598236-EPP-1-2018-1-LT-EPPKA2-CBHE-SP Digital competence framework for Ukrainian teachers and other citizens (dComFra)

WP 1.1: Analysis of existing DC programs and curricula at Program Countries' Universities

Delivery date: 30–May–2019

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Work Package 1: DC needs &EU DigComp frameworks: Analysis

Deliverable 1.1: Analysis of existing DC programs and curricula at Program Countries' Universities

WP1 duration – from 15.11.2018 to 15.10.2019

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Leader – Kharkiv National University of Radio Electronics (NURE) (P11)

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Results Overview

The report contains state-of-the-art overview for digital skills of citizens in the EU countries - project partners. Information about common European initiatives in the field of digital technologies and the creation of digital coalitions in the countries participating in the project is provided. An EU-wide online platform to support universities using digital technology is described. The analysis of an issue of teaching digital technologies in universities of the countries participating in the project is carried out. The conclusion concerning the high level of development and effective organization of educational processes in universities, oriented to preparing students in the field of digital technologies is made.

The methodic of analysis of educational programs and its results in universities in Austria, the Czech Republic, Lithuania, Poland and Romania is described. The programs are focused on teaching basic digital skills and competencies in IT. Data on university educational programs collected by universities participating in the project; the data include names of training courses, their volumes, digital competencies acquired as a result of their study, and levels of proficiency of competencies. A quantitative and qualitative comparative analysis of the collected data is presented; best practices on educational programs for the development of digital competences are given. As a result it makes sense to use these practices in order to increase the effectiveness of teaching digital competencies for citizens of Ukraine.

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Introduction

1. Aims and goals

The main goals of WP1 are to develop major requirements for building the dComFra program by using the WP1 results for target groups' DC needs on a base of UA and EU labour market, EU DigComp[1] frameworks analysis, existing experience of UA partners, and Program Countries best practices; and to launch Ukrainian National Digital Coalition (UNDC). The aim of deliverable 1.1 is to carry out the comprehensive study of existing programs and curricula at project targeted DC available at EU partner organizations. This report will summarize the available program and curricula as well as good practices in DC aimed on enhancing of various professional educations to fit challenges and demands on contemporary economy.

The output of this research will serve as a starting point for:

- Conceptual Design of DC office: technical, pedagogical, methodological.
- New public structure – UNDC and signed memorandum by UA stakeholders. UNDC action plan for coming year.
- At least 11 DC Profiles based on interview the specialists of various areas, DC frameworks and EU experience.

2. Methods

For research purposes according to WP1.1, the partnership used the following methods:

- Desktop research (WP1.1-1, WP1.1-2)
- Data processing
- Analysis
- Data summarising

Guidelines for implementing the research were prepared by Lead partners P11 and P14 to facilitate the research for partners in their own countries.

The following templates were used in order to collect the data:

- Desktop research template questionnaire (WP1.1-1);
- Interview with experts template questionnaire (WP1.1-2).

The following countries were involved in the research: Austria, Czech Republic, Lithuania, Poland and Romania. WP1 lead partners collected all the results, processed, analysed and summarised the data,

[1] https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-21-digital-competence-framework-citizens-eight-proficiency-levels-and-examples-use

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providing detailed summary reports for WP1.1-1, WP1.1-2, as well as joint summary report with conclusions on both.

3. Target groups

Target groups within the research were:

• Partners themselves (Desktop research WP1.1-1, WP1.1-2).

• Experts in DC teaching from participant countries universities that are not participants of project consortium (for collecting information about DC programs and curricula in WP1.1-1, WP1.1-2).

4. Ukrainian background and challenges

Impact of a digital economy development on the labor market

• Two-thirds of all jobs in countries will be automated

•Automation can replace almost 60% of jobs in countries OECD (*Organisation for Economic Cooperation and Development, OECD*)[2].

• Technologies can automate activities for 1.2 billion full-time equivalent positions and $ 14.6 trillion in wages.[3].

• The structure of employment is changing, new requirements for professional competencies are emerging

• Growing demand for information and communication technology professionals

• Professionals employed in majority of sectors of the economy should have sufficient level of digital literacy, working skills related to modern telecommunications and software tools

Position of Ukraine in world ratings:

1. The Human Capital Index (HCI), 2018 [4] – 50th position *(Austria – 12, Czech Republic – 14, Poland – 30, Lithuania – 37, Romania – 67)*;

[2] World Development Report 2016: Digital Dividends, World Bank https://openknowledge.worldbank.org/bitstream/handle/10986/23347/9781464806711.pdf

[3] "The Countries Most (and Least) Likely to be Affected by Automation," Harvard Business Review, April 12, 2017

[4] https://openknowledge.worldbank.org/bitstream/handle/10986/30498/33252.pdf?sequence=5&isAllowed=y

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2. The Global Competitiveness Index 4.0 [5] – 83d position (total number is 140) *(Austria – 22, Czech Republic – 29, Poland – 37, Lithuania – 40, Romania – 52);*

3. Global Innovation Index (GII-2018)[6] – 43d position (total number is 126) *(Austria – 21, Czech Republic – 27, Poland – 39, Lithuania – 40, Romania – 49)*;

4. E-Government Development Index (2018)[7] – 82d position (total number is 193)*(Austria – 20, Poland – 33, Lithuania – 40, Czech Republic – 54, Romania – 67)*;

5. ICT Development Index,2017[8] – 79th position (total number is 176) *(Austria – 21, Lithuania – 41, Czech Republic – 43, Poland – 49, Romania – 58)*;

6. IMD World Digital Competitiveness Ranking[9] – 58th (total number is 63) *(Austria – 15, Lithuania – 29, Czech Republic – 33, Poland – 36, Romania – 47)*

The ranking positions of Ukraine allow for conclusion that the country has faced challenges in term of adaptation citizens for modern economic circumstances, in particular:

• human potential is insufficient for digital transformations;

• the digital literacy level of civil servants and the population as a whole does not meet modern requirements ;

• lack of specialists for the development of the digital economy is increasing;

• insufficiently developed practice of training citizens and staff in the field of ICT, additional training for employee in the field of ICT;

• educational programs are not updated and do not provide the formation of basic digital competencies;

• the share of study time devoted to digital competences in the main educational programs does not exceed 20% overall time.

[5] http://reports.weforum.org/global-competitiveness-report-2018/competitiveness-rankings/
[6] https://www.globalinnovationindex.org/Home
[7] https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2018-Survey/E-Government%20Survey%202018_FINAL_PRINT.pdf
[8] https://nonews.co/wp-content/uploads/2018/08/MISR2017.pdf
[9] https://www.imd.org/wcc/world-competitiveness-center-rankings/world-digital-competitiveness-rankings-2018/

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Review. State-of-the-art of DC skills at project's countries participants

Digital technologies are used in many sectors such as farming, healthcare, transport, education, retail, automatics, energy, shipping, logistics, teaching and the information and communications technology industry. The demand for information and communications technology specialists is growing fast. In the future, 9 out of 10 jobs will require digital skills. At the same time, 169 million Europeans between 16 and 74 years – 44% – do not have basic digital skills, see Fig.1[10].

37% of the EU workforce has low digital skills or none at all. Less than half of children are in schools which are highly equipped digitally. Only 20-25% of them are taught by teachers who are confident using technology in the classroom. 18% of primary and secondary schools in the EU were not connected to broadband.

According to the European initiatives in terms of digitalization in current report we follow main goals established by the European Commission in Digital Skills and Jobs Coalition[11], DigComp frameworks and the Digital Agenda for Europe (DAE)[12].

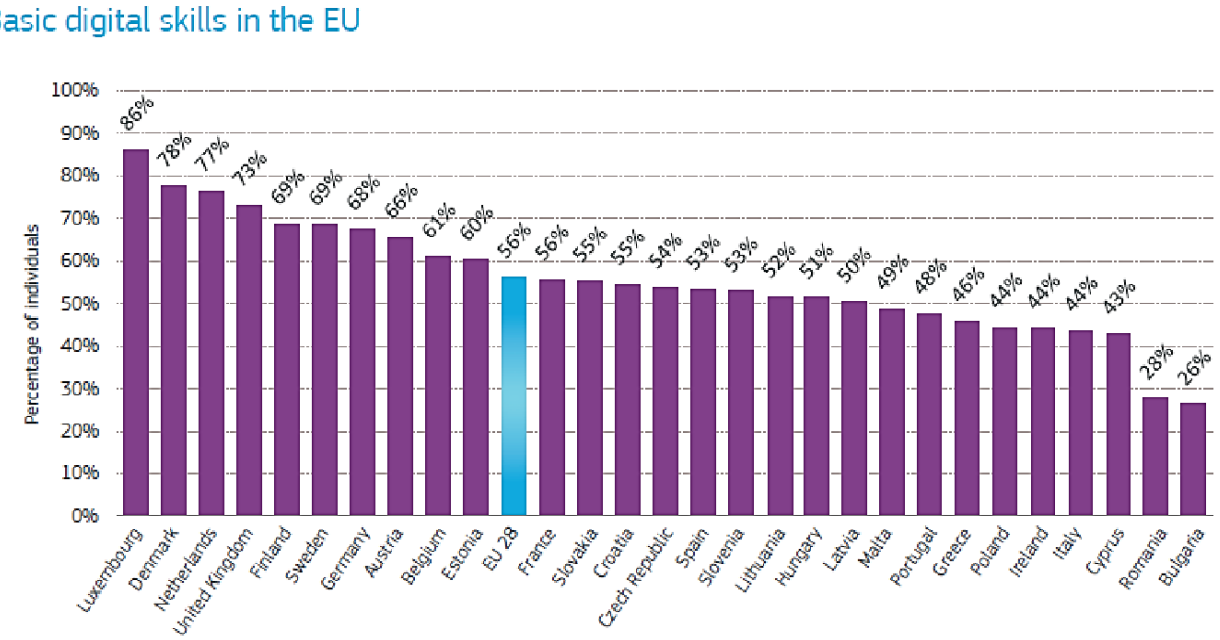

Figure 1: Basic digital skills in EU countries. Source: Eurydice, 2018/19

[10] https://ec.europa.eu/digital-single-market/en/news/digital-skills-gap-europe

[11] https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition

[12] http://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe

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According to the latest Digital Society and Economy Index there are significant differences between Member States when it comes to citizens' digital skills.

Employees will need to be able to work with sophisticated machines and IT solutions as part of their everyday activities, from car mechanics to doctors and nurses. Developing skills is primarily the competence of the Member States. The European Union can support their efforts and has launched several initiatives to advance digital skills in the EU. The Digital Skills and Jobs Coalition launched in 2016 brings together Member States, companies, social partners, non-profit organizations and education providers to tackle the lack of digital skills in Europe. In less than a year, members of the Coalition have trained more than seven million Europeans. As a result, 7 million European citizens have been equipped with basic digital skills over the last year.

As a key concept of Digital Agenda for Europe is Digital Single Market Strategy. Digital Single Market Strategy is based on three items: providing better access for consumers and businesses to digital goods and services across Europe; creating the right conditions for digital networks and services to flourish and maximizing the growth potential of the digital economy.

Digital Competence Framework for Citizens (DigComp 2.1) describes reference conceptual model which includes 8 proficiency levels and examples of use applied to the learning and employment field.

Current chapter is aimed to analyse the main particularities of national education systems of project participants as well as their initiatives to facilitate a digital competences acquirement.

In order to focus on the structure of mainstream education in European countries it makes sense to refer to the European Commission/EACEA/Eurydice project[13].

In accordance with the International Standard Classification of Education (ISCED 2011) the diagrams indicate three main organizational models of primary and lower secondary education were developed. These diagrams are parts of compulsory education in all European education systems and show the mainstream educational programmes considered to be the most representative in each country. They encompass early childhood education and care provided in publicly subsidised and accredited centre based settings for children from the youngest age of enrolment; primary and secondary education programmes including the period of compulsory education; post-secondary non-tertiary programmes; tertiary level main programmes. The graphic layout of the diagrams is divided in two parts. The first part (left side bar) shows educational programmes from pre-primary to post-secondary non–tertiary levels. The second one (right side bar) explains the main programmes at the tertiary level.

[13] European Commission/EACEA/Eurydice, 2018. The Structure of the European Education Systems 2018/19: Schematic Diagrams. Eurydice Facts and Figures. Luxembourg: Publications Office of the European Union

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Among other initiatives an EU-wide online platform that will be created to support Higher Education institutions (HEIs) in using digital technologies to:

- improve the quality and relevance of learning and teaching;
- facilitate internationalisation;
- support greater cooperation between HEIs across Europe.

Digital transformation can bring a range of benefits to HEIs:

- improving the quality and relevance of learning and teaching;
- making higher education more accessible to a wider range of students;
- creating links between higher education institutions, research institutions, employers and the wider community. The online platform will be a single access point to existing online platforms and improve dissemination of best practice to all HEIs.

The platform will encourage international collaboration and co-creation of knowledge and content.

The platform will provide HEIs with material on:

- training for academic staff on innovative pedagogies and curriculum design;
- exchange of material and best practices;
- blended and digital learning and blended mobility;
- collaboration between HEIs and employers.

Many national platforms on digital technologies in Higher Education institutions can be found in the Member States; some have a national perspective, others more transnational. This action will scale-up these initiatives to European level[14].

The education landscape across Europe is changing. At the 2017 Gothenburg Summit, EU leaders outlined a vision for education and culture. In its December 2017 Conclusions[15], the European Council called on Member States, the Council and the Commission to take forward a number of initiatives, including:

'…strengthening strategic partnerships across the EU between higher education institutions and encouraging the emergence by 2024 of some twenty 'European Universities', consisting in bottom-up networks of universities across the EU which will enable students to obtain a degree by combining

[14] https://ec.europa.eu/education/education-in-the-eu/european-education-area/digital-education-action-plan-action-4-higher-education-hub_en

[15] https://www.consilium.europa.eu/media/32204/14-final-conclusions-rev1-en.pdf

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studies in several EU countries and contribute to the international competitiveness of European universities'.

Co-developed by higher education institutions, student organisations, Member States and the Commission, the European Universities Initiative responds to this call. Today, it is one of the flagship initiatives of the EU's ambitions to build a European Education Area.

These transnational alliances will be the European universities of the future, promoting European values and identity, and revolutionising the quality and competitiveness of European higher education. In order to achieve this quantum leap, the European Commission has launched a new call to test different cooperation models based on the following principles:

- An alliance of chosen partners from all types of higher education institution covering a broad European geographic scope;
- With a co-envisioned long-term strategy focussed on sustainability, excellence and European values;
- Offering student-centred curricula jointly delivered across an inter-university campus, where a diverse student body can build their own programmes and experience mobility at all study levels; (make reference)
- Taking a challenge-based approach where students, academics and external partners can cooperate in cross-disciplinary teams to tackle the biggest issues facing Europe today[16].

[16] https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiative_en

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Austria

According to the Austrian Federal Constitutional Law Article 14 – as amended (Bundesverfassungs-Gesetz, B-VG, Art. 14) the fundamental principles of education in Austria are democracy, humanity, solidarity, peace and justice, openness and tolerance towards everyone regardless of race, social status and financial background[17].

In 2017 the Education Reform Act (Bildungsreformgesetz 2017) defined a new governance model for education system and an evidence-based quality assurance:

- Definition of a comprehensive framework on school quality
- Regular collection of data on all aspects of school quality
- Availability of these data for all levels of the school administration
- Production of annual school reports
- New system of school inspection and school evaluation

According to the Work Programme of the Austrian Federal Government academic and scientific knowledge as well as research are vital pillars of Austria's overall development and their potential needs to be secured in the long term. The challenge in the coming years is to design framework conditions and structural prerequisites with a view to competitiveness and future requirements. This also includes a strengthening of the tertiary sector and of research – the target is to make 2% of the GDP available for tertiary education establishments by 2020. Austria boasts a diversified range of higher education programmes, most of which are offered by the universities. In the past few years, a large number of coordinating measures have been introduced in terms of strategy, including Mapping Process for the Austrian Higher Education System. The Mapping Process is a dialogue-based strategy process of public university co-ordination, including research infrastructure and building, human resources, internationalization and a new model of public funding of universities based on capacities. The main focuses of the process are enhanced cooperation and coordination, improved use of available resources, coordinated specification of profiles and special focuses, coordinated further development of the range of subjects.

The mapping process is implemented in four partial projects: large research infrastructure, infrastructure road map, new university funding scheme and coordination measures.

According to the Standard Classification of Education (ISCED 2011) the Schematic Structure of the Austrian Education System is shown in Figure 2.

[17] https://eacea.ec.europa.eu/national-policies/eurydice/content/austria_en

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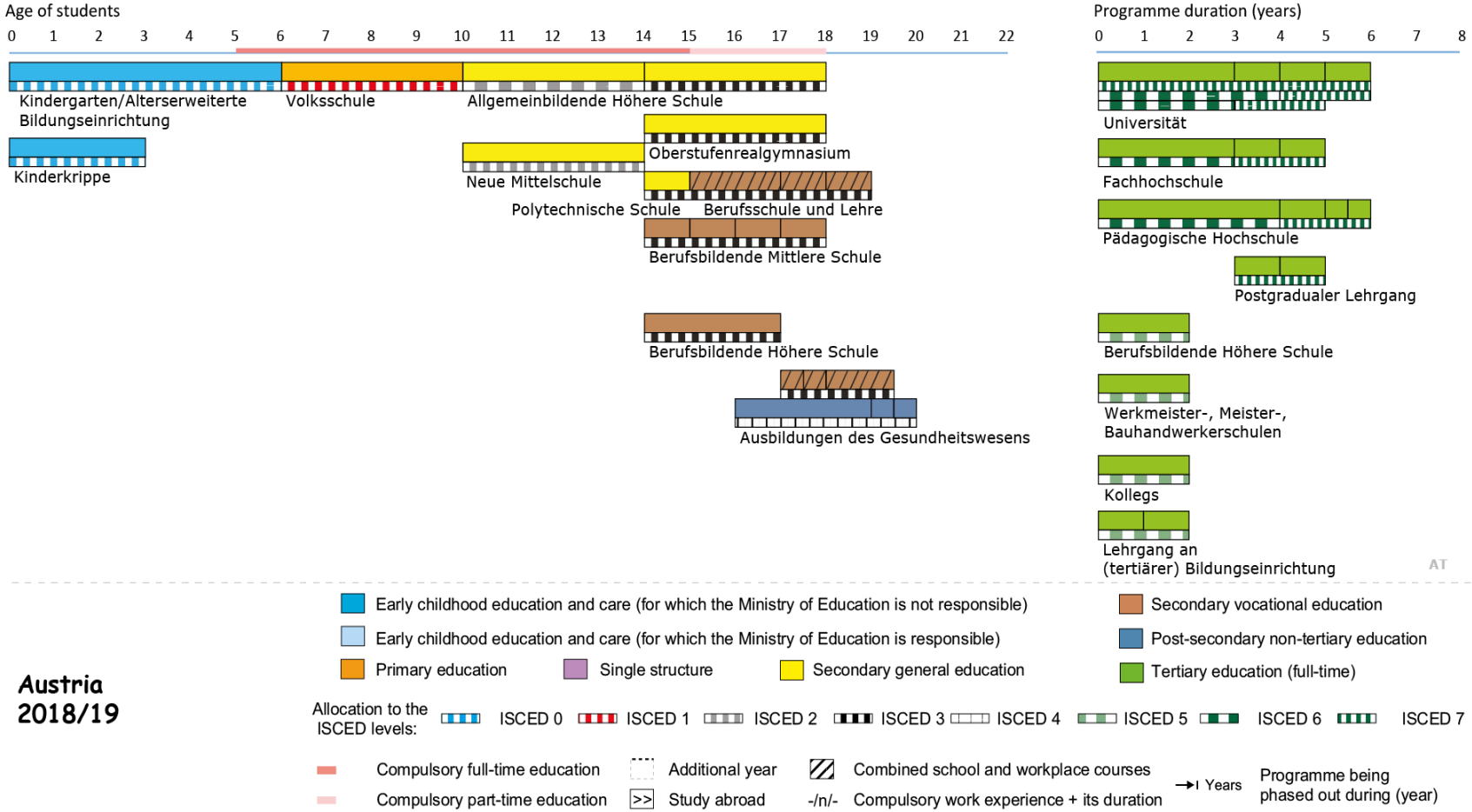

Figure 2: Schematic Structure of the National Education System in Austria. Source: Eurydice, 2018/19

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Alongside technical abilities and knowledge about technology the ability to find information and to evaluate it is a crucial aspect of digital literacy. Digital education should be widely integrated into the curriculum in Austrian schools and should be taught as early as possible – in nurseries – and at the same time in an age-appropriate manner in order to sustain the enthusiasm and interest of children and young people.

Consolidate existing initiatives and present a new overall digital strategy for schools will allow for improvement the digital literacy. Teach digital skills to school pupils in line with the "digi. komp. model"[18]. Teach basic IT knowledge (coding, computational thinking) and encourage a fun approach to technology at primary school. Encourage the reflective and responsible use of technology (media education, data protection, ethics) at school and provide hands-on programmes for adults to help them improve their media skills.

Strengthen subject-related and vocational training in key IT development areas such as network technology, business IT, commercial data processing and databases, digital business, computer engineering, media informatics and medical informatics.

At universities and colleges of higher education, the use of digital technology is increasing both in teaching and in the publication sphere. It offers numerous opportunities and at the same time requires educational and teaching approaches to be further developed. It must be ensured that it is legally permissible to share and expand teaching and learning materials and that appropriate quality assurance measures are taken.

Strengthen the digital skills of educators through training measures for the effective practical use of digital media and e-Learning in lessons (teaching methodology) and through new forms and models in education and training (e.g. MOOCs and expansion of the Virtuelle Pädagogische Hochschule [Virtual College of Education]) Facilitate knowledge transfer from experts' school to beginners' school and promote networks of innovative schools. Present digital and interactive school books, increase the availability of (self-organized) further training programmes, use of innovative educational technologies. Launch the Foundation for Innovation in Education 2017, which focuses in particular on the topics of digital education and accelerating EduTech. Optimize the framework for the use of technology at school sites, in particular by increasing the availability of Wi-Fi and broadband. Increase the use of open source software. Continue to develop the e-Infrastructure repository initiative in line with the University Structural Funds Ordinance. Reach an agreement on the creation of electronic teaching and learning programmes. Prioritize digital competence training programmes for adult educators (e.g. adult education MOOCs) and new non-formal and informal education programmes delivered digitally (e.g. webinars, serious games) in extracurricular youth programmes and parent education.

[18] http://www.digikomp.at/

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Czech Republic

In general, education policy in the Czech Republic until 2020 is heading towards an education system following the concept of lifelong learning. This should fulfil the paramount purpose of education: personal development that is conducive to the quality of human life, the preservation and development of culture as a system of shared values, the pursuit of active citizenship as a prerequisite for democratic governance and preparation for employment.

In accordance with the International Standard Classification of Education (ISCED 2011) the diagram depicted bellow (Figure 3) reveals three main organisational models of primary and lower secondary education.

The Digital Education Strategy until 2020 formulates three priority objectives on which the first interventions will focus:

- Opening-up education to new teaching methods and techniques through the use of digital technologies;
- Improving students' competencies in working with information and digital technologies, and
- Developing computational thinking amongst students.

These include seven main directions of intervention:

1) Ensure non-discriminatory access to digital learning resources.
2) Ensure conditions for the development of digital competencies and computational thinking amongst students.
3) Ensure conditions for the development of digital competencies and computational thinking amongst teachers.
4) Ensure the construction and renovation of educational infrastructure.
5) Support innovative procedures, monitoring and evaluation and the dissemination of their results.
6) Put in place a system to help schools to develop in the integration of digital technologies in teaching and in school life.
7) Increase the understanding of the aims and processes involved in integrating technology into education among general public.

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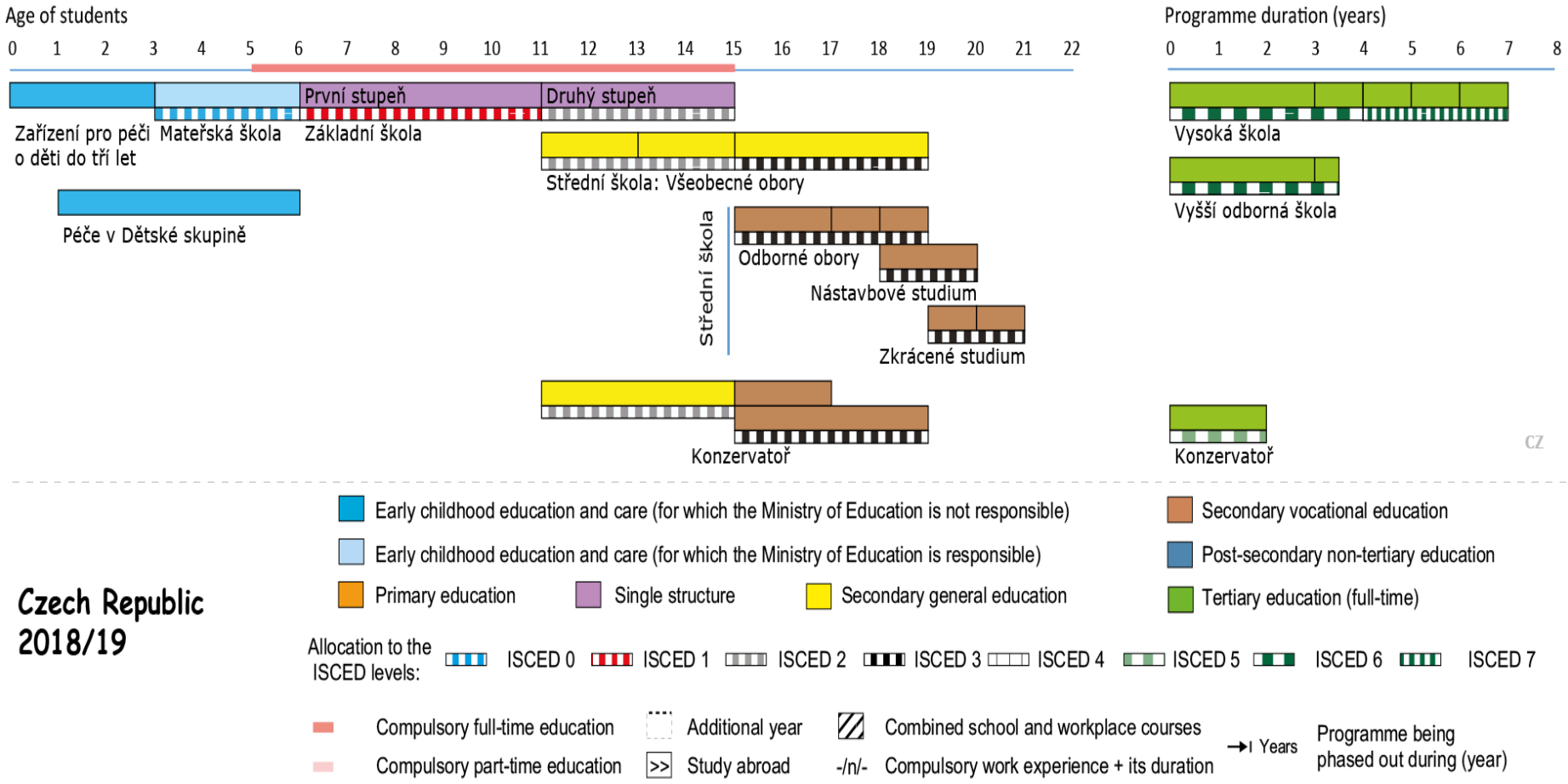

Figure 3: Structure of the Education System in Czech Republic. Source: Eurydice, 2018/19

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One of the strategic documents of the Ministry of Education, Youth and Sports of the Czech Republic is the Framework for the Development of Higher Education until 2020. It is planned to lay down the essential priorities for the development of higher education in the Czech Republic and provide analytical and strategic background for further development of the whole system. Expected priority points consist of strategic management of higher education institutions quality assurance and evaluation of higher education institutions, educational activity of higher education institutions, internationalization of higher education, research, innovation, arts and other creative activities of higher education institutions, participation of higher education institutions in the social and economic life of society, support activities.

Strategy for Digital Education aimed to the creation of the Strategy for the Increase of Digital Literacy and Development of Electronic Skills. The work on the Strategy for Digital Education began in January 2014 and is coordinated by the Ministry of Education, Youth and sports and by the National Institute for Education in cooperation with a group of more than 50 experts on digital education from the academic, education and business sectors. Expected priority points include:

- non-discriminatory approach to digital education resources;
- development of digital skills and computational thinking of pupils;
- development of digital skills and computational thinking of teachers;
- development and modification of school infrastructure to facilitate digital education;
- support for the development and distribution of innovations.

One of the goals of Digital Education Strategy of the Czech Republic until 2020 is formation of Digital Skills and Jobs Coalition. The Coalition seeks to support, connect and inspire organisations whose ambition is to foster digital education for the labour market. The Czech National Digital Skills and Jobs Coalition contributes to the development of digital literacy of the population through synergies of co-operating organizations, their targeted activities and specific commitments of individual members.

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Lithuania

The education system of Lithuania is defined by the law on education. As per the law, the education system of Lithuania comprises of formal and non-formal education. Formal education encompasses primary, basic/lower secondary and upper secondary education, formal vocational education and training, and tertiary education. Non-formal education encompasses pre-school education, pre-primary education, and other non-formal education for adults. According to the laws of the Republic of Lithuania, each and every child has the right to primary, basic/lower and upper secondary education in Lithuania. Education in Lithuania is free of costs and comprises of pre-tertiary and tertiary education. The pre-tertiary education in Lithuania consists of four stages: pre-school education, pre-primary education, primary education, secondary education- basic/lower and upper secondary education.

The higher education in Lithuania is imparted by the universities and colleges. Lithuania has adopted the Bologna system in 2006. Tertiary education in Lithuania is based on the European credit system (ECTS).

In Lithuania, there are two types of higher education institutions:

Universities: These higher education institutions provide academic studies that lead to a bachelor, master and PhD degrees.

- Colleges: These higher education institutions are non-academic and provide vocational education and offer professional bachelor degrees. Following are the degrees offered by the higher education institutions in Lithuania:
  - Bachelor's degree: This degree lasts for 3-4 years
  - Master's degree: This qualification lasts for 1-2 years
  - Doctorate degree: The duration of this qualification varies depending upon the study area.

The studies at the higher educational level can be full-time or part-time.

Structure of Lithuanian education system is depicted in Figure 4.

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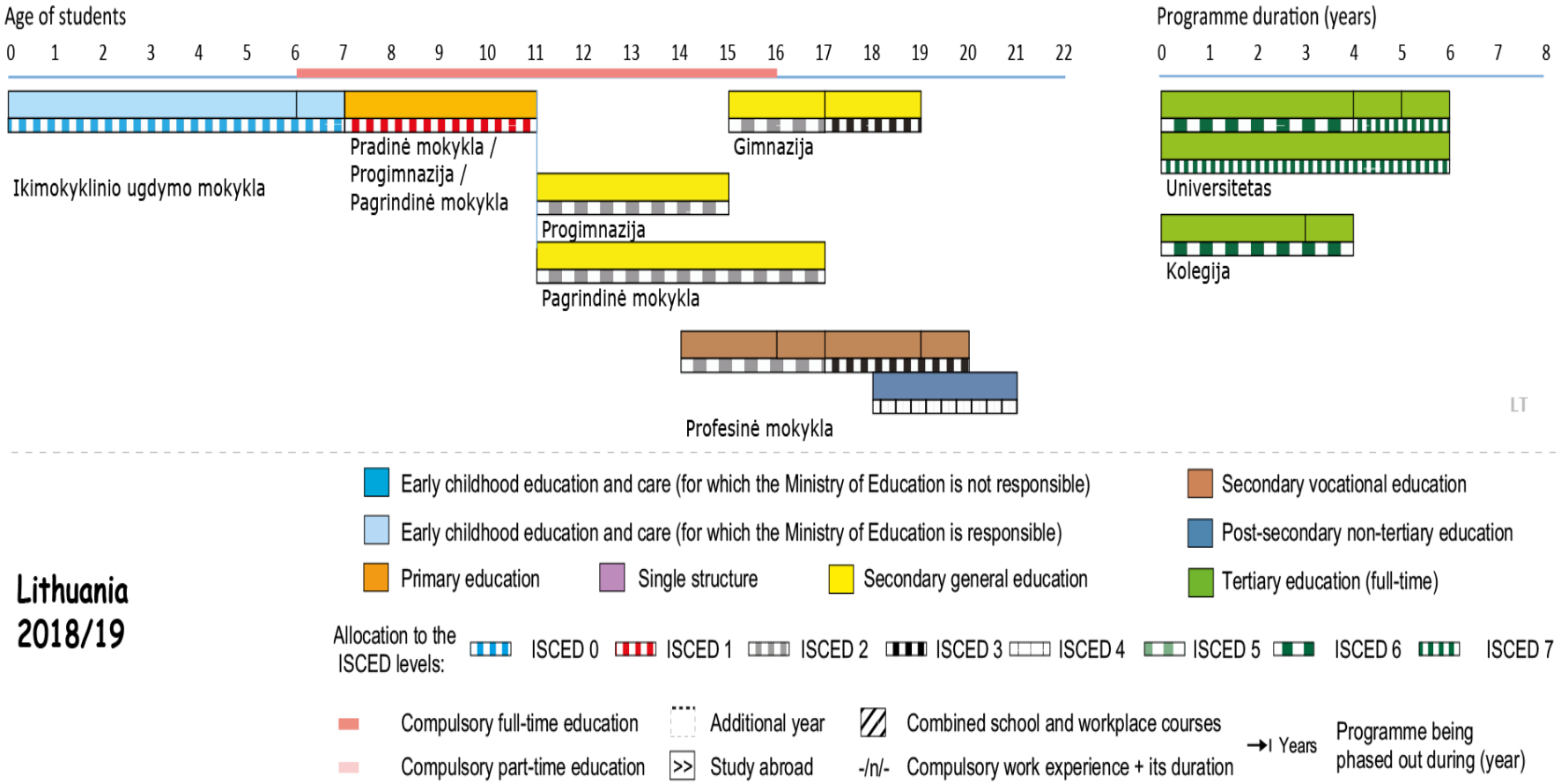

Figure 4: Structure of the Education System in Lithuania. Source: Eurydice, 2018/19

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Bearing in mind that the significant shortage of professionals in information and communications technology (ICT) in the European Union (EU) creates a bottleneck for economic growth, while educational institutions fail to provide a sufficient number of professionals with adequate ICT knowledge and skills demanded on the labour market, in December 2012, the European Commission (EC) announced the Grand Coalition Initiative for the Promotion of Digital Skills and Jobs, the aim of which is to implement the Digital Agenda for Europe and to solve this problem through concrete and coordinated actions of the public and private sectors, by increasing the number of ICT apprenticeships as well as to establish more direct links between education and business, to standardize qualification requirements and to achieve other goals that are pursued.

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Poland

According to the Lifelong Learning Strategy (LLL) the Government which took office in 2015 has adopted the Responsible Development Plan and Strategy. These identify education as a key element of social and regional development. The objectives of the lifelong learning (LLL) policy are based on the Lifelong Learning Perspective, adopted in 2013 in response to the European Commission's Europe 2020 Strategy. The LLL policy focuses on five principal objectives which have been addressed through education reforms and other measures.

Structure of the Education System in Poland is presented in Figure 5.

Educational reform in Poland is being implemented since the beginning of 2017. Its main goal is to offer students a solid background of general education required for further personal development and the needs of contemporary labour market. The key elements of the reform are as follows:

- change in the school structure: introduction of a long, 8-year primary school as well as 4-year general and 5-year technical secondary school;
- an obligation for 6-year-olds to attend 1 year of pre-primary education in order to acquire basic skills before they start school at 7 (this education, as it is the case for the school education, is financed from the general subvention from the State budget);
- provision of textbooks free of charge;
- strengthening secondary education – both general and vocational – through the extension of secondary programmes by 1 year;
- introduction of 3-year sectoral VET learning (to obtain a professional qualification) with a possibility to continue education for further 2 years at the second stage of sectoral VET school in order to upgrade qualifications and to prepare for the matriculation exam;
- promotion of dual vocational training in cooperation with the business sector, • extending the participation of employers in co-financing of vocational education through the establishment of the Fund for Vocational Education Development.

In the Polish education system full-time compulsory education and part-time compulsory education are defined. Full-time compulsory education (obligation to attend primary and lower secondary school – old structure, and primary school – new structure) applies to pupils aged 7-16 years (7-15 in the new structure) while part-time compulsory education (obligation to be in education) concerns pupils aged 16-18 (15-18 in the new structure) and it may take place either in school settings (a student attends an upper secondary school) or in non-school settings (e.g. a student follows vocational training offered by employers).

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There are two types of Higher Education Institutions: • university-type (uczelniaakademicka), • non-university-type (uczelniazawodowa). They both offer first- and second-cycle programmes as well as long-cycle Master's degree programmes while only university-type HEIs can offer third-cycle programmes (doctoral studies) and are authorized to award doctoral degrees. Studies are organized in the form of full-time (studiastacjonarne) or part-time (studianiestacjonarne) programmes. First-cycle programmes lead to two types of degrees:

- licencjat (equivalent of Bachelor's degree) – 3-4 year programmes,
- inżynier (equivalent of Bachelor's degree) – 3.5-4 year programmes.

Holders of the Bachelor's degree can enter second-cycle programmes, which take 1.5-2 years depending on the area of study. Only several fields of study offer long-cycle Master's degree programmes that last for 4-6 years. Firstcycle, second-cycle and long-cycle Master's programmes end with a diploma examination and students who have passed it are granted a relevant degree. The Master's degree (magister or its equivalent) entitles its holder to practice a given profession and provides access to third-cycle studies. They are organised in HEIs or research and development institutions other than HEIs and last for 3-4 years.

The development of citizens' digital competences is closely related to IT education, that had been formally introduced to Polish education system in 1985 (Information technology is present in every school curricula since that time). But in practical approach IT classes are present in schools since 1990, when the first textbook "Elements of computer science" was published and when first school laboratories had been equipped with computers and appropriate software. Citizens who did not have the opportunity to acquire digital competences during school education could acquire them through courses and trainings. In 2004, when Poland joined European Union, the European Founds started to play a significant role in enhancing the digital competences of citizens, since the founding program was directed to improve digital competences of European countries' citizens. The development of digital competences has a relatively short history since the computer science is a young field of science, so as a consequence developing digital literacy among population is also a new area.

Digital literacy of citizens can be assessed on the basis of their operational use, and in Poland this is summarized in the reports of the Central Statistical Office. Digital competences are obtained by children and young people at every stage of formal education.

Education in the field of digital competences in Polish higher education is not regulated in a systematic manner. There is no minimum number of hours for IT classes nor the number of ECTS points in study plans related to the achievement of digital literacy by students. Ministerial guidelines obligate universities only to develop study programs in which learning outcomes for qualifications 6, 7 and 8 of the Polish Qualification Framework (PRK) are covered.

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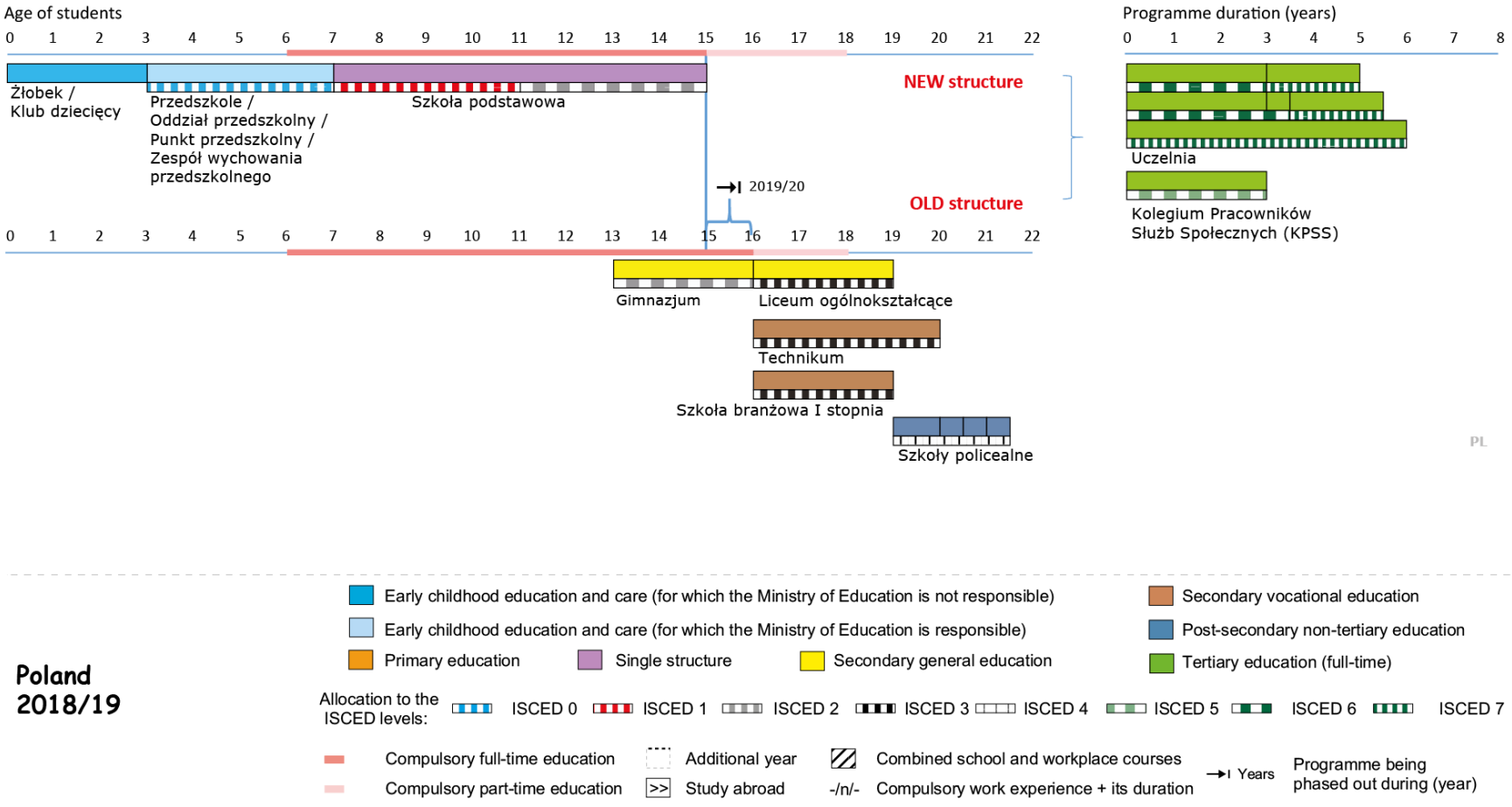

Figure 5: Structure of the Education System in Poland. Source: Eurydice, 2018/19

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Poland participates in the European Digital Skills and Jobs Coalition initiative. 16 regions in Poland decided to join the Broad Alliance of Digital Skills in Poland.

At the initiative of the Leader of Digitization and the Minister of Administration and Digitization cites Broad Agreement for the Development of Digital Skills , of which the goal is to inspire and support activities leading to universal digital education, effective use of digital technology and acceptance of changes caused by its constant development. The agreement is an informal association of goodwill of institutions, organizations and companies that identify with its goals and intend to work towards their implementation. It will seek synergies between implemented initiatives, inspire new ventures, gather information about good practices, and propagate them in various environments - even those distant from the issues of digitization. By increasing awareness of benefits and risks, it will act for access to knowledge and information, popularization of digital participation and acquiring skills necessary in all periods of life and areas of social and professional activity[19].

[19] http://umiejetnoscicyfrowe.pl/

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Romania

Education in Romania is administered and enforced by the Ministry of Education, Research, Youth and Sports. The Ministry of Foreign Affairs is in charge of working with the MECT to enable exchange programmes in the area of education, as well as for international citizens the right and proper conditions to study in Romania. The general legal framework for the organization, regulation and functioning of education is laid down by the Constitution through the Education Law- Law 84/1995 republished, with certain amendments. The basic pillars of the Romanian educational system are:

- Pre-school education
- Compulsory education
- Upper secondary education
- Vocational education
- Tertiary education

The higher education in Romania is given by the public and private institutions of higher education. Romania higher education comprises of:

University education

The university education is split up into three cycles:

- Bachelor
- Master
- Doctoral

Post-university studies

The Romanian higher/tertiary education system is organised on three levels: Undergraduate, graduate and postgraduate education.

Undergraduate education offers 2 kinds of programmes:

- Short-term university education: Such programmes are of 2-3 years duration.
- Long-term university education: Such programmes are of 4-6 years in duration and offered by the universities, academies and conservatories.

Graduate education programmes comprise:

- Advanced studies: This course of study is of 1-2 years duration for university graduates, and the graduates are awarded a degree diploma after the completion of the studies

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- Master studies: The master studies are of 1-2 years duration for university graduates
- Graduate academic studies: The duration of study for these programmes is 2-3 years

The doctoral study programmes are of 4-6 years duration, and provided by universities and accredited research institutes

University education lasts 4-9 years depending on the study programme and the cycles, and is offered by universities, academies and post-university schools.

Structure of Romanian Education System is shown in Figure 6.

The Romanian National Coalition (Skills4IT) is an open platform that includes a variety of stakeholders: policy makers, ICT companies, associations, training providers and NGO's involved in the digital transformation.

A part of the objectives established by the European Digital Agenda were taken-over and adapted to the current context in Romania, to the extent that they are relevant and aligned to the I&CT strategic vision for Romania 2020. The purpose of this action is to ensure the I&CT development of Romania to the level of the countries in the region and to set forth the premises of the Romanian integration on the European Digital Single Market, from the I&CT perspective.

Based on the priorities set forth by the European Commission and adopted by Romania, the interventions which are to be implemented regarding the education through the I&CT can be organized into 3 categories:[20]

1. Education through 1 digital interactions. One of the best-practice models successfully developed and implemented in Romania: the POSDRU project "Key I&CT Competences in the school curriculum", the INSAM project (digital instruments for improving the assessment quality in the pre-university education) "Restructuring the school curriculum in the high-school level education".

[20] https://ec.europa.eu/epale/sites/epale/files/strategia-nationala-agenda-digitala-pentru-romania-20202c-20-feb.2015.pdf

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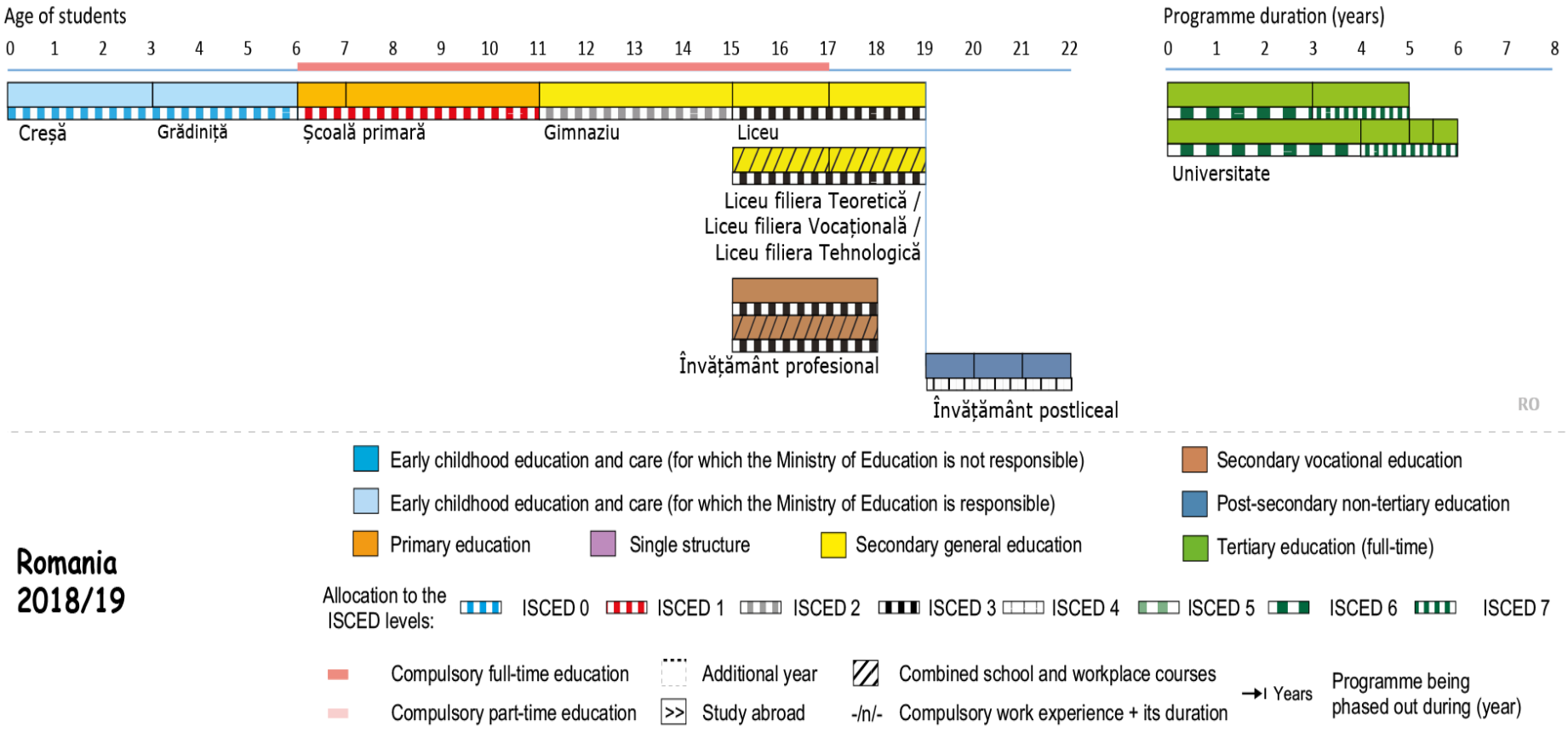

Figure 6: Structure of the Education System in Romania. Source: Eurydice, 2018/19

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2. Education through the I&CT-based extracurricular activity. The resources used in this project are the I&CT technologies for supporting the extracurricular activities (creation camps, experience exchanges, international study visits and the eVacanta project).

3. Continuing Professional Training - Life-Long-Learning with the help of the I&CT. the objective of the continuing professional training is to have adults voluntarily acquire necessary knowledge and skills throughout their lives for their personal or professional benefit. Thus, a special attention must be granted to the creation of a policy in the field based on the national consensus obtained as a result of the social dialogue.

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Summary of Country Analysis

The fundamental principles of national education systems of project participant countries - Austria, Czech Republic, Poland, Lithuania and Romania have been analyzed. The analysis revealed heterogeneity in terms of structure of education systems and approaches to digital education. However, educational systems of project participants can be considered as a basis for improvement of digital skills and competences. At the same time education systems of all the countries are aimed to lifelong learning concept.

The competent use of digital technologies is a key element of lifelong learning and increasing opportunities on the job market. In order to develop and improve digital literacy of citizens it makes sense to focus on following objectives:

- The development of citizens' digital competences is closely related to IT education.
- Digital education should be widely integrated into the curriculum of educational institutions.
- Combine existing initiatives in order to develop an effective digital strategy on all educational levels.
- Ensure conditions for the development of digital competencies amongst students as well as teachers.
- Reskill IT professionals according to the market requirements.
- Provide an appropriate ICT infrastructure and services as well as open educational resources.
- Increase the understanding of the aims and processes involved in integrating technology into education among general public.
- Raise public awareness of the importance of digital skills and competences.

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Survey Research

Overview

The results of the report are based on a systematic analysis of data from two questionnaires that were prepared by a working group and sent to project participants from Program Countries' Universities. Representatives of the Program Countries 'Universities working groups collected and submitted the necessary data for analysis.

- The **object** of the analysis is programs and curricula in the universities of the countries participating in the project, focused on teaching basic digital competences and skills.
- The **purpose** of the analysis is to identify and select the most successful programs and curricula of Program Countries 'Universities for subsequent use in Ukraine in teaching digital competencies.

Methodology

The desk-top research methodology for data collecting and analysis was conducted. The main document on which both questionnaires are based is the EU DigComp frameworks[21]. A set of 21 digital competencies presented in this document defines all the necessary digital skills for modern citizens of the European Union. These competencies can be used in relevant educational programs in Ukraine.

The first questionnaire WP1.1-1 is aimed at collecting and quantitative analysis of general data on programs and curricula, and contains the following data for each of them:

- Educational institution / university
- Specialty
- Specialization
- Name of the discipline
- Number of ECTS credits
- What competences and at what level covers (in your opinion).

The form of the questionnaire WP1.1-1 is presented in Appendix 1.

[21] https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-21-digital-competence-framework-citizens-eight-proficiency-levels-and-examples-use

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The second questionnaire WP1.1-2 aims to identify the best examples of DC learning programs in Program Countries 'Universities. It contains more detailed information about the training courses, including:

- Partner name:
- Course title:
- Number of ECTS credits allocated:
- Subject annotation:
- Course form: Online/auditorium/
- Study outcomes of the subject
- Subject content.
- Study hours:
- Evaluation procedure of knowledge and abilities:
- Availability of certification.
- Study programs.
- Other important information.
- Links.

The form of the questionnaire WP1.1-2 is presented in Appendix 2.

Sampling

Data were collected from five Program Countries' Universities:

- Vytautas Magnus University (VMU), Lithuania;
- Carinthia University of Applied Sciences (CUAS), Austria;
- Czech University of Life Sciences Prague (CULS), Czech Republic;
- Pedagogical University (UP), Poland;
- University Polytechnics of Bucharest (UPB-CAMIS), Romania.

The data and their quantitative analysis are presented below. Based on data collected in first questionnaire WP1.1-1 sent by the universities 89 DC learning programs and curricula were processed and analysed (Figure 7).

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In our opinion, the questionnaires allow us to evaluate the existing training systems for citizens (target groups) in terms of DC development based on the needs of the EU labor market, highlight best practices and experiences of preparing DigComp citizens for EU partners.

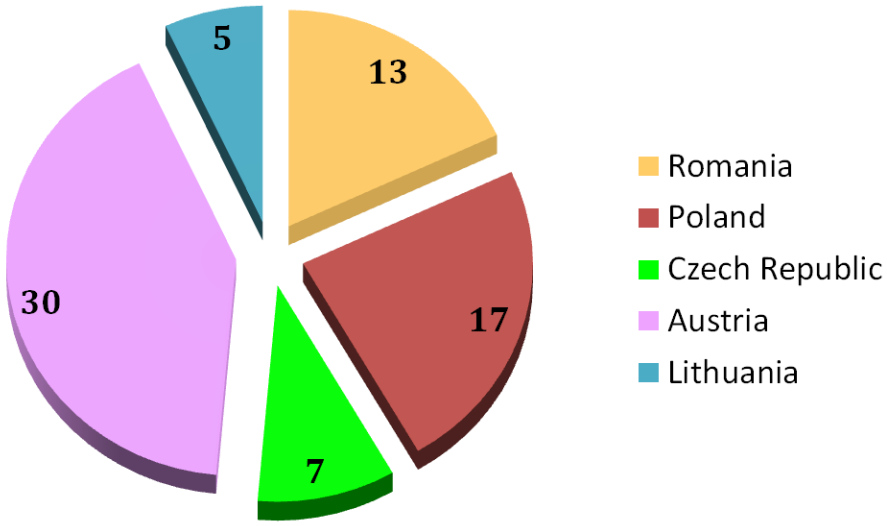

Figure 7: The number of submitted programs by country

For an analysis of citizen training, WP1.1-1 reflects the competencies highlighted in DigComp 2.1. We propose to use only 3 levels of competence (Foundation - F, Intermediate - In, Advanced - A). The evaluation of the orientation (specialization) of training programs was carried out according to the criterion of program coverage of the total number of competencies out of 21 proposed in DigComp 2.1. At the same time, if the program covers less than 15% of the total number of competencies, then we consider it narrowly specialized (Narrow). A program that covers more than 50% of competences is a universal (multi-disciplinary) program (Wide). The rest were considered as specialized programs (Specialized).

When completing the questionnaire, experts from partner universities evaluated the training programs taking into account the amount of competences and their acquiring level. General results are presented in Figure 8.

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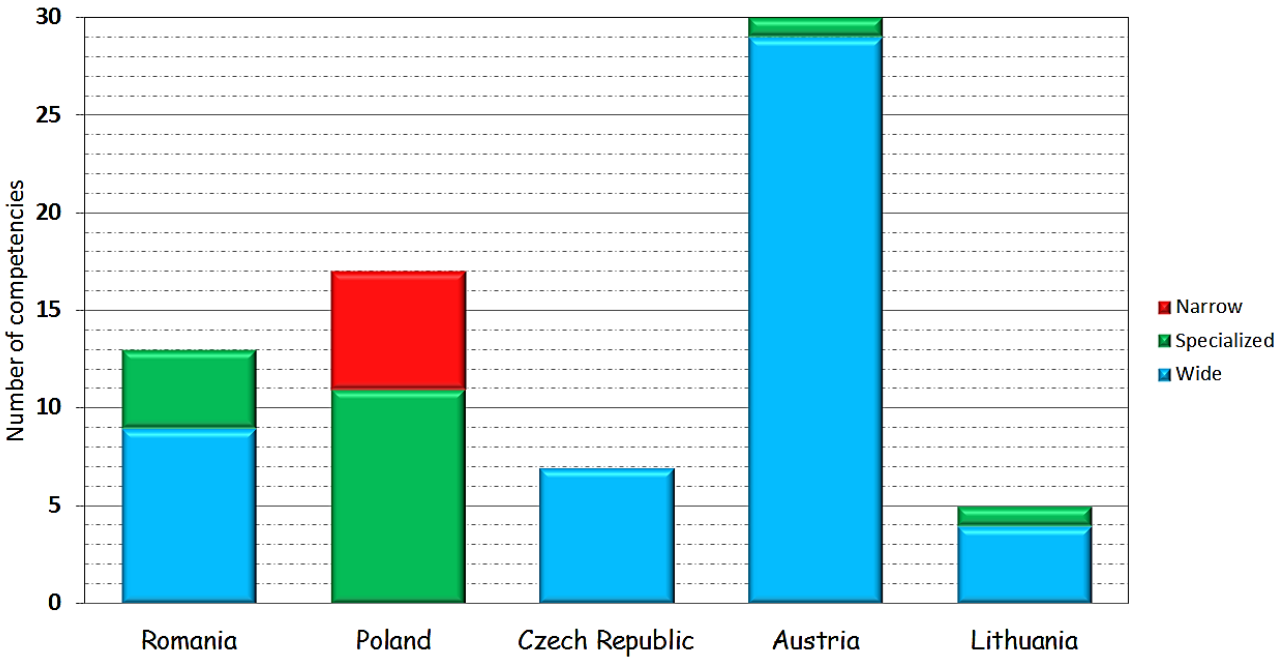

Figure 8: Covering of competences by DC-programs for project participant countries

Obviously, in partner countries, in preparing citizens at universities, they use mostly universal (multi-disciplinary) programs (56%). And only about 15% of the programs are highly specialized.

The curricula of Austria (fig. 9) are practically all multi-disciplinary and cover a wide range of competencies that students have to acquire. Programs are focused mainly on acquisition competencies at the level of Basics (Foundation) - 76% and Intermediate (20%) (fig. 10). The presented programs (Table 1) are studied for quite a long time, mainly more than 2 ECTS credits (fig. 11).

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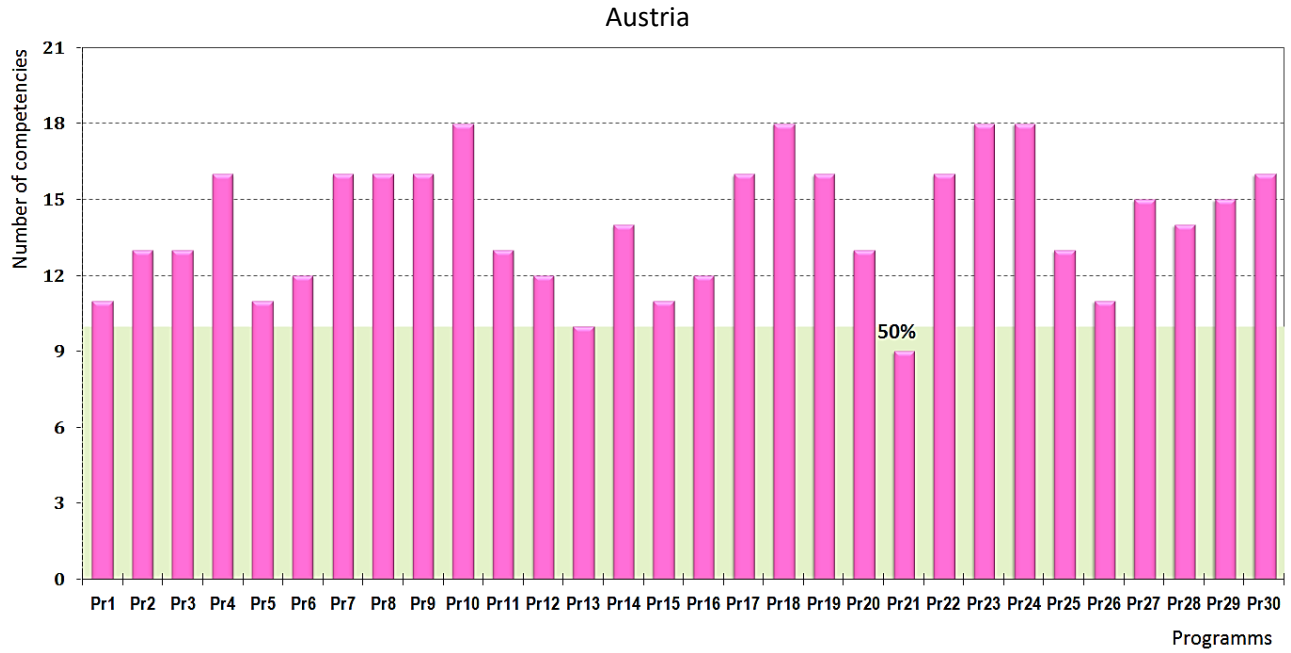

Figure 9: Covering of competences by DC-programs in Austria

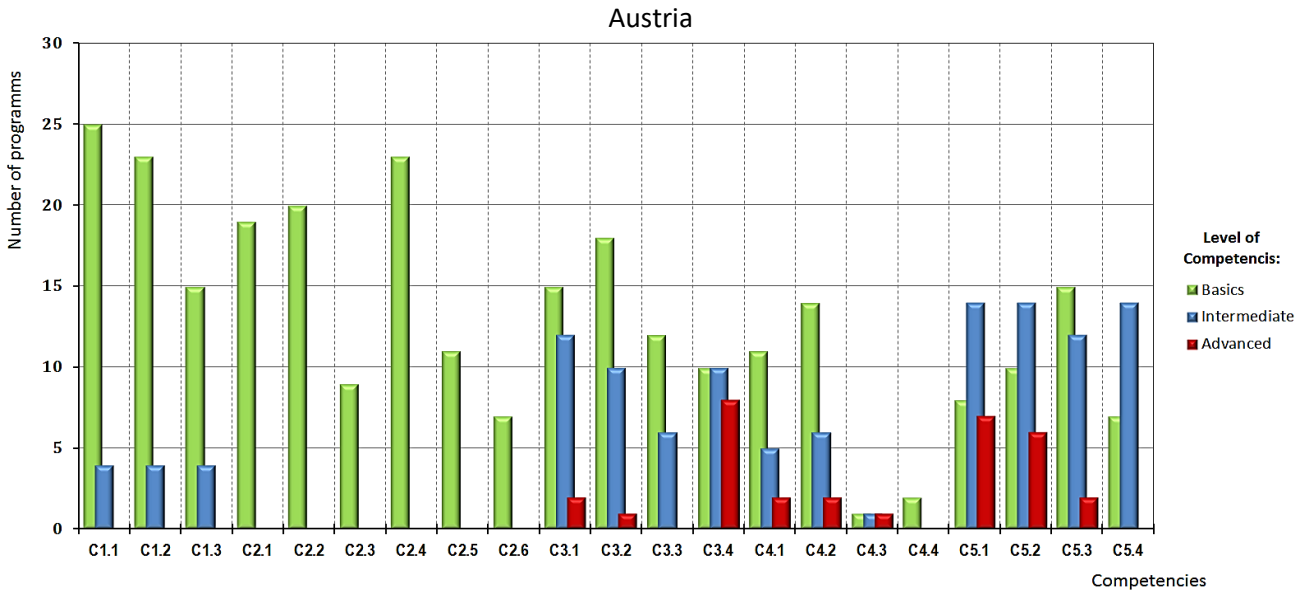

Figure 10: Competences acquisition level for DC-programs in Austria

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Table 1. List of DC programs according to specializations in Austria

Specialization	Name of the discipline
Basics of Computer Science	Introduction to Computer Science 1 Introduction to structured and object-based programming
Specific supplementary subjects	Databases Algorithms and data structures Computer networks and network programming Introduction to theoretical computer science Software Development Internship (for the teaching profession)
Didactic basics	Introduction to Computer Science Didactics Specialist Didactics Programming, Algorithms/Data Structures Specialist didactics Hardware and system software
Basics of Computer Science	Introduction to Computer Science Programming Introduction to structured and object-based programming Human-Computer Interaction
Specific supplementary subjects	Databases Data structures and algorithms Software development in distributed environments Software Development Internship System-based programming Computer graphics Introduction to Information Security
Didactic basics	Introduction to Computer Science Didactics Specialist Didactics Programming, Algorithms/Data Structures Didactics Operating system, hardware and networks
Engineering & IT (System engineering)	Computer Science 1: Basics and Programming
Business & Management (Digital Business Management)	IT Basis
Computer Science Teaching	Didactics of application software (3 semesters) Computer Science(4,5,6 semesters) Didactic support in computer science (4,5,6 sem.) Computer Science Didactics at Secondary Level (7 semesters)

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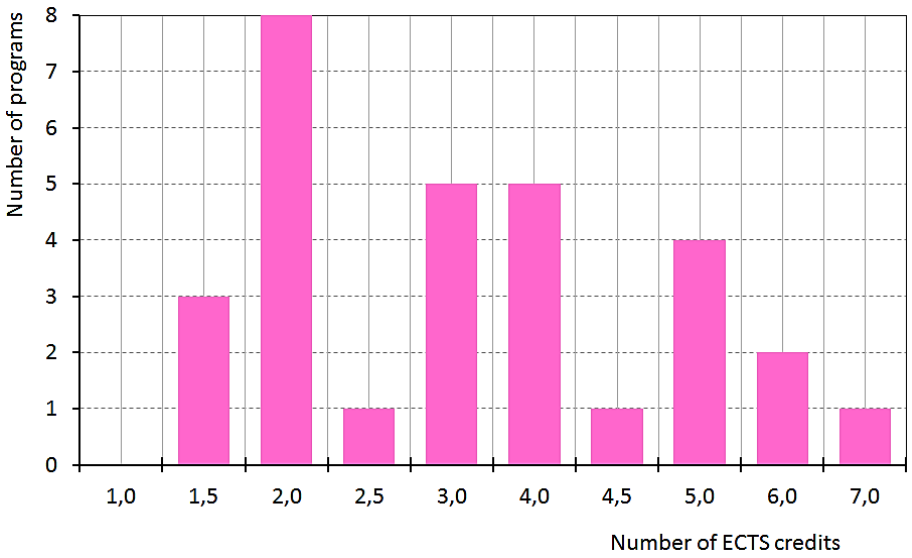

Figure 11: Duration of study programs in Austria

In the Czech Republic, wide-ranging training programs are also used (fig. 12), which are aimed at acquisition a significant number of digital competencies. In this case, it is assumed that the listeners will acquiring them at the basic and intermediate level (fig. 13).

The duration of the studied programs (Table 2) is quite long (fig. 14).

Table 2 . List of DC programs according to specializations in Czech Republic

Specialization	Name of the discipline
Business Administration	Information and Communication Technologies
Economics and Management	Information and Communication Technologies
Regional and Social Development	Information and Communication Technologies
Economics and Management	Informatics
Business Economics and Management	Informatics
Arts management	Informatics

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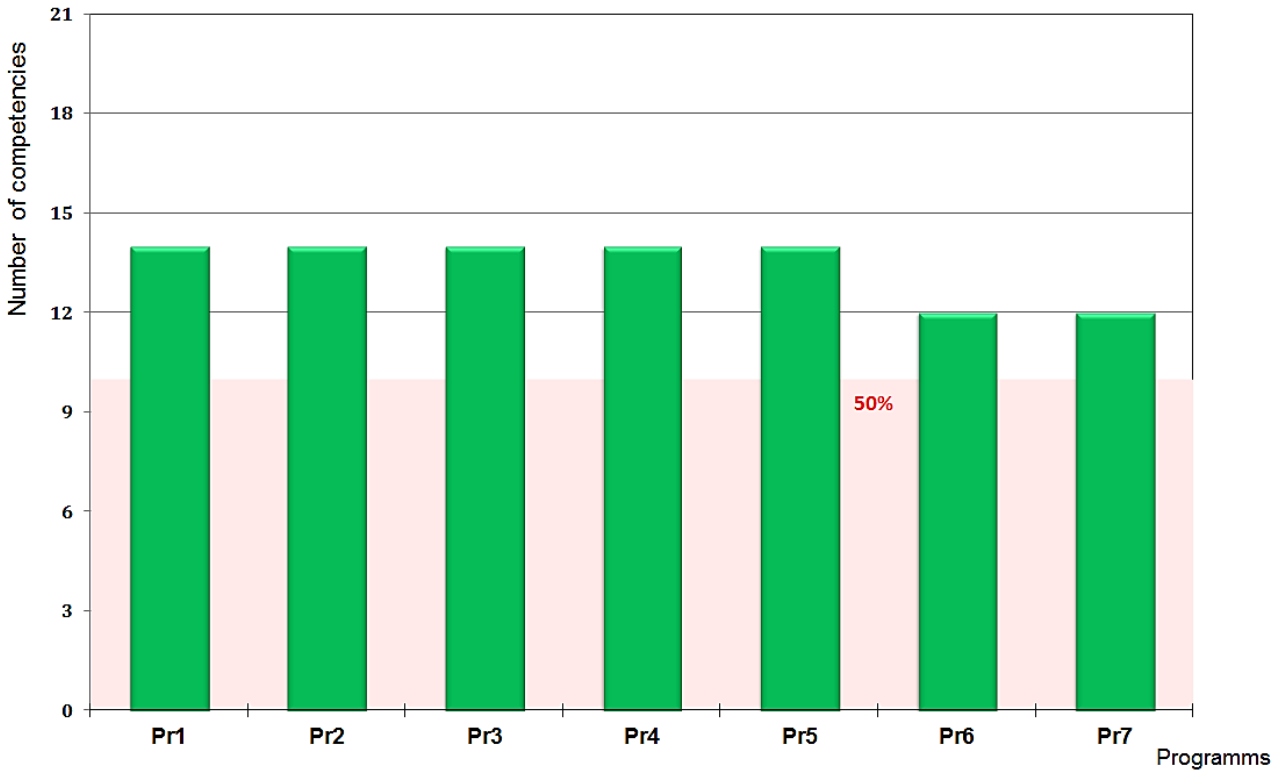

Figure 12: Covering of competences by DC-programs in Czech Republic

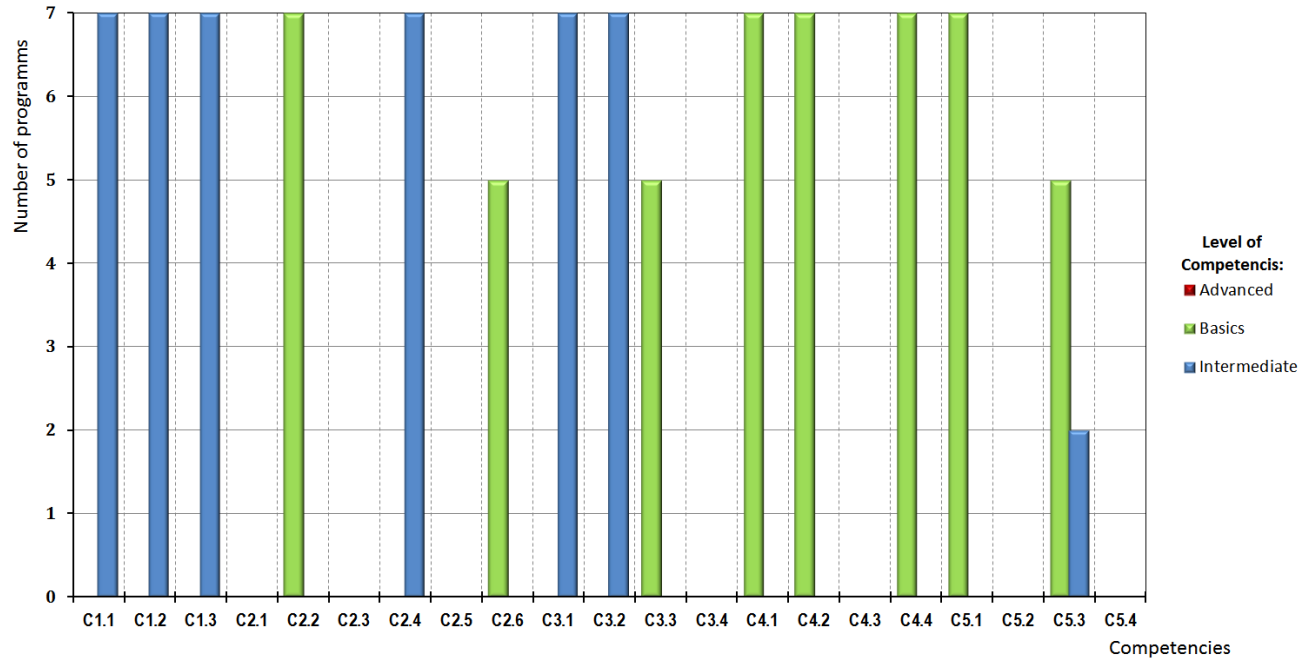

Figure 13: Competences acquisition level for DC-programs in Czech Republic

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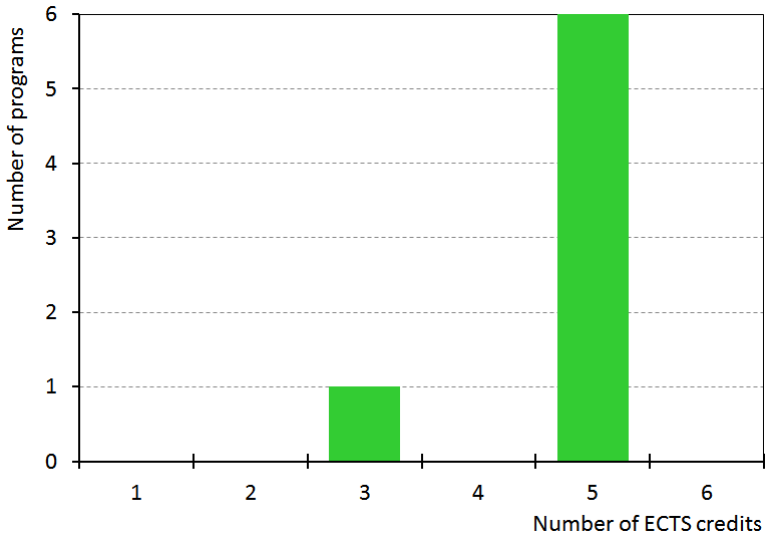

Figure 14: The duration of the study subjects in Czech Republic

Programs from Lithuania mainly oriented to universal (multi-disciplinary) programs: 80 % – Wide, 10 % – Specialized (fig. 15).

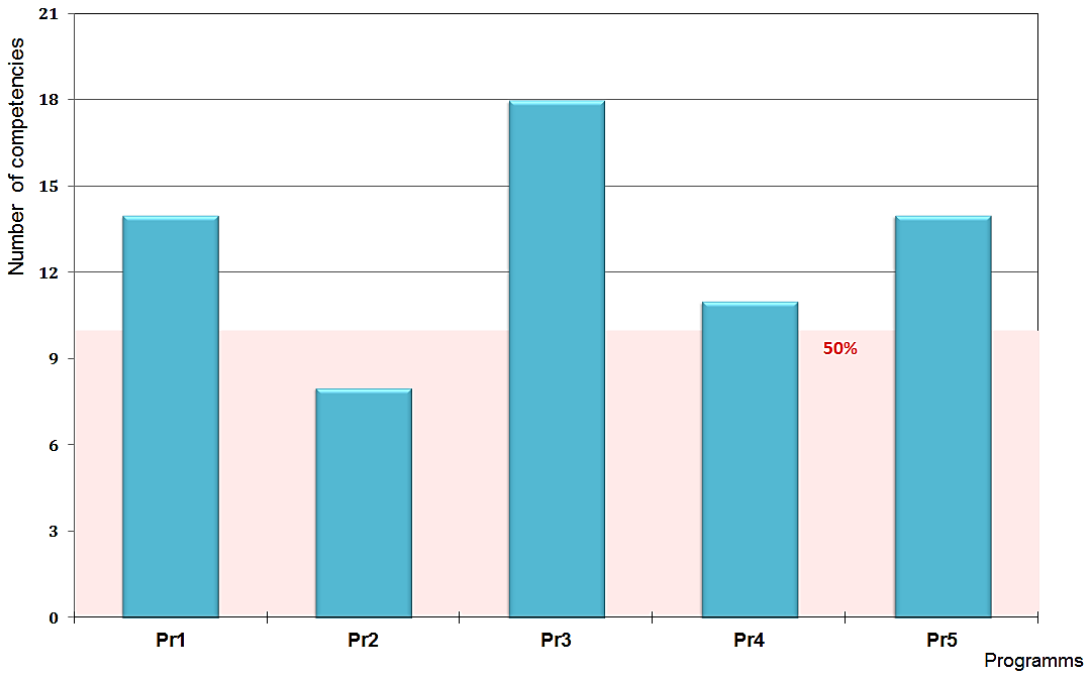

Figure 15: Covering of competences by DC-programs in Lithuania

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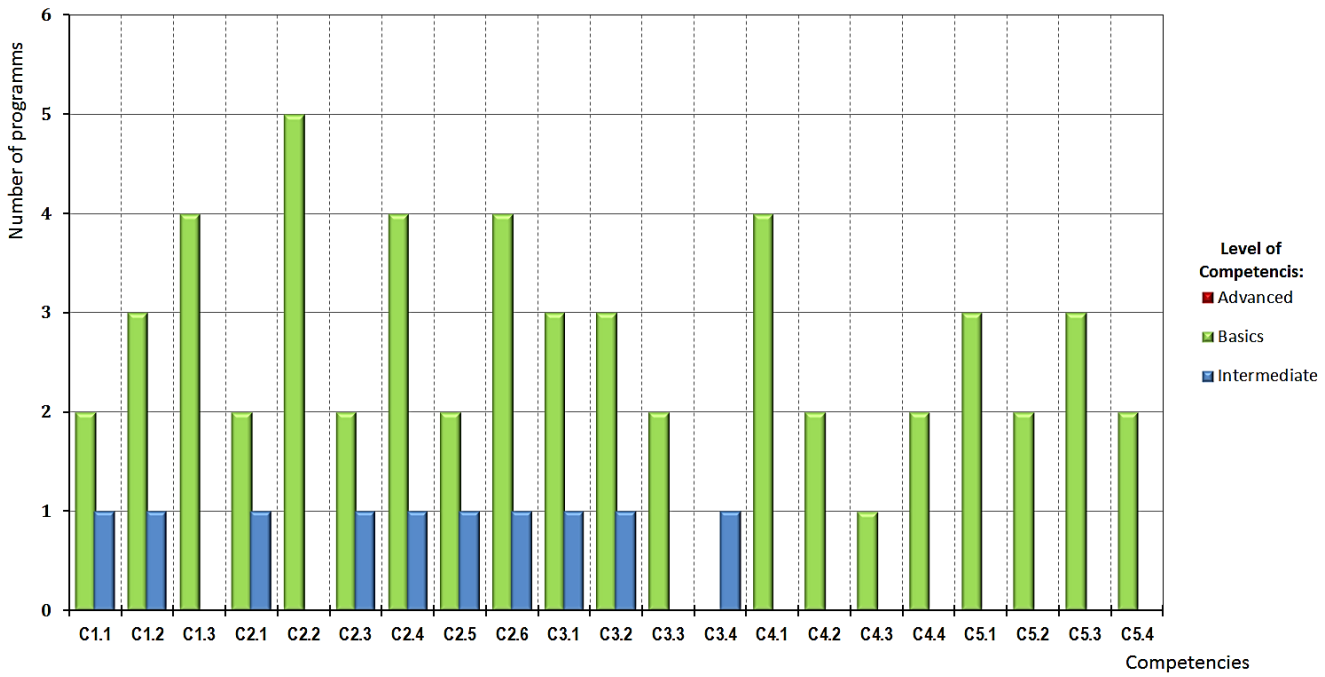

Figure 16: Competences acquisition level for DC-programs in Lithuania

Competence acquisition should be based on foundation level (fig.16). The presented in Table 3 programs are long-term ones and 4 and more credits ECTS (fig.17).

Table 3. List of DC programs according to specializations in Lithuania

Specialization	Name of the discipline
This course is taught in all VMU study programs: physical, biomedical and technology sciences, art, music, humanitarian, social, law, economic, education, political sciences	Computer Literacy
The course is optional for physical, biomedical and technology sciences, art, music, humanitarian, social, law, economic, education, political sciences.	Information Society Technologies
The course is optional for physical, biomedical and technology sciences, art, music, humanitarian, social, law, economic, education, political sciences studies.	Digital Humanities
The course is optional only for humanitarian sciences studies.	Digital Linguistics
Compulsory course in Hydrotechnical construction engineering, Planning, Renewable energy technologies, Production and recycling engineering, Agricultural mechanics engineering, Forestry, Applied Ecology study programmes. Optional course in Logistics and Trade, Accounting and Finance study programmes.	Information Technologies

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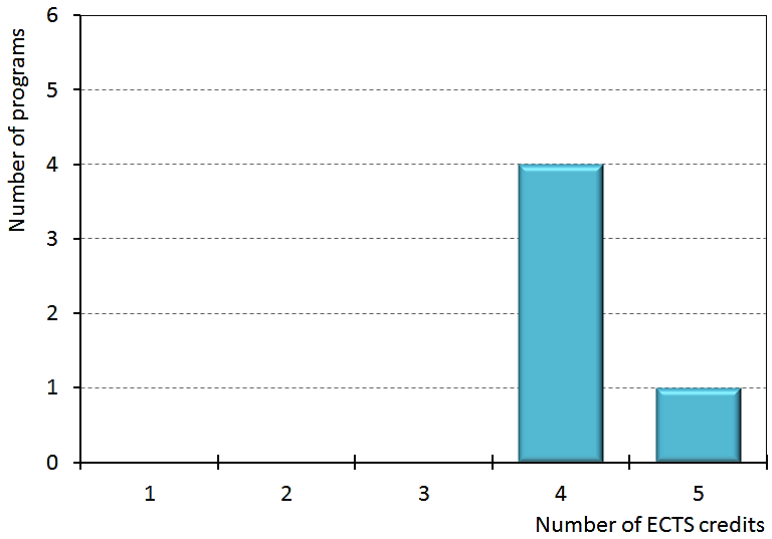

Figure 17: The duration of the study subjects in Lithuania

Analysis of the answers of experts from Poland shows that mainly specialized (fig. 18) relatively short (up to 3 credits) (fig. 20) digital competence training programs for acquisition at the middle and high level (fig. 19) are used.

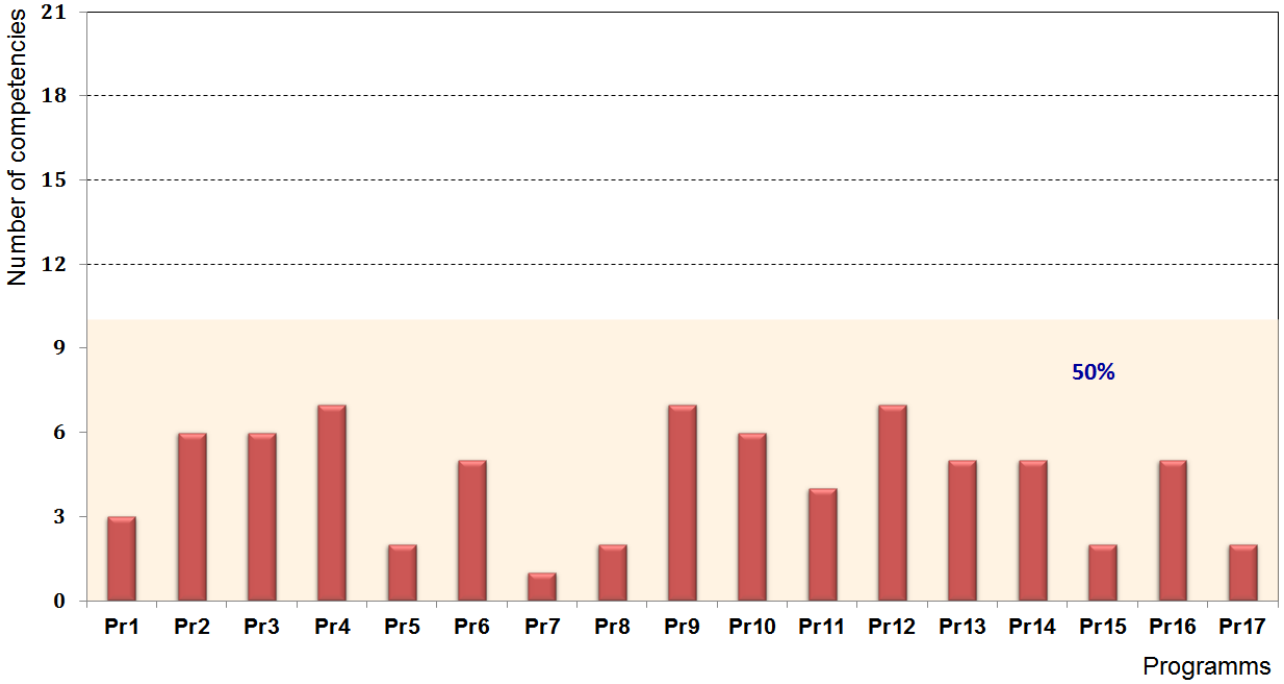

Figure 18: Covering of competences by DC-programs in Poland

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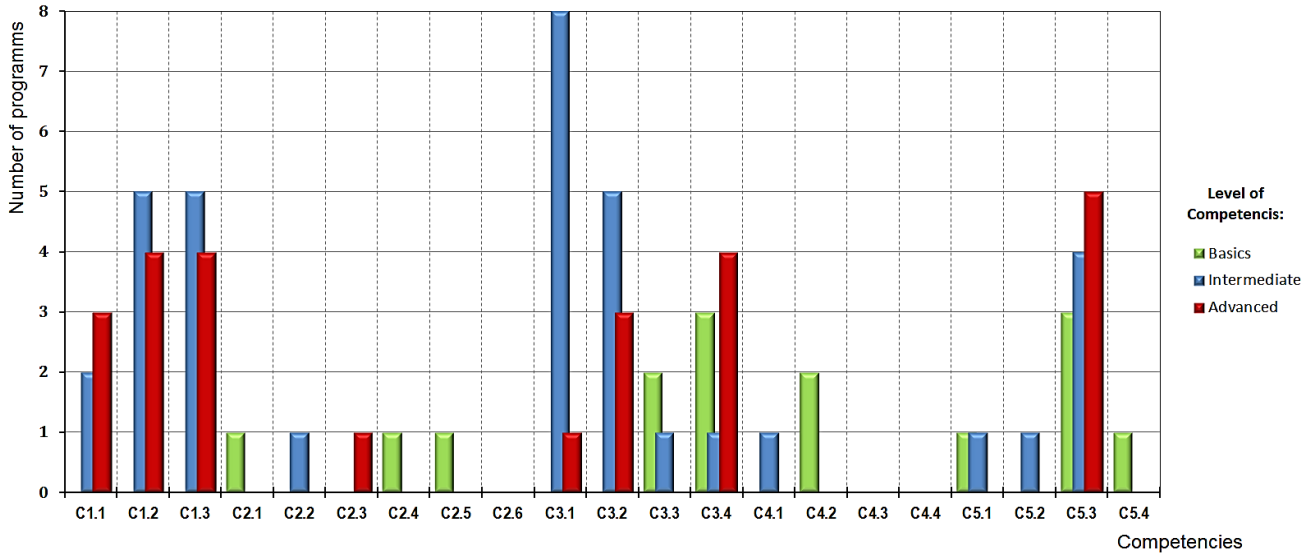

Figure 19: Competences acquisition level for DC-programs in Poland

Table 4 List of DC programs according to specializations in Poland

Specialization	Name of the discipline
E-administration	Word processing and multimedia presentations
	Spreadsheets in office work
	Database management
	Digitization of administration
	Computer networks and security
	Creating and publishing websites
	Administration of operating systems
	Graphics in polygraphy
Mathematics	Excel and introduction to VBA in Excel
	Databases
	Informatics
	Symbolic mathematical computation programs 1
	Introduction to R
	Object oriented programming
	Descriptive statistics with Excel
	Theoretical Foundations of Computer Science

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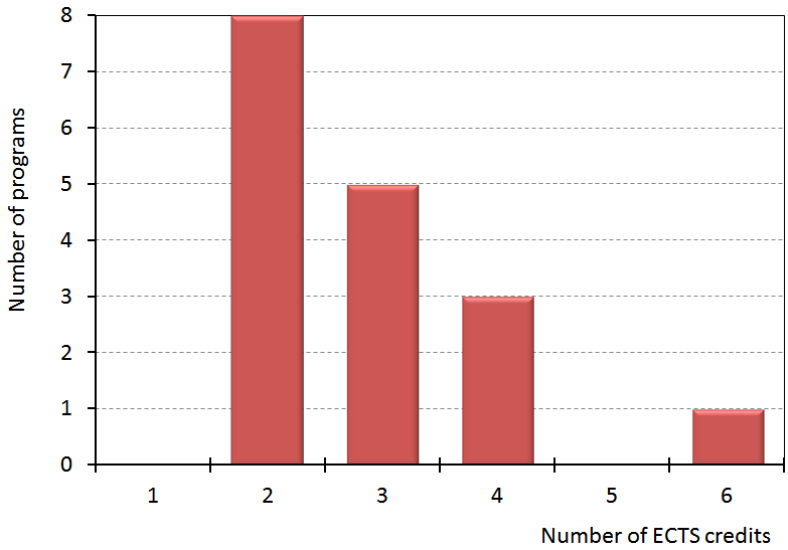

Figure 20: The duration of the study subjects in Poland

Programs of Romania are more universal than Polish ones – 70% – Specialized, 30% – Narrow (Fig. 21). Romanian programs are aimed to acquisition of basic competences on foundation level (Fig. 22).

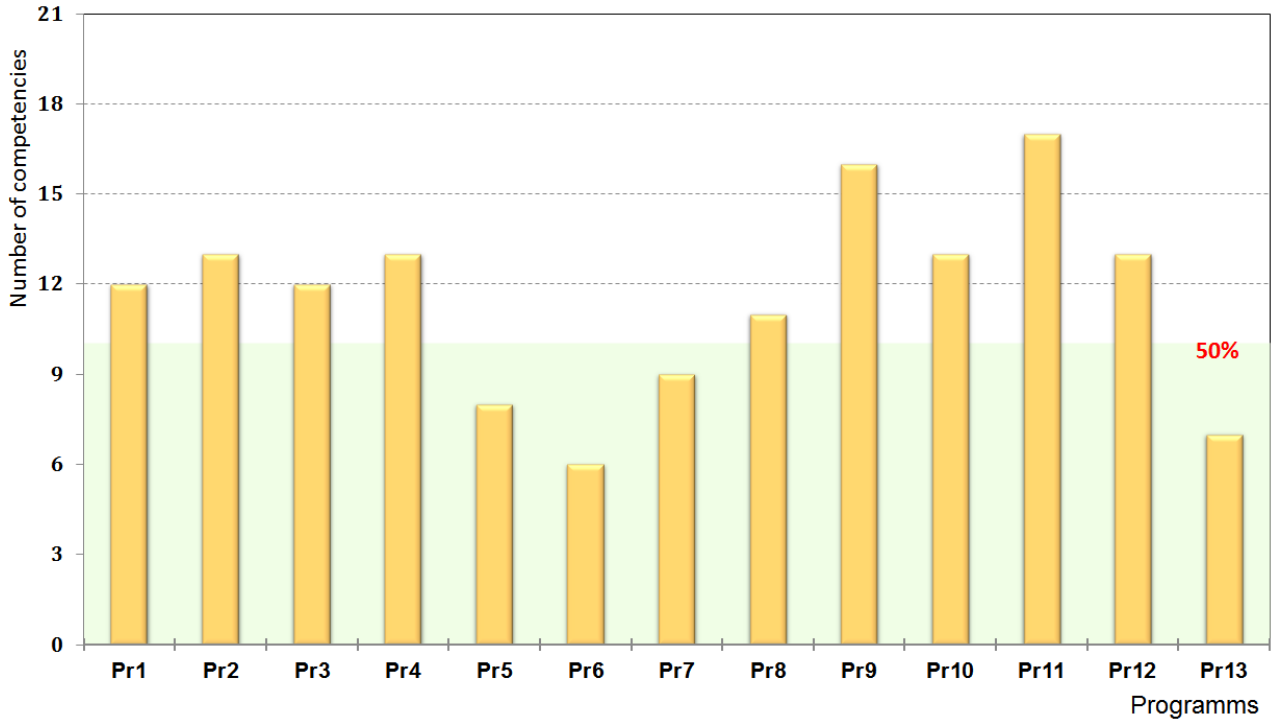

Figure 21: Covering of competences by DC-programs in Romania

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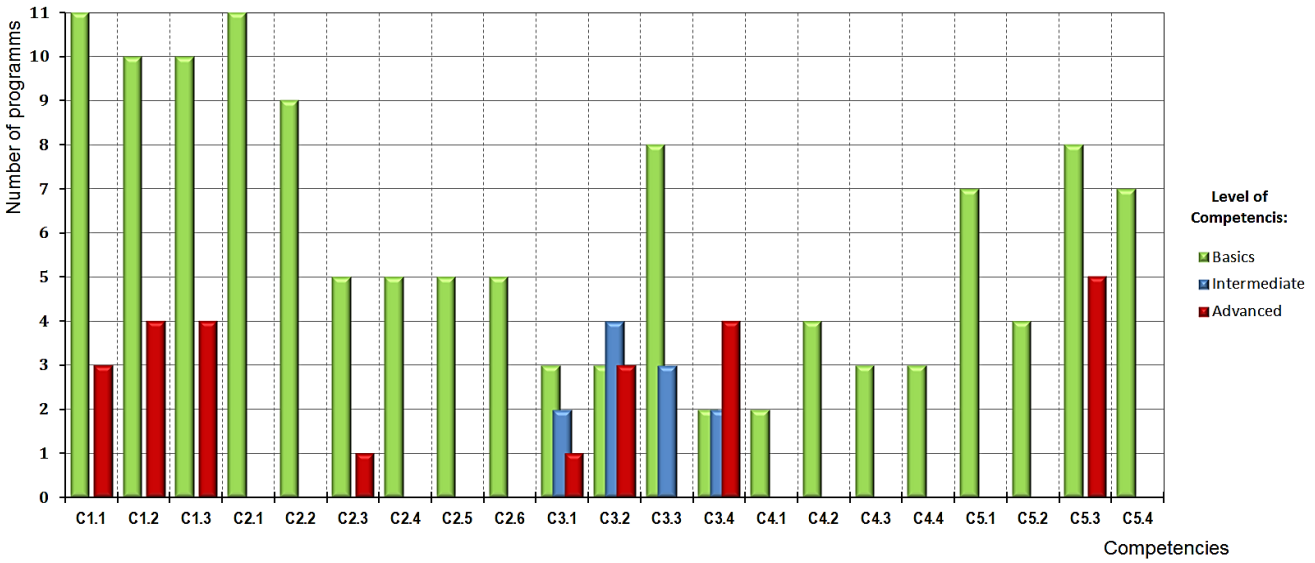

Figure 22: Competences acquisition level for DC-programs in Romania

Programs of Romania (Table 5) are characterized by high volume and long-term duration, mainly – 3 and more credits ECTS (fig. 23).

Table 5. List of DC programs according to specializations in Romania

Specialization	Name of the discipline
Engineering and Quality Management	Computer Programming 1
	Computer Programming 2
	Advanced 3D Design
	Information Systems in Quality Engineering
	Engineering and Quality Management
	Database
	Information technology in engineering 1
	Information technology in engineering 2
Education Sciences	Use of information tools (web 2.0) into the communication about career counseling
	Multimedia in education
	Computer Assisted Training
	Informatics for Educational Organizations
Engineering and management	Business Informatics

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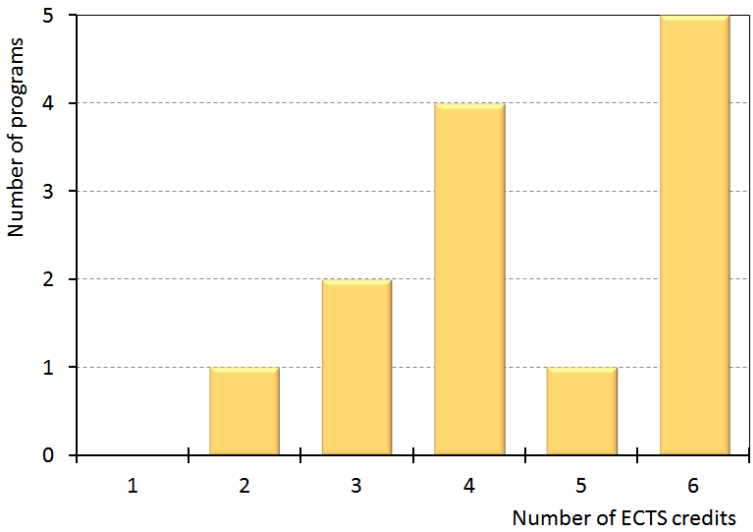

Figure 23: The duration of the study subjects in Romania

Common to all respondents' answers is that the competences of C4.3 Protecting health and well-being and C4.4 Protecting the environment are covered by the minimum number of programs in all partner countries.

Summary

1. Training programs for citizens from EU partner countries are characterized by diversity and heterogeneity in term of digitalization of economics, social spheres and labor markets.
2. Programs covering more than 50 percent digital competences are predominant on Foundation level and have more than 3 credit ECTS.
3. Narrowly specialized programs are prevailing on advanced learning level of ICT courses.

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Best Practices

This part of the report is devoted to a description of Best practices that have been accumulated in the countries participating in the project. They provide descriptions of the most successful DC programs and curricula in Program Countries' Universities.

Based on data collected in questionnaire WP1.1-2 sent by the universitieswhich are members of consortium we analysed 33 DC learning programs and curricula. All the programs and curricula are described in details according to the questionnaire, see Appendix 2. We conducted detailed analysis of orientation of the programs to certain specializations, study outcomes, numbers of credits, subject contents, DC competences covered by the programs etc.

As a result of the analysis a number of most successful programs which are recommended for using in Ukraine were selected. Descriptions of the selected programs are represented below.

Best Practice for teachers

1. **Educational institution / university**: Technical University Graz
2. **Course title**: Basics of Computer Science
3. **Number of ECTS credits allocated**: 20,5
4. **Subject annotation**:

- overview of the field of computer science and its specific ways of thinking and working Basics of
- programming with modern software
- basics of hardware architecture

5. **Course form**:

- Auditorium

6. **Study outcomes of the subject**

After completing the course, students will be able to:

- to have an overview of the different areas of information science and can understand and explain the interaction of these areas;
- to have basic knowledge and skills in programme development;
- can describe, understand and use computer hardware in interaction with software;
- to know basic ways of thinking and working in computer science and can use them to describe and solve computer problems.

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7. Subject content.

Lectures (topics):

- Introduction to Computer Science
- Programming
- Introduction to structured and object-based programming
- Computer Networks and Organization
- Human-Computer Interaction

Practical works:

- Introduction to Computer Science
- Programming
- Introduction to structured and object-based programming
- Human-Computer Interaction

8. Study hours:

Work in auditorium in hours: 11/week in semester

Practical works in hours: 8/week in semester

Individual student work (including preparation for laboratory work, colloquium and exam)

9. Evaluation procedure of knowledge and abilities:

Examination

10. Availability of certification.

Graduates of the Bachelor's degree programme in general secondary education are awarded the academic degree "Bachelor of Education".

11. Study programmes.

Secondary teacher training General education

12. Other important information.

The university didactic approach is based on concepts of research-based and dialogical learning and aims at active knowledge construction and self-dependent competence acquisition. Learning-promoting performance feedback and performance assessments are integrative parts of the teaching/learning concepts and are related to the competences to be acquired. The model of the Pedagogical-Practical Studies is based on the model of reflective practitioners and aims to link educational, technical and didactic knowledge, to translate it into action competence and to plan,

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evaluate, analyses, reflect and further develop teaching according to the principles of practical research.

13. Links.

https://www.tugraz.at/en/studying-and-teaching/degree-and-certificate-programmes/bachelors-degree-programmes/computer-science/

https://mibla-archiv.tugraz.at/16_17/Stk_11a/Bachelorstudium_Informatik_mit_Erg_2017.pdf

Best Practice in Engineering

1. Educational institution / university: Carinthia University of Applied Sciences

2. Course title: Computer Science 2: Algorithms and Object-oriented programming

3. Number of ECTS credits allocated: 5

4. Subject annotation:

- Pointer and dynamic memory;
- Object-oriented programming in C ++: classes, objects, constructor, destructor, inheritance;
- Native myDAQ programming;
- Lists and trees;
- Recursion;
- Graphical user interfaces with MFC.

5. Course form:

– Auditorium
– Integrated course, programming exercises

6. Study outcomes of the subject

After completing the course, students will be able to:

- Students know pointers and dynamic memory management;
- Students are able to develop smaller programs with C++ (object oriented);
- Students are able to use the data structures list and binary tree in practical applications;
- They are able to apply recursion to simple examples;
- Students are able to program the myDAQ with native code;
- Students are able to create graphical user interfaces with MFC.

7. Subject content.

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Lectures (topics):

- Algorithms and object-oriented programming

Practical works:

- Algorithms and object-oriented programming

8. Study hours:

Work in auditorium in hours: 50

Practical works in hours: 50

9. Evaluation procedure of knowledge and abilities:

Final exam

10. Availability of certification.

Bachelor of Science in Engineering (BSc)

11. Study programmes.

Systems Engineering

12. Other important information.

Literature :

G. Pomberger, H. Dobler: "Algorithmen und Datenstrukturen: Eine systematische Einführung in die Programmierung", Pearson Studium, 2008
Ulrich Breymann; C++ Einführung und professionelle Einführung, Carl Hanser Verlag, 2003, 7., überarbeitete Auflage
Bjarne Stroustrup; Die C++ Programmiersprache; Addison-Wesley Verlag, 2000; 4, aktualisierte und erweiterte Auflage

13.Links.

https://www.fh-kaernten.at/en/degree-programs/engineering-it/overview/engineering-it/bachelor/systems-engineering/current-courses/?vlvId=4340353394&alvId=4331036312&param=

Best Practice in Digital Business Management

1. Educational institution / university: Carinthia University of Applied Sciences

2. Course title: Fundamentals of IT

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3. Number of ECTS credits allocated: 4

4. Subject annotation:

The contents of the course are related on the one hand to principles of computer science and on the other hand related to the usage of MS Office products. In the first part, students will get to know basic principles of computer science, like bits and bytes, data storage and operating systems. The second part of the course will focus on MS Office products. Students will learn advanced usage of MS Word (e.g. to create a scientific document like a master thesis). In addition students will learn how to use MS Excel to solve typical business problems (usage of functions, date related calculations, database operations ...).

- Business Software
- Internet and web technology
- Digital Media Literacy

5. Course form:

Auditorium

6. Study outcomes of the subject

After completing the course, students will be able to:

- review the basic principles of computer science (e.g. data storage, operating systems).
- create a scientific document by using MS Word.
- use MS Excel in a business environment.

7. Subject content.

Lectures (topics):

- Introduction to digitization
- IT &organisation

8. Study hours:

Work in auditorium in hours: 80

9. Evaluation procedure of knowledge and abilities:

Computer - assisted written examination

10. Availability of certification.

Bachelor of Arts in Business

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11. Study programmes.

Digital Business Management

12. Other important information.

Literature : Fahnenstich K., Haselier R. G.: Microsoft Word 210 - Das Handbuch; Microsoft Press (2011)

Schieke D., Schuster H., Schwenk J.: Microsoft Excel 210 - Das Handbuch; Microsoft Press (2010)

Gumm H.P., Sommer M.: Einführung in die Informatik; Oldenbourg Wissenschaftsverlag (2010)

Stahlknecht P., Hasenkamp U.: Einführung in die Wirtschaftsinformatik, Springer Verlag (2012)

13. Links.

https://www.fh-kaernten.at/en/degree-programs/management/overview/management/bachelor/curriculum/?vlvId=4312275821&alvId=&param=

Best Practice in physical, biomedical and technology sciences, art, music, humanitarian, social, law, economic, education, political sciences studies

1. Partner name:

Vytautas Magnus University (VMU)

2. Course title:

Digital Humanities

3. Number of ECTS credits allocated: 4

4. Subject annotation:

The course introduces the computer tools for data collection, processing and encoding, analysis and visualization that are useful in the social sciences and humanities research and practice. Students become aware of different kinds of data, methods of their collection and analysis and ethical issues. During the course, students create collaborative and multidisciplinary digital humanities projects based on their research of sociocultural phenomena.

5. Course form: Online/auditorium/

Auditorium**.**

6. Study outcomes of the subject

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After completing the course, students will be able to:

– Describe the integrated methods for analyzing public / cultural processes and the possibilities of using computer technologies in research. Apply and combine field research methods and digital tools for collecting and analyzing text, audio, and visual data.

– Describe traditional and digital historical sources and research methods, apply them to collect and analyze data.

– Use intelligent survey tools (electronic questionnaires with game elements and mobile phone gadgets) to collect survey data.

– Apply computer analysis tools to numerical and textual data.

– Describe the possibilities of 'social networking' research, to use it to collect and analyze research examples.

– Describe data mining techniques and apply them to text analysis, recognizing text objects and events.

– To explain the application of the principles of communication design to visualize project results, to form an appropriate information architecture.

– Select an effective presentation type, form its structure and create a presentation.

7. Subject content.

Lectures (topics):

1. What is Digital Humanitarianism? Relevant public / cultural processes and research issues. Use of computer technology in research. Research model. Integrated research methods and data.

2. Real and Virtual Ethnography - Real and Virtual Groups (Twitter, FB) monitoring, interviewing, document analysis. Combining qualitative and quantitative methods. Research questions and examples of research. Field research ethics, researcher basics and digital tools.

3. Use of computer tools for processing and analyzing text, sound, visual data of field research. Digitization and storage of data, preparation for analysis, coding, identification and comparison of objects and events. Techniques and tools for visualizing text information.

4. Digital historical sources. Topical research questions, traditional and digital research methods - text analysis, data and text extraction, maps, data visualization. Examples of Digitization, Preservation and Visual Presentation of Historical Texts. Techniques and tools for visualization of textual information.

5. Digitization and storage of data and texts. Creating maps.

6. Intelligent research tools - electronic questionnaires and mobile phone gadgets, their use and research examples. Integration of game elements into questionnaires. Ethics of the questionnaire and basics of the researcher's work.

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7. Fundamentals of computer questionnaire data analysis, advantages of numerical and textual data integration, data visualization, presentation.

8. 'Social networks', opportunities and perspectives of their research, related research issues, analysis of examples. Research ethics and research fundamentals.

9. Computerized analysis and visualization of social network data.

10. Large data, data mining and examples of its use. Data storage. Metadata formats. Ethics in dealing with large data and the basics of the researcher's work.

11. Preparation of texts for analysis. Methods of Text Data Analysis and Classification of Texts.Object and event recognition in text. Information maps suitable for large data. Methods and tools for information visualization.

12. Conceptualization and visualization of project results.

Practical works:

–

8. Study hours:

Please provide how many hours is dedicated for each category.

Lectures - 15 hours,

Seminars / workshops - 15 hours,

Virtual collaboration - 15 hours,

Individual self-study (project preparation) - 75 hours.

9. Evaluation procedure of knowledge and abilities:

Please provide short information how the knowledge are evaluated after this course.

Colloquium - 15% of final grade.

Project - 35% of final grade.

Exam - 50% of final grade.

10. Availability of certification.

YES. If the final grade is 8, 9 or 10, the student is entitled to an ECDL certificate.

11. Study programmes.

The course is optional for physical, biomedical and technology sciences, art, music, humanitarian, social, law, economic, education, political sciences studies.

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Best Practice in Engineering, Forestry, Applied Ecology

1. Partner name:

Agriculture Academy at Vytautas Magnus University

2. Course title:

Information Technologies

3. Number of ECTS credits allocated: 4

4. Subject annotation:

This course is designed to teach students the basics of computers and information systems. The course emphasizes technological advances of the computer, communications and consumer electronics industries generated through the exchange of information in the digital format used by computers.

5. Course form: Online/auditorium/

Auditorium

6. Study outcomes of the subject

After completing the course, students will be able to:

– use spreadsheet tools and tools to solve practical tasks;

– create a database and modify it according to the requirements; create queries, forms, and reports;

– develop an integrated document that combines objects created by various applications.

7. Subject content.

Lectures (topics):

1. The Information Society and the importance of Information Technologies. Virtual learning environments.
2. Modern computer hardware, data structures.
3. System and application software.
4. Information networks, group work on a computer network.
5. Electronic spreadsheet technology.
6. Database technologies.

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7. Data analysis and preparation of documents with electronic spreadsheets. Graphical data analysis tools.
8. Using mathematical, logical and other functions in electronic spreadsheets. Macros.
9. Lists: Data Processing and Analysis.
10. Use of spreadsheets tools for solving practical tasks
11. Design of DB tables and their relations. Forms, queries and reports.

8. Study hours:

Lectures - 16 hours;
Practical works - 25 hours;
Consultations, exam - 3 hours;
Individual work - 63 hours.

9. Evaluation procedure of knowledge and abilities:

Practical work - 30% of final grade;

individual task - 10% of final grade;

exam - 60% of final grade.

10. Availability of certification.

NO.

11. Study programmes.

Compulsory course *in Hydrotechnical construction engineering, Planning, Renewable energy technologies, Production and recycling engineering, Agricultural mechanics engineering, Forestry, AppliedEcology study programmes.*

Optional course in Logistics and Trade, Accounting and Finance study programmes.

Best Practice in Economics and Management

1. Partner name: CULS

2. Course title: ICT for Managers – EMN1 (ETEA8E)

3. Number of ECTS credits allocated: 5 ECTS

4. Subject annotation:

The aim of the course is to develop students' knowledge of new information and communication technologies and to prepare the student - future manager - to their effective use primarily in terms of

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their own managerial needs. The subject responds to the development of ICT and creates conditions for effective use of these technologies in related vocational subjects. When processing semester project, students solve complex practical situations of enterprises in relation to their information systems.

5. Course form:

Auditorium

6. Study outcomes of the subject

The aim of the course is to develop students' knowledge of new information and communication technologies and to prepare the student - future manager - to their effective use primarily in terms of their own managerial needs. The subject responds to the development of ICT and creates conditions for effective use of these technologies in related vocational subjects. When processing semester project, students solve complex practical situations of enterprises in relation to their information systems.

Knowledge:

Graduates are acquiring broader theoretical knowledge and skills at use and management of modern information and communication technology (ICT). Theoretical knowledge in ICT field is a fundament of effective use of various internet technologies. Some knowledge is highly specialized and enables not only a scientific approach to use of modern information and communication technology, but it also gives the qualification for management of implementation and innovation of enterprise information systems. Graduates are gaining highly specialized education about chances of ICT applications that will allow them to work as middle and top managers. Graduates have a clear conception of the scope of their ICT knowledge and of their further possible development during the specialized study.

Skills:

The graduate can use acquired knowledge in different situations, e.g. to prepare a design and implementation of an e-commerce site, to innovate and to integrate information systems. He/she can solve some situation in usage different methods of Search Engine Optimization. He/she is mastering the rules for creating accessible web sites.

Competence - Communication:

The graduate can manage and control work operations, is able to improve the level of ICT utilization in the organization and can set and evolve strategic goals within the managed working group.

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Competence - Opinion:

Graduate's theoretical knowledge and practical skills are issue for managing the strategic situations in ICT usage. He /she can promote ICT knowledge for the company sustainable development.

Competence - Education:

The graduate has ability to educate and to develop in the field of information and communication technology and in other related fields. He /she can watch specialized information sources, specify his /her education needs and adjust the pace of the study through LMS (Learning Management System) to the personal needs.

7. Subject content

Lectures (topics):

1. Introduction into the course unit - Data-Information-Knowledge.
2. Development of ICT, The Architecture C/S.
3. Markup languages. Characteristics of HTML and XML.
4. Internet Infrastructure. WWW technologies.
5. Computer Graphics and Multimedia.
6. Client side Internet Technologies.
7. Server side Internet Technologies.
8. Usability and accessibility of web sites.
9. Data management, Modelling of the real world.
10. Architectures of Information Systems.
11. E-commerce - Internet marketing.
12. Knowledge society.

Practical works:

1. Introduction - server KIT, tasks - student projects.
2. Markup languages. Web site Usability.
3. Search Engine Optimization, PageRank.
4. Copywriting. Web site Accessibility.
5. Use of Social networks.

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6. Presentation and defend of students' projects + Assignment.

8. Study hours:

Please provide how many hours is dedicated for each category.

Work in auditorium in hours: 24

Practical works in hours: 12

Individual student work (including preparation for laboratory work, colloquium and exam): 89

9. Evaluation procedure of knowledge and abilities:

Continuous study during the course: In order to achieve the assignment criteria, student needs to gain a minimum of 60 points out of 100. Maximum of 90 pts could be awarded for fulfillment of study tasks and 10 pts for activity during the lectures. All information is available at http://moodle.czu.cz.

Examination consists of written and oral part

Written part includes a test (multiple choices, calculations and fill-in questions) and the results from the course.

Test - minimum 60 pts of out of 100.

Suggested grade after written examination (total of assignment and test):

. Grade A excellent (výborně) > 175 pts

. Grade B very good (velmidobře) 151-175 pts

. Grade C good (dobře) 125-150 pts

. unclassified - failed < 125

Oral examination can change the final result.

10. Availability of certification.

No.

11. Study programmes.

Economics and Management

12. Other important information.

Master's Study Programme

13. Links.

URL in English

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URL in Czech

Best Practice in E-administration

1. Partner name:

Pedagogical University of Krakow

2. Course titles:

- Web development techniques 4 credits
- Digitalization of government 3 credits
- Operating systems – maintenance and administration 3 credits
- Computer Networks and Network Security 4 credits
- Word processing and multimedia presentations 3 credits
- Electronic spreadsheets in office work 3 credits
- Databases Management Systems 2 credits
- Computer graphics 2 credits

3. Subject annotations:

- The goal of the course is to prepare students to design websites based on HTML5 and CSS3.
- The goal of the course is to familiarize students with the development of information society, the use of information technologies in the functioning of administration and the process of digitalization of state services. During the course, students learn about legal acts, the knowledge of which is necessary while working with information in electronic form.
- The goal of the course is to prepare students to work in different, most common operating systems. The course focuses on the mechanisms of operation of these operating systems and the ability to configure and manage them both in the context of local and network work. Attention will be paid to increasingly common remote work and distributed data storage.
- The goal of the course is to familiarize students with the types of computer networks, their topology and exemplary network protocols, such as: Ethernet, TCP/IP, UDP. The implementation of the course will enable students to understand the principles of functioning of modern computer networks and will give theoretical basis for independent network design. Students will learn to diagnose and eliminate simple mistakes in local computer networks.

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- The aim of the course is to prepare students for practical using the text editor on the advanced level and extend knowledge about creating multimedia presentations from the cloud computing.
- The aim of the course is to prepare students for the use of advanced spreadsheets (ECDL-A advanced level) for using applications to improve administrative work, in particular statistical processing of numerical data, databases, analysis and simulation.
- The aim of the course is to prepare students to work with an ECDL-A advanced level information database development and management program, meaning the proficient use of this type of software.
- The aim of the course is to prepare students to use sample computer programs designed to create and edit raster and vector graphics, which will enable the preparation of graphic designs for the so-called small polygraphy, printing or publication on the Internet.

4. Study hours:

- Work in auditorium in hours: 15; Practical works in hours: 30; Individual student work (including preparation for laboratory work, colloquium and exam): 100;
- Work in auditorium in hours: 15; Practical works in hours: 15; Individual student work (including preparation for laboratory work, colloquium and exam): 75;
- Work in auditorium in hours: -; Practical works in hours: 30; Individual student work (including preparation for laboratory work, colloquium and exam): 75;
- Work in auditorium in hours: -; Practical works in hours: 30; Individual student work (including preparation for laboratory work, colloquium and exam): 100;
- Work in auditorium in hours: -; Practical works in hours: 30; Individual student work (including preparation for laboratory work, colloquium and exam): 75;
- Work in auditorium in hours: -; Practical works in hours: 30; Individual student work (including preparation for laboratory work, colloquium and exam): 75;
- Work in auditorium in hours: -; Practical works in hours: 30; Individual student work (including preparation for laboratory work, colloquium and exam): 50;
- Work in auditorium in hours: - Practical works in hours: 30; Individual student work (including preparation for laboratory work, colloquium and exam): 50.

5. Study programmes.

E-administration

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Summary of Survey Results

Best Practices which are selected as a result of the analysis of questionnaire WP1.1-2 have the following features and advantages over other programs presented by universities of the countries participating in the project.

• All the selected DC programs are oriented for non-ICT university specialties.

• Most of them are 3-5 ECTS credits.

• Each of them is focused on effective learning of basic digital competencies in sufficient volume to develop the necessary skills for students.

• Each selected program focuses on supporting the digital skills of students in a particular specialty or group of specialties.

So, the selected DC programs of universities in Austria are designed for teachers with a volume of 20.5 credits (which is significant), engineers and Digital Business managers. In Vytautas Magnus University, there is a “universal” DC program in physical, biomedical and technology sciences, art, music, humanitarian, social, law, economic, education, political sciences. The program is designed to teach all the basic digital skills according to DigComp without taking into account the specifics of specific university specialties. Another program of Vytautas Magnus University is used for Engineering, Forestry, Applied Ecology.

At the University of CULS, the program is focused on learning digital competencies in the field of Economics and Management.

Pedagogical University of Krakow has indispensable experience in E-administration. It consists of a block of 8 DC programs of 2–4 ECTS credits for training a wide range of digital competencies. The main part of Study hours is independent work of students, a smaller part - practical work in auditorium. Together, these 8 DC programs constitute the “coverage” of all basic digital skills according to DigComp in E-administration.

To sum up, all selected Best Practices are effective tools for teaching digital competences in various areas of special knowledge. All of them are recommended for implementation to the system of digital competencies learning in Ukraine.

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Conclusion. Implications of Results for Programme

This concluding section draws together the results from the desktop research, survey, and analysis to make recommendations for the programme that will form the core of the dComFra project.

- The dComFra project is needed for the implementation of the European experience in effectively teaching citizens digital competencies.
- The Program Countries participating in the project adopted a national competence framework based on the basic European documents, in particular Digital Skills and Jobs Coalition, DigComp frameworks and the Digital Agenda for Europe, taking into account national peculiarities. This harmonizes the development of digital competencies of citizens of these countries.
- The set of digital competencies for citizens adopted in the EU countries and their level of knowledge meets the requirements of the labor market.
- In EU countries, considerable attention is paid to the development of DC skills of all groups of citizens.
- There are a sufficient number of effectively organized DC programs in Program Countries' Universities.
- University programs and curricula cover mostly all digital competencies defined in the DigComp frameworks.
- The positive experience of the EU countries as a whole, the experience of the countries participating in the project, the basic European documents, the selected best programs of Program Countries' Universities can be successfully used in Ukraine for:
  - creating a national digital competence framework;
  - increase the effectiveness of teaching digital competencies;
  - composing profiles of digital competencies for various target groups of citizens of Ukraine.

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Appendix 1: Form of questionnaire WP1.1-1

Designations: Competence areas – CA, Competences – C

CA1. Information and data literacy.
C1.1 Browsing, searching and filtering data, information and digital content.
C1.2 Evaluating data, information and digital content.
C1.3 Managing data, information and digital content.
CA2. Communication and collaboration.
C2.1 Interacting through digital technologies.
C2.2 Sharing through digital technologies.
C2.3 Engaging in citizenship through digital technologies.
C2.4 Collaborating through digital technologies.
C2.5 Netiquette.
C2.6 Managing digital identity.
CA3. Digital content creation.
C3.1 Developing digital content.
C3.2 Integrating and re-elaborating digital content.
C3.3 Copyright and licenses.
C3.4 Programming.
CA4. Safety.
C4.1 Protecting devices.
C4.2 Protecting personal data and privacy.
C4.3 Protecting health and well-being.
C4.4 Protecting the environment.
CA5. Problem solving.
C5.1 Solving technical problems.
C5.2 Identifying needs and technological responses.
C5.3 Creatively using digital technologies.
C5.4 Identifying digital competence gaps.

Level – Foundation – F, Intermediate – In, Advanced – A

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WP1. DC needs & EU DigComp frameworks: Analysis

Report on analysis of existing DC programs and curricula at Program Countries' Universities

№ з/п		Competence Areas	CA1			CA2						CA3				CA4				CA5			
		Competences	C1.1	C1.2	C1.3	C2.1	C2.2	C2.3	C2.4	C2.5	C2.6	C3.1	C3.2	C3.3	C3.4	C4.1	C4.2	C4.3	C4.4	C5.1	C5.2	C5.3	C5.4
1	Educational institution / university	Vytautas Magnus University																					
	Specialty	**INFORMATICS SYSTEMS**																					
	Specialization	Data Engineering, Business Informatics, and Software Systems																					
	Name of the discipline	Informatics																					
	Number of ECTS credits	4																					
	What competences and at what level covers (in your opinion)	If competences are covered, set the level mark (F, In, A)	F	F		F	F	F	F			F	F	F	F	F	F			F	F	F	F
2	Educational institution / university																						
	Specialty																						
	Specialization																						
	Name of the discipline																						
	Number of ECTS credits																						
	What competences and at what level covers (in your opinion)																						

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Appendix 2: Form of questionnaire WP1.1-2

Questionnaire about training courses in your university (only for EU partners)

This template should be used by each country partner to conduct desktop research.

The primary objective of the research is to identify available study programmes and curricula in EU partner organizations of various professional education (project targeted digital competences).

The outputs of this phase of the research will (1) provide context for the curriculum development activity and (2) generate an input into curriculum development.

Notes on completion:

- Please follow the template guidance as much as possible to ensure consistency between the country analyses.
- Please provide information about study programme as much as possible. If it is possible please provide links to described study programmes.
- If partner university has more than one study programme, please describe at least 5 study programmes.
- Please aim to have a draft of this complete by 24 of May, 2019.

1. **Partner name:**

2. **Course title:**

3. **Number of ECTS credits allocated:**

4. **Subject annotation:**

A brief summary of course indicating the main aim of the course.

5. **Course form:**

Online/auditorium/

6. **Study outcomes of the subject**

Please provide competencies, which students will get after this course.

After completing the course, students will be able to:

- …..

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7. Subject content.

Please provide main topics of the course.

Lectures (topics):

- …..

Please provide main topics of the course.

Practical works:

- …..

8. Study hours:

Please provide how many hours is dedicated for each category.

Work in auditorium in hours:

Practical works in hours

Individual student work (including preparation for laboratory work, colloquium and exam):

9. Evaluation procedure of knowledge and abilities:

Please provide short information how the knowledge are evaluated after this course.

10. Availability of certification.

Please provide information, if it is possible to get international certification after this course.

11. Study programmes.

Please provide information in which study programmes this course is used.

12. Other important information.

Please provide other important information related with this course.

13. Links.

Please provide links to the course, if it is possible.