, to provide the necessary training alone.

The process of acquiring the necessary skills does not entail exclusively the formal education sector, but also other learning contexts and providers. E-skills can be therefore acquired in a variety of settings:

- Formal education institutions, K12 or tertiary
- Non-formal education contexts, family, clubs, private courses
- On the job or during job placement experiences

And be provided by a variety of actors:

- Schools, universities, VET institutions
- NGOs, think tanks, associations
- Private companies, or the employers, who have a twofold interest in training people on the use of their technological solution as well as training talented professionals for fulfilling their human resources needs

For capturing a representation of this offer of training and educational programmes we have therefore decided to consider initiatives provided by these three categories of actors and in these three different settings.

The work of the Secretariat of the Grand Coalition for Digital Jobs has been focused on advocating for additional support to the delivery of high quality and tailored training opportunities, which include educational programmes rolled out by both formal and non-formal education actors, on the job training opportunities and internships, programmes to upskill ICT practitioners and initiatives aimed to match the competences and skills provided to learners with the ones requested and needed by the employers.

In this context, we hereby focus on successful education and industry initiatives to promote / educate on digital skills for jobs, including internships, and addressed to young people in education or already searching for a job.

Key examples of best practices are further explored, common or unique features crucial for their success highlighted. Policy recommendations have been also drafted for education decision makers to integrate such programmes into national approaches, while practical suggestions have been set out for business to improve their cooperation with public sector (Ministries, education and training bodies).

Recommendations are identified both at the level of practical application (regarding implementation, approaches to collaboration, etc.) but also at a policy level in order to ensure that the right conditions are available for introducing these initiatives to a larger audience.

The identified best practices and the drafted recommendations are expected to support National and Local Coalitions, as well as other private or public actors, to design and implement their solution to the skills mismatch addressed. The readers of this document are also be encouraged, in case they do not have an interest in setting up their own initiatives, to consider joining and supporting one of the existing programmes.

2. Executive Summary

It is our intention to present a summary of the best practices on formal and non-formal educational programmes in Europe with the purpose of identifying recommendations for replicating or upscaling these initiatives at a local, regional or national level.

The target audience of this document are therefore stakeholders with an interest in providing training opportunities in the field of ICT, which can include National and Local Coalitions coordinators and members, policy makers in the field of education or employment, industry experiencing a shortage of ICT skilled professionals, professional development providers and institutes.

This mapping and selection activity is a means of ensuring that successful initiatives and programmes are not left unnoticed and are brought to the attention of the relevant actors in order to contribute to fostering local, regional and national cooperation in the area of digital competences.

A number of the identified programmes demonstrate some common features, others represent a unique combination of activities and partner cooperation. The aim of this publication is to identify those unique features but also to highlight the common practices which achieve good results and which could be introduced on a larger scale.

The data has been collected through both consultations with relevant stakeholders and desk research. Significant contribution was identified among available resources from the Ingenious project, via an online tool gathering school-industry cooperation practices, eTwinning, the network of European teachers and schools, Scientix, the aggregator of projects related to science and technology education and I-LINC, an initiative on digital competences and inclusions. Additionally, programmes organised in the framework of the Grand Coalition relevant pledges have also been included, as well as available resources from the eSkills for Jobs campaign resources database.

The collection of best practices, case studies and recommendations would like to guide the reader through a definition of what could represent a successful educational programme to be upscaled or developed from the start. This is reflected by adopting the following structure.

The first part of the collection, Chapter 4, underpins case studies of initiatives which have proven successful and which demonstrate respectively examples of programmes on: innovative teaching and learning; raising awareness on the importance of ICT skills and attractiveness of digital jobs, skills matching and on the job experiences, transversal approach to teaching and learning digital competences.

The second part, Chapter 5, is dedicated to recommendations and suggestions to be kept into consideration while planning to set up or upscale initiatives aimed at training for digital jobs. Recommendations are identified both on the level of practical application (regarding implementation, approaches to collaboration, etc.) but also on a policy level in order to ensure that the right conditions are available for introducing these initiatives to a larger audience.

The third part, chapter 6, has finally been designed as an actual catalogue of best practice initiatives which have been summarised in a way so as to serve as a reference for interested stakeholders who would like to take on some of the initiatives and contribute to upscaling them.

3. Definitions

Educational programme is a term which could be used in a narrow or broader sense. As the aim of this document is to present an extensive list of practices with different approaches and focuses we have adopted the use of educational programmes in the sense of partnerships, initiatives, courses, clubs who develop pupils or young people's ICT digital skills and aim to raise awareness about jobs in the ICT sector, and make them more appealing to young people.

It is also important to stress the fact that this exercise included the mapping of initiatives active on the formal as well as non-formal education contexts, since we believe that the acquisition of e-skills, which are by definition closely interconnected with real and professional settings, can better happen in multiple domains.

Formal education is learning that takes place in an institutional environment (schools, university) and is guided by a specifically designed curriculum.

Under **non formal education** we hereby consider learning activities which take place outside of the official educational institutions (schools, university, etc.). It is a voluntarily learning which may be moderated by professional learning facilitators (trainers) or by volunteers. Courses and learning activities are more flexible and often lack the strict structure of official curriculum.

Best practices is understood as programmes which have proven successful in increasing computer science and digital literacy of students in K12 education and young people, which are well known and which have managed to increase their scope i.e. reaching out to many students. The synthesis report will also highlight examples of successful collaboration between government and industry partners.

4. Case Studies of Educational Programmes

4.1 Innovative teaching and learning programmes

Computer science education, which encompasses the main e-skills taught at formal education level, is extremely unevenly represented in the national curricula of different countries. There are different approaches to teaching and training computer science. Some curricula focus more on the theoretical foundation of the subject, other devote more teaching hours to the practical application of computer science skills. Currently, we also observe a proliferation of non-formal or after schools programmes which present more innovative ways for teaching and learning computer sciences. Innovation in teaching computer sciences might contribute to engaging more students and raising their interest into continuing further their education in the subject.

4.1.1 Case study: ProgeTiger Programme

Name of initiative/programme:	ProgeTiger Programme
Organisation:	HITSA IT Education Development Centre
Partners:	HITSA IT Education Development Centre, Estonian Ministry of Education and Research, universities, private sector and third sector institutions.
Date of introducing:	The programme was launched in 2012.
Scope of initiative/programme:	Estonia
Initiative/programme's main activity:	The Programme is aimed at preschool, primary and vocational education in effort to integrate technology education into curriculum, offering teachers educational resources and training opportunities, financially supporting kindergartens and schools in acquiring different programmable devices. The aims of ProgeTiger are to: develop students' logical thinking, creativity, mathematical skills etc.; demonstrate that programming can be interesting and done by anyone; teach the basics of programming through practical activity; and teach students to use different age-appropriate programming languages.
Website:	*http://hitsa.ee/it-education/educational-programmes/progetiger*

The initiative in detail:

The ProgeTiger programme is carried out by the HITSA IT Education Development Centre. The Information Technology Foundation for Education (HITSA) is a prominent actor in Estonian education field which receives support and cooperates with a wide variety of organisations and institutions with the ultimate aim of enhancing ICT education in Estonia. All programmes and projects delivered by HITSA try to facilitate the integration of digital tools in the teaching and learning practices of Estonian schools and other education institutions.

The ProgeTiger programme was started and is funded by the Estonian Ministry of Education and Research. Universities, the private sector and institutions of the third sector are involved in the development of training and methodological materials as well as in information sharing and awareness activities. ProgeTiger may serve as a good example of cooperation between different stakeholders which are united by the same goal of increasing the level of digital literacy of students and young people in Estonia, starting form an early school age.

The teaching and learning activities in the framework of the ProgeTiger Programme are based on a flexibility of the learning environments. Teaching may take place both in classes and in after- school clubs. It targets students from 1 to 12 grade.

The main goal of the ProgeTiger programme is to enhance learners' technological literacy and digital competences. ProgeTiger focuses on teaching programming, web applications and website creation. The teaching activities vary according to the age group of students and the level of their digital literacy.

At the elementary level graphic programming languages (LOGO, KODU Game Lab and Scratch) are used. Robots are also integrated in the teaching activities because they are seen as a nice tool for demonstrating the immediate output of the programming tasks. For students in middle and high school the teaching activities include the creation of websites and web applications. All activities are delivered in an engaging way with a variety of technological solutions.

In addition to programming skills of children and young people, the ProgeTiger Programme has contributed to developing problem-solving skills and fostering creativity through the use of technological tools.

The programme also acknowledges the importance of teachers' competences which is why the programme supports teachers in enhancing their technological literacy by introducing them to a wide variety of tools and resources they could take advantage of and introduce into their teaching practices. As a step further, the programme also fosters networking and information sharing between teachers.

4.1.2 Case study: Programma il Futuro (Program the Future)

Name of initiative/programme:	Programma il Futuro – Program the Future
Organisation:	Ministry of Education – Italy, National Inter-University Consortium for Information Technology (CINI)
Partners:	Framework agreement with Confidustra Digitale, IAB Italia
Date of introducing:	The programme was introduced in 2014.
Scope of initiative/programme:	Italy
Initiative/programme's main activity:	Programma il Futuro is an initiative which aims to provide a set of simple and engaging tools in the form of a series of interactive lessons, for teaching and learning the basic concepts of computer science. The initiative grants free access to the materials for teachers and students, but also all people interested in the topic. The materials could be used by teachers in any subject and by all type of schools.
Website:	*http://www.programmailfuturo.it/progetto/descrizione-del-progetto*

The initiative in detail:

Programma il Futuro is an excellent example of a multi-stakeholder cooperation. The initiative has managed to attract the support of prominent actors in the digital sector, setting the conditions for a long-lasting government-industry cooperation. There are several types of stakeholders involved. Patrons of the initiative are Il Futuro Firmato Telecom Italia, TIM. There are several benefactors and donors, namely ENGINEERING, Microsoft, DEAR Scuola, Intel, Oracle and Samsung. In addition to that, Associazione Nazionale Docenti di Informatica (ANDINF), Facebook, Fondazione IBM Italia, IBM, SEEWEB have pledged their support to the programme.

All listed organisations and entities provide financial support or share educational resources, materials, technological solutions, united by the aim of achieving a cultural growth and development of Italian society.

It has been recognised by the stakeholders behind this initiative that students and young people need to be prepared for the digital society we live in by possessing the adequate digital literacy which would then enable a smooth integration into the new cultural context and the highly competitive labour market.

Teaching and learning programming develops a set of skills which have been recognised as a necessary prerequisite in order to be able to compete in the digital jobs sector. Computational thinking and an enhanced problem-solving capacity are part of this skills' set which programming helps to develop. That is why the goal of Programma il Futuro is to introduce programming in schools through the use of user-friendly tools.

The stated goal is to be achieved by making available a series of interactive lessons and teaching materials adapted to the Italian educational context. The materials available are divided into two teaching and learning paths - basic and advanced, and every school can access them through the programme's website and use them freely.

It has to be noted that the programme was designed and initiated by the Italian Ministry of Education, who has engaged several industry and civil society actors in order to mobilise in short time a considerable amount of resources and act quickly to address the demand for educational resources and activities on coding.

4.2 Raising awareness for ICT skills and jobs

Career guidance and raising awareness for digital jobs at school age is an important factor for the timely integration of young people into the labour market. Career counselling should be integrated into the education practices so that education content reflects students' needs in terms of skills meeting the requirements of the jobs they wish to pursue.

Career guidance does not necessarily mean giving advice to students about a particular job or what could be the best fit for a particular student. It can also entail presenting the broad prospect of opportunities so that students would be able to make an informed decision based on their skills' sets and wishes.

The fact that fewer students embark on a career path in the digital sector does not mean that digital jobs are not attractive, it could also simply mean that students are not aware of what exactly these jobs entail. Practice shows that sometimes students have a biased idea about digital jobs as to being difficult and simply not fulfilling.

That is why it is important to raise awareness about ICT careers and the competences associated with them at a school age.

4.2.1 Case study: Bring it on (Northern Ireland) / Big Ambition (England, Scotland and Wales)

Name of initiative/programme:	Bring IT on / BigAmbition
Organisation:	The Tech Partnership
Partners:	Tech Partnership, Dep. For Employment and Learning, Momentum, Invest Northern Ireland, etc.
Date of introducing:	2008
Scope of initiative/programme:	United Kingdom
Initiative/programme's main activity:	Provides information on digital career opportunities by giving access to role model videos, companies' profiles, news and articles on career trends, competitions, games, quizzes. The ultimate idea of the initiatives is to inspire young people into digital careers.
Website:	*http://bringitonni.info/* *http://www.bigambition.co.uk/*

The initiative in detail:

Bring IT on and Big Ambition are initiatives coordinated by the Tech Partnership. They share the same aim and similar structure. They provide information on digital career opportunities by giving access to role model videos, companies' profiles, news and articles on career trends, competitions, games, and quizzes with the aim of attracting more young people to embark on the digital careers' path.

One particular feature of this case study is the fact that the two initiatives presented above target specific parts of United Kingdom. They follow the same approach but are, at the same time, aligned to the regional

specifics (type and number of jobs available) and needs. The structure of the platforms is more or less the same but the content varies according to the region.

The platforms target students but also teachers, parents and employers. They are divided in different sections covering specific topics and focus areas. There is a dedicated section to girls in technology and an information portal on IT apprenticeships in the area.

A section on job types is present on both websites. There is a list of job profiles and a subsection for each of them starting with an explanation on the job profile and what tasks it entails, what skills are required for delivering good results if in the position, profiles of professionals (in the format of videos) who are working in the same positions.

The platforms provide useful tips and advice on various topics. Each piece of information on the platform covers some aspects of the digital career cycle - choosing and matching, information about the job profile, required skills and training, company profile. The web pages are interactive, user friendly and have customization options.

There are also interactive tools such as the Dream Job Reloaded quiz (BigAmbition) or the Progression Routes (Bring IT On) tool which help young people explore future career opportunities.

4.2.2 Case study: GetBusy.gr

Name of initiative/programme:	GetBusy.gr
Organisation:	Greek Network of Professional Informatics (HePIS)
Partners:	Getbusy.gr The program is part of the International Initiative Microsoft YouthSpark and is a collaborative effort carried out through the cooperation of the Greek Network of Professional Informatics (IePIS) with: Microsoft Hellas, PEOPLECERT, ALBA, DEREE, Intelen, Close The Loop, HR Passport, Flya Consulting, ISON Psychometrica, ManpowerGroup and Look4Studies.
Date of introducing:	The initiative was launched in 2013.
Scope of initiative/programme:	Greece
Initiative/programme's main activity:	Getbusy.gr is a web portal containing comprehensive information and educational material that can be used by young people in Greece in order to empower their skills in accordance with today's modern and very challenging economic environment.
Website:	*http://getbusy.gr/Pages/View/2/description*

The initiative in detail:

Getbusy.gr is a Greek initiative instituted by companies, educational and training institutions, Startups and HR agencies, aiming to motivate young people to improve their e-skills and employability, increase their entrepreneurial expertise and learn about new technologies.

Getbusy.gr, has educational and informational material, divided into four sections. All the resources in the different categories are presented in a downloadable pdf format.

The first section covers ICT Skills which are based on the official courseware of ECDL Core. The resources and materials are divided in topics, including the basic skills of word processing, spreadsheets, presentation and databases. In addition to that, there is also material for image editing, web editing, IT security and ICT project planning.

The second category is Personal & Professional Development. It provides tips and advice on the different steps of the job search process (for example CV and cover letter, job search, job interviews' preparation, networking and self-branding, working abroad, etc).

The third category focuses on entrepreneurship and tries to enhance young people's knowledge about innovation models, business plan authorship, creation and the lifecycle of a start-up. It also provides various case studies.

The final category is New Technologies and Sustainability which includes basic concepts of green entrepreneurship, Carbon Emissions, Green ICT, ECO labels for ICT.

A unique component of the platform is the educational quiz which young people can take online. The quiz questions are derived from the educational and informational material available at the portal and serve as a tool to apply the knowledge and skills developed through the use of educational materials.

An additional feature of the Getbusy portal is the section which provides up-to-date information on activities, events, jobs offerings, internship opportunities, interesting articles and study opportunities.

The Getbusy portal demonstrates a comprehensive approach to helping young people develop digital literacy and enhancing their adaptability to the challenges of the social and economic developments in Europe.

4.3 Matching skills to digital jobs and practical experience for students and young graduates

The mismatch between skills acquired in education and those needed in the labour market has been recognised as a major problem which inevitably leads to a widening digital skills gap. There is a significant number of jobs in the ICT field which are vacant because of the lack of candidates with the relevant skills. That is also the main reason behind the establishing of the Grand Coalition for Digital Jobs. Education and

training have a crucial role to play, but it is important that they are more aligned to the labour needs and employers expectations. Synergy needs to be achieved.

Furthermore, practical training opportunities such as internships may serve as an important prerequisite for entering the market of ICT jobs. Internships are a chance for young people to experience the practical application of acquired skills in a work environment. In addition to that, practical training may contribute to acquiring even more skills which are not embedded in the formal educational programmes.

An internship programme may grant the unique opportunity of acquiring more information on the type of work environment, type of work tasks and the level of skills associated with these tasks. As a consequence, internships could also raise the profile of the ICT jobs among young graduates and make them more appealing to young people who are finding their way into the labour system.

Hence, initiatives which combine training and matching of training content to digital jobs require special attention and are a good example of activities which could be up-scaled in order to reach a wider audience of young people.

4.3.1 Case study: Academy Cube

Name of initiative/programme:	Academy Cube
Organisation:	Academy Cube gGmbH (global non-profit company), Berlin, Germany.
Partners:	The Academy Cube initiative combines the enterprise network and experience of global companies, research institutions and universities
Date of introducing:	The initiative was introduced in 2013.
Scope of initiative/programme:	International
Initiative/programme's main activity:	At the heart of the Academy Cube initiative is a cloud-based internet platform that companies and institutions can use to provide e-learning courses and post job offerings.
Website:	*http://www.academy-cube.com/*

The initiative in detail:

The Academy Cube initiative was introduced in 2013 at CeBIT by Neelie Kroes, former European Commissioner for the Digital Agenda, and Jim Snabe, former Co-CEO of SAP SE. Academy Cube is among the first initiatives to pledge their support to the Grand Coalition for Digital Jobs.

The initiative has gained popularity both among companies and also young graduates which are looking for job opportunities. It is one of the few platforms which serves as a bridge between job seekers and employers.

SAP supports the program by providing e-learning content modules and course curricula for relevant SAP solutions, including the new SAP HANA e-academy.

Academy Cube has several characteristics which in combination form a unique package of activities aimed at helping young people acquire the skills they need in order to obtain a position in the digital jobs sector.

On the one hand, it serves as an online e-learning platform targeted to enrich STEM (science, technology, engineering and math) graduates' skill-sets with relevant ICT competences. On the other hand, it has been also developed as a job portal where companies could post job vacancies.

The third feature of Academy Cube presents a unique component which complements the other two and positions Academy Cube among the few platforms which present a comprehensive solution to the problem of digitals skills gap in Europe. Academy Cube uses a matching system called USP which proposes courses based on a job-seekers' self-assessment.

The courses proposed as a result of the matching system have a focus on developing those skills that would meet the criteria of the desired job profile. Courses curriculum is aligned with the needs and expectations of the employers which the platform connects. Thus ensuring companies that the graduates which apply have the relevant skills and competences. As a result, the matchmaking process facilitates the recruiting process of graduates who are using the platform.

The e-learning platform has content in English and German, but it is constantly evolving. Some of the courses provided are free and others require an enrolment fee.

Furthermore, Academy Cube tries to engage more young people by sharing interesting and inspiring articles, organising Career Days, Live Q&A sessions with experienced professionals. The Academy Cube is also a stakeholder of the eSkills for Jobs campaign.

4.3.2 Case study: Talentum Startups

Name of initiative/programme:	Talentum Startups
Organisation:	Telefónica
Partners:	Telefonica, Ericsson, Qualcomm, Mediatek, Fundación Adecco, SEPI Foundation, Bizkaia Talent, Fundación Carolina, Fundación Barrié, Top Seeds Lab, Eleven Paths, Movistar.
Date of introducing:	The initiative was introduced in 2012
Scope of initiative/programme:	Spain
Initiative/programme's main activity:	Telefónica Talentum Startups is a scholarship programme which attracts young talented students and gives them the opportunity to gain practical experience (through internships) of working in a start-up or partner companies in the digital sector.
Website:	*http://www.talentumstartups.com/*

The initiative in detail:

Telefónica's programme is aimed at university students studying technological courses, recent graduates or young people with entrepreneurial ideas and interest in technology, based in Spain, who wish to experience working in a highly innovative professional environment. Talentum Startups has two initiatives.

Talentum Startups Short Track, aimed at "techies", who receive support through mentoring, financial assistance, hardware, training, etc., with the aim of developing their first technological project.

Talentum Startups Long Track offers grants for students to spend six months part-time in one of the Startups in partner accelerator from the Telefonica partner network.

One of the internship opportunities offered by Talentum Startups is a six-month internship in the IMDEA Networks Institute. They have the opportunity to get practical training and at the same time perform tasks to support advanced research projects in the field of ICT.

Talentum Startups is an open innovation programme that seeks to establish synergies between three pillars: young talent, technology and entrepreneurship. It helps young people develop their projects and at the same time it contributes to the development of an entrepreneurial mind-set. A fact which supports this statement is Telefónica's testimonials according to which 75% of the young people who participate in the programme start working after the programme and 20% of them decide to create their own Startups.

4.4 Transversal approach to equipping young people with digital skills

It has to be recognised that it is difficult to make clear distinctions and categorisations of programmes with regard to educating young people and developing their digital skill set. All educational activities are interlinked and interdependent. Delivering innovative trainings to students is also accompanied in one way or another by raising student's awareness about ICT jobs and the related skills. In addition to that, a crucial component of the

process of matching skills to jobs is the training element. Career guidance campaigns and other activities aimed to raise awareness may also include workshops and short-term training activities. Career choice facilitation integrates a matching process by giving information to students about the useful skills and competences they need to develop in order to fulfil a certain job profile.

While the examples discussed in the previous sections may deliver many of the mentioned activities to a certain extent, they focus primarily on one type of activities.

That is why the last section of case studies in this report is dedicated to programmes which have a stronger focus on several activities among the following: delivering innovative training, raising awareness, matching skills to jobs, sharing resources, preparing teaching materials, exchanging best practices, etc. This last group of case studies shares a more transversal approach of delivering a wider range of programme activities from the engagement of pupils and students, via awareness raising programmes, to the matching of their skill-set with the right job-profile, passing through the delivery of training on digital competences in formal and non-formal education settings.

4.4.1 Case study: Pasc@line Association

Name of initiative/ programme:	Pasc@line
Organisation:	Pasc@line Association
Partners:	85 higher education institutions and over 1,700 companies plus two sector specific trade unions (Syntec Numérique and CICF Informatique)
Date of introducing:	The association was established in 2006.
Scope of initiative/ programme:	France
Initiative/programme's main activity:	It is a multi- stakeholder partnership with the goal to promote dialogue between academia and the ICT business sector in France. Most objectives of the association seek to promote the attractiveness of ICT jobs amongst the youth in order to raise numbers of ICT graduates, help develop high standards for ICT in secondary and higher education and promote ICT as a growth driver for the national economy.
Website:	*http://www.assopascaline.fr/650_p_40631/commissions-pasc-line.html*

The initiative in detail:

A specific feature of Pasc@line is the fact that it represents a wide network of companies working in or associated with the digital jobs sector. As a consequence, the activities and programmes that the association promotes are very closely linked to employers' needs and requirements. Thus, contributing to enhancing the process of matching young people's skills to the jobs available. Young people get a clear idea of what is expected from them and which of their competences they should develop further.

One of the main aims of the association is to promote the development of digital literacy among young people through concrete actions. One of the measures is a series of videos presenting different professions. Another important step was the introduction of ICT as an A-levels school subject in 2012 in high schools, with Pasc@line's support.

In addition to that the association engages in actions aimed at establishing cooperation and lost lasting relationship between industry and educational and training institutions. The strong network established through Pasc@line tries to build upon the specific activities of awareness raising, career guidance, training and matching and as a consequence to produce recommendations for the enterprises and the digital sector training institutions ensuring that ICT education and job matching are always close to the industry's needs.

Pasc@line has been recognised as a strong network of industry stakeholders and educational institutions. Unfortunately, due to the fact that the Pasc@line activities are funded only by the industry partners and have not received any government budget allocations, cooperation with government institutions has been limited. This is, however, one area which could be further explored, in order to achieve a successful policy dialogue which could enhance the scope and results of Pasc@line Association's work.

4.4.2 Case study: Jet- Net – Youth and Technology Network Netherlands

Name of initiative/ programme:	Jet- Net – Youth and Technology Network Netherlands
Organisation:	Jet- Net – Youth and Technology Network Netherlands
Partners:	The network consists of 91 national and international companies, representatives of government ministries, trade organisations, the national Science and Technology Platform and 175 HAVO / VWO schools.
Date of introducing:	The network was established in 2002
Scope of initiative/programme:	Netherlands
Initiative/programme's main activity:	Jet-Net companies organise a wide variety of programmes for students attending higher-general secondary (havo) and pre-university (vwo) education schools. They include special lectures, classroom projects, helping students choose subject combinations, offering career-orientation information sessions, giving tours of their facilities and coaching students during projects connected with subject combinations.
Website:	*http://www.jet-net.nl/home.html*

The initiative in detail:

The network has been selected as a case study in this report as it demonstrates a successful long lasting multi-stakeholder cooperation which is also growing in popularity and scope and offers many initiatives which could be replicated or upscaled on a regional or international level. The network could serve as an example of a successful application of a transversal approach to equipping young people with skills they needed in order to be competitive on the labour market.

The initiatives developed in the framework of Jet- Net are numerous. All programmes and initiatives are designed by companies in close cooperation with schools in order to fit the educational activities and students' curriculum in a meaningful way.

The activities delivered by the members of the network include special lectures, classroom projects, helping students choose subject combinations, offering career-orientation information sessions, giving tours of their facilities and coaching students during projects connected with subject combinations. All activities complement each other with the goal of encouraging students to engage in STEM related study activities and spark their interest in pursuing a job in the STEM fields.

In addition to specific programmes between individual companies and schools, Jet-Net also develops general programmes which are focused on career guidance and helping students make informed choices in respect of their future studies and careers. An example for such programme is the annual Jet-Net Career Day which offers students the opportunity to discuss their future prospects with young engineers and research staff in a wide variety of disciplines.

The Jet-Net network has demonstrated through its activities that they recognise the importance of teachers and parents in the process of developing students' skills sets. That is why many initiatives in the framework of the network focus also on developing teachers' competences and encouraging parents' involvement.

Information materials are regularly produced and disseminated within the teacher's community and parents. Workshops for teachers are delivered. Furthermore, a teacher work experience programme has been introduced. Teachers are given the opportunity to acquire practical experience within a company's activities which then influences their teaching practices. During the programme teachers have the opportunity to reflect on how companies could contribute to delivering curriculum related activities.

Jet- Net is an excellent example of a programme which has a strong network cooperation at its basis. The fact that since its launch in 2002 the initiative has grown in number and scope makes Jet-Net an excellent case study which offers successful practices of school- industry cooperation. The initiative could provide useful tips for maintaining such a wide network and ensuring that all cooperation activities are uninterrupted.

The strength of the network and the success of its activities is ensured by the functioning of a 'buddy system' where companies with more experience of working within the network share tips and best practices regarding schools- industry cooperation with the newly involved companies. This prevents the new companies from making the same mistakes and adopting approaches to cooperation which are not so successful.

Another interesting feature of the network is the clustering of small organisations in regional activities and cooperation where they share resources and know-how and make sure that the activities that are delivered have a stronger impact. This facilitates the establishment of a stronger network and more focused activities in which regional specifics have been taken into consideration.

The coordination and communication within the network is based on a network of coordinators. Each company has an appointed company coordinator or project manager who is aware of all the Jet- Net projects and activates that the company delivers or participates in.

There is one body that provides coordination at a central (national) level- Jet-Net's national coordination desk. Schools or teachers could at any moment reach out to this body and be provided with all the information they need.

5. Conclusions and Recommendations

In this report we have considered a variety of initiatives and educational programmes established with the aim of addressing the digital skills gap and equipping young people with competences, critical for their success and thriving in a digital economy. The initiatives we have selected and described in this document are considered best practices since they proved to be innovative, sustainable and impactful, and they also show some common elements which contributed to their success.

One of the main aspects we want to focus on is the importance of the establishment of multi-stakeholder partnerships, joint ventures who see the participation of government agencies, industry and civil society organisations and which are driven by the concept that the private sector can complement and support the services traditionally provided by the public sector.

As the main aim of this document is to inspire and guide stakeholders to replicate or scale up such initiatives, we thought it would be appropriate to provide some suggestions and recommendations to be taken into account while considering and planning to undertake an educational programme in the field of digital skills and competences.

Operational recommendations can be addressed to the main actors involved in the development of educational programmes, especially when they consider the establishment of multi-stakeholder partnerships, i.e. representatives from industry and the civil society, on the one hand, and teachers and other professionals from the education field, on the other. Having in mind that these are usually the main persons directly involved in the design and roll out of government-industry partnerships, it is important that they take into account practical advice and suggestions, which help to achieve short-term objectives, with the aim of improving and facilitating the proper development and effectiveness of these initiatives.

On the other hand, **strategic recommendations**, focused on the achievement of long-term objectives, should also be established. In this respect, it is important to address policy makers at national and European level and establish action plans and promote broad approaches that can offer a proper environment to reach the goal of increasing the number of digitally skilled young people.

In between of these two levels of measures, it is also necessary to establish **tactical recommendations**, which are focused on short and medium-term objectives. These are mainly addressed to policy makers at national, regional, and local levels, as well as to facilitators or organisations which can coordinate government-industry educational programmes (e.g. National and Local Coalitions, employers' organisations, universities, research centres, etc.).

The importance of particularly acting at regional and local levels is crucial to effectively reach the main stakeholders involved in multi-stakeholders partnerships and to align the national strategic objectives with the (mainly local) operational actions.

The following recommendations were discussed in a workshop that took place in Zurich during the annual conference organised by EUN, in November 2014 and that gathered important stakeholders at European level (policy makers, representatives from multinational businesses, education experts).

5.1 Operational recommendations

Avoid duplication of initiatives and programmes
Before developing a new educational programme it is advisable to verify whether in the country or area of scope there are already initiatives addressing the same topic or matter. While a reasonable competition among educational programmes may be stimulating for the actors involved, in presence of a multiplication of initiatives the limited resources private and public bodies can allocate would inevitably be dispersed.

Liaise with other initiatives and actors in the area in order to benefit from their knowledge and experience.
This could mean liaising with actors and programmes in the same geographical area (region) or the same thematic area. They could bring useful know-how reflecting the regional specifics and could point to useful channels of cooperation and communication.

Make openly available initiative outputs and results
Making available guideline documents, evaluation tools, and databases with practices, policies and role models –when possible in open license format- it is crucial to effectively disseminate the initiative result and allow third organisations to build on the work done so far.

Encourage/Invite volunteer participation
Engaging people with strong motivation and high interest in the activities could be a driver for innovation in delivering educational activities and disseminating results and best practices. CoderDojo, Stemettes, Google SC First, Code Club are examples of programmes which demonstrate a very well integrated volunteer participation.

Include in the programme specific actions aimed to achieve gender balance in the field of ICT
Despite efforts to achieve a more even representation of female professionals with advanced digital skills in the ICT, a gender balance is far from achieved. Numerous analyses have shown that females perform just as well as males in ICT jobs and in the STEM fields in general. Therefore, more efforts should be focused on introducing targeted educational activities with the aim of fostering girls' interest in ICT careers. Role-model activities could serve as a useful tools for boosting female's confidence in pursuing a job in ICT.

Integrate evaluation activities as part of the design of the educational programme
The integration of feedback and evaluation of delivered educational initiatives is a useful tool for ensuring that the needs of the target audience are met and there is a constant improvement of the quality of educational materials. A peer review process is particularly advisable for educational resources for educators.

5.2 Tactical recommendations

Engage multiple stakeholders (industry, government, educational institutions, and third sector).
Most of the initiatives presented as case studies demonstrate successful multi-stakeholder partnerships. The advantage of collaborating with partners from different background (government, industry, civil society, etc.) is that each partner could contribute with a different set of activities, knowledge and resources, coming from their field of work. Hence, educational programmes could reflect their contribution and be more comprehensive in delivering useful and meaningful activities. A Multi-stakeholder partnership should ideally aim to identify and engage all the most relevant actors in a specific field of expertise or sector to maximise the quality and impact of the design initiative.

Multi-stakeholder partnerships are also beneficial for overcoming the polarisation between the formal education institutions and the industry actors (employers) and for building a trusted cooperation ecosystem.

Support teachers'/educator's in further developing their competences.
Development of teachers'/educators' competences ensures that the teaching activities are innovative and engaging and new tools are integrated in the teaching process. As underpinned by the case studies (e.g ProgeTiger, Jet-Net, etc.) presented in this report many of the well-functioning programmes have also focused efforts at ensuring that the educators involved have the necessary competences.

Developing teachers' competences could have a positive impact on the process of integrating career counselling into the education practices so that education content reflects students' needs in aspects of useful skills meeting the requirements of the jobs they wish to pursue.

According to a recent *Eurydice report*, there are several areas for which teachers say they have moderate or high levels of needs for Continuing Professional Development (CPD) that are often not matched by participation. One of the areas identified by the teachers is student career guidance and counselling.

Integrate career counselling activities into education practices
Career counselling should be integrated into the education practices so that education content reflects students' needs in aspects of useful skills meeting the requirements of the jobs they wish to pursue.

That is why it is crucial to address this issue by aligning educational programmes to the requirements of the labour market. A significant contribution to solving this problem would be strengthening the government-industry cooperation. Considering the lack of digitally skilled young people, a synergy between educational activities and practices and employers' requirements ought to be achieved.

5.3 Strategic recommendations

Try to achieve broader political support to educational programmes
In order to support multi-stakeholder partnerships and their educational programmes it is important to gain a broad political recognition and endorsement which would ideally see the involvement of different Ministries and particularly the Ministry of Education, as well as Industry and Employment.

Foster the integration of formal and non-formal teaching and learning
Formal and non-formal teaching and learning should be more and more integrated in educational programmes. It is the responsibility of the formal education sector to provide young people with the skills and mind-set necessary to thrive in a digital society, but being the ICT constantly evolving, the possibility for the young people to acquire competences via after school clubs, online trainings and other opportunities is highly beneficial and allow the individual to follow a personalised and self-driven learning path.

Improving coordination within local, regional and national initiatives.
National programmes based on long terms strategies are more likely to be sustainable in the long term and achieve a strong impact in the audiences they target. However, the majority of the educational programmes analysed are focused on a specific skill set or ICT sector or operate according to a specific and tailored approach. That is why a top-down comprehensive programme might be difficult to implement. Federating such initiatives, and having more tailored communication channels may prove more useful in creating an ecosystem where local, regional and national initiatives benefit from the support of an umbrella entity which is more sensitive to their specific focus area or sector.

Contribute to the alignment of expectations of stakeholders and search for common goals
Alignment of stakeholders' expectations could only be achieved by facilitating an inclusive policy dialogue where stakeholders could share their position and generate progressive policy recommendations. Although stakeholders are often very diverse, common goals shared by all could be identified and ways of achieving these goals mapped. The need for a search of common goals is underpinned by the fact that the integration of ICT has been recognised as a transversal phenomenon which affects all societal actors-public institutions, third sector and all industry domains.

Focus on mind-set changing competences as coding and computing
Despite the debate on what skills and competences are the most useful and are most needed in the labour market is open and evolving, more and more initiatives are now focusing on equipping young people with the right mind set to navigate in a digital economy. The recent trend is to focus specifically on coding or computer programming in order to make pupils aware of what lies behind any automation and piece of technology, and several very successful initiatives have been organised around this skill. The popularity of this approach is also due to the fact that learning how to code proved to be successful for developing collateral skills, e.g. logical thinking, problem solving and creativity. Furthermore, via recently developed tools and online application, coding can be integrated in the teaching of several subject, allowing to link more explicitly ICT, and related competences, to a variety of subject and disciplines.

6. Collection of best practices

6.1 Innovative teaching and learning programmes

Initiative	Country	Target	Link	Short description
CoderDojo clubs	International	Young people 7- 17	*Link*	A Dojo is a local, independent, volunteer-led programming club which offers free coding lessons.
TechFuture Girls (Computer Club for Girls)	United Kingdom	High school girls	*Link*	The initiative helps girls develop their skills in IT through a series of carefully-graded challenges, themed around their interests – like fashion, music, sport and celebrity. It aims to boost their confidence and self-esteem.
Code Club	United Kingdom	Children aged 9-11	*Link*	Nationwide network of free volunteer-led after-school coding clubs for children. Coding clubs are organised at schools or at non-school venues such as libraries.
Devoxx 4 kids	International	Children aged 10-14	*Link*	Teaching children Computer Programming by introducing them to concepts of robotics, electronics and generally being creative with these kind of devices.
ProgeTiger	Estonia	Grades 1 to 12	*Link*	Teaches programming, web applications and website creation during classes or in hobby clubs to students from grades 1 to 12.
SmartLabs (NutiLabor)	Estonia	Yong people 10- 19	*Link*	SmartLabs supports and promotes IT-related afterschool activities (web designing, programming, 3D modelling, computer engineering, etc.) among youth to improve IT awareness and increase the number of youth choosing to study science or IT.
Computational Thinking and Practice	Denmark	Secondary school students	*Link*	A Danish initiative to redefine and revitalise computing in Danish high schools, taking a broader approach and accommodating the four different types of high schools in Denmark with one generic computing subject.
IT School	Poland	Students of secondary level	*Link*	The IT School is an online pre-university programme for learning theory and application of Information and Communication Technologies. The programme serves as an additional tool for teachers to enhance the learning process.

Initiative	Country	Target	Link	Short description
Introduction to Computer Science programme	International	Secondary schools students	*Link*	Oracle Academy's Introduction to Computer Science curriculum is designed to awaken student interest in computer science. It offers access to world-class software, Java development environments, curriculum, faculty training, certification preparation,etc.
Telerik Academy	Bulgaria	Primary and secondary students, People of all ages	*Link*	Telerik Academy offers free training to students in secondary and higher education and professionals which would help them acquire the relevant skills in order to meet the demands of the labour market.
Small Basic	International	Students	*Link*	Microsoft Small Basic is a project that is aimed at making computer programming accessible to beginners. The project comprises a simple programming language that gathers inspiration from the original BASIC programming language.
Codecademy	International	People 13+	*Link*	Codecademy is an online interactive platform that offers free coding classes in 8 different programming languages including Python, PHP, jQuery, JavaScript,AngularJS, and Ruby, as well as markup languages HTML and CSS.
Microsoft Digital Literacy Curriculum	International	People of all ages	*Link*	The Curriculum helps people develop essential skills to begin computing with confidence. The curriculum features screen shots and simulations from Windows 8 and Microsoft Office 2013 to illustrate and provide hands-on examples.
Khan academy	International	People of all ages	*Link*	Khan Academy offers learning materials that empower learners to study at their own pace in and outside of the classroom. The Academy tackles math, science, computer programming, history, economics, etc.
Code Power	Netherlands	Upper-primary school teachers	*Link*	Offers a range of courses to get teachers familiar with the basics of programming. Workshops are approachable and offer room for personal experimentation.
TechFuture Classroom	United Kingdom	Young people 11-19	*Link*	TechFuture Classroom is a hub of free computing resources, developed with industry to provide authentic projects mapped to computing, ICT and computer science qualifications.
Talentum Schools	Spain	Young people 4-18	*Link*	An online platform, offering courses covering various areas such as programming, robotics, augmented reality and the development of mobile apps.

Initiative	Country	Target	Link	Short description
Digital Skills Academy	International	Young graduates, People of all ages	*Link*	The Academy's programmes are focused on developing industry-ready talent through degree programmes that are closely aligned with the needs of industry.
Programma il Futuro	Italy	Primary and Secondary teachers and students	*Link*	The programme enables teaching and learning of programming in Italian schools, by providing a series of interactive lessons on coding which every school and teacher of any subject can use according to their needs.

6.2 Raising awareness for ICT skills and jobs

Initiative	Country	Target	Link	Short description
Women Into Technology, FIT	Austria	High school students (girls)	*Link*	The program aims to encourage an increased number of female school leavers to opt for technical or scientific studies, by providing information about university programmes and promoting the success stories of women in the technology sector.
Bebras	Lithuania	Grade 1 - grade 12	*Link*	The Bebras International Contest on Informatics and Computer literacy is a motivation competition in informatics that addresses all lower and upper secondary school pupils.
GetBusy.gr	Greece	Young people	*Link*	Getbusy.gr is a web portal containing comprehensive information and educational material that can be used by young people in Greece with the aim to motivate them to improve their e-skills and employability.
"TIK? – TAK!" ("ICT? – YES!")	Poland	Students of primary and secondary schools	*Link*	"ICT? Yeah!" is a National Computer Science Competition for primary and secondary schools.
Jet- Net Junior	Netherlands	Students in primary education	*Link*	Jet-Net Junior Hubs are regional grouping of primary school pupils, teachers and students of the various teacher training colleges. The Jet-Net Junior Hub ensures that current students and teachers enjoy the contact with science and technology.
Jugend forscht	Germany	Students under 21	*Link*	Jugend forscht" is a country wide competition in which students research a self-chosen topic using methods from mathematics, computer science, natural science or technology. The winners are offered internships as well as the chance to participate in international competitions.

Initiative	Country	Target	Link	Short description
Bundeswettbe-werb Informatik (Federal Informatics competition)	Germany	Young people under 21	*Link*	The federal information technology competition aims on promoting information technology as a subject. The winners are rewarded with scholarships and or invited to participate in the "Informatik Olympiade" (Informatics Olympics).
Stemettes	United Kingdom	Girls in primary and secondary education	*Link*	Stemettes aim to inspire the next generation of females into STEM fields by showing them the amazing women already in STEM via a series of panel events, hackathons, exhibitions, and mentoring schemes.
Sci-Tech Challenge	UK, France, Italy, Belgium, Netherlands, Norway, Poland, Romania, Russia	Young people 14-18	*Link*	The Challenge is a one-day workshop focused on fostering young peoples' problem-solving and innovation skills. Students are given a specific challenge, presented by industry experts. Employee volunteers are involved as expert mentors.
TechFuture Ambassadors	United Kingdom	Students, teachers, young graduates	*Link*	TechFuture Ambassadors are tech and digital professionals from across the sector who volunteer their time in schools to actively inspire young people about the exciting career opportunities in tech.
Smart Futures	Ireland	Students in post-primary education	*Link*	Smart Futures is a collaborative government-industry programme promoting STEM careers to second-level students in Ireland, highlighting opportunities in these sectors.

6.3 Matching skills to digital jobs and practical experience for students and young graduates

Initiative	Country	Target	Link	Short description
Cisco Networking Academy	International	Students, teachers, people of all ages	*Link*	IT skills and career building program available to learning institutions and individuals worldwide.
Academy Cube	International	Young graduates	*Link*	Academy Cube offers a cloud-based internet platform that companies and institutions can use to provide e-learning courses and post job offerings. It uses a matching system which proposes courses based on a job-seeker's self-assessment.

Talentum Statrups	Spain	Graduates, university students in technological courses	*Link*	Telefónica Talentum Startups is a scholarship programme which attracts young talented students and offers practical experience (internships) of working in a start-up or companies in the digital sector.
YouRock	International	Young people	*Link*	YouRock helps users identify their professional work skills, and build a dynamic profile showing their primary skill groups. It helps employers to: identify proactive new employees with specific skills and see international candidates in any of the system languages.
FIT	Republic of Ireland and Northern Ireland	Young graduates and jobseekers	*Link*	FIT is an industry-led multi-stakeholder initiative which develops and promotes technology-based programmes and career development opportunities for job seekers.

6.4 Transversal approach to equipping young people with digital skills

Initiative	Country	Target	Link	Short description
High school subject: Computational Thinking	Denmark	High school students	*Link*	This new ICT course holds the ambition to cover all needs for computer literacy at high school level.
Pasc@line	France	High school students	*Link*	Pasc@line promotes a dialogue between academia and the ICT sector in France. The association seeks to promote ICT jobs amongst the youth and to help develop high standards for ICT in secondary and higher education, etc.
ROBERTA	Germany	Children and young people	*Link*	Robotics courses are at the heart of the Roberta concept using special, gender-appropriate teaching and learning materials and specific coaching concepts.
Innovationen machen Schulen Top! (IMST)	Austria	Teachers	*Link*	IMST is a flexible support system. Teachers, supported by scientists working in the above mentioned areas, lead innovative classroom and school projects and work together in networks.
Think Big School	United Kingdom, Spain and Germany	Young people 11- 18	*Link*	Telefonica's Think Big School is a programme which tries to enhance programming and entrepreneurial skills in young people.
Barefoot project	England	Primary school teachers	*Link*	The project aims to develop free high-quality, practical resources and deliver computer science workshops to support primary school teachers in England.

Initiative	Country	Target	Link	Short description
Biblioteca escolar digital	Spain	Primary and secondary students, teachers	*Link*	The Digital School Library aims to be an efficient tool for anyone interested in the use and incorporation of ICT in education. It provides information on online and offline courses, database of best practices, resources, etc.
Jet- Net, Youth and Technology Network Netherlands	Netherlands	Students in secondary education	*Link*	Through guest lessons, workshops and other activities, young people see that they can find interesting jobs in technology. The focus of Jet-Net is a 1-to-1 collaboration between a company and a (HAVO / VWO) school.
Google CS First	International	Students 9-14, parents	*Link*	CS First is a free program that increases student access and exposure to computer science (CS) education through after-school, in-school, and summer programs.

Formal and Non-formal Educational Programmes on Digital Skills and Competences

Best Practices and Recommendations

This publication has been developed by European Schoolnet as part of the work of the Secretariat of the Grand Coalition for Digital Jobs. It presents a summary of the best practices among formal and non-formal educational programmes in Europe with the purpose of identifying recommendations for replicating or upscaling these initiatives on a local, regional or national level.

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