Digital competence programs in Serbia

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Table of Contents

Introduction

Citizens' digital skills are one of the important indicators of the digital transformation of society. They are recognized in various domestic strategic documents and, in particular, in the Digital Skills Development Strategy 2020-2024 (hereinafter: the Strategy). It follows the European framework which was defined in 2017, after numerous expert meetings, academic research, analysis, redefining and supplementing of previous models, through DigComp 2.0. The Strategy defines digital skills as "possession of appropriate knowledge, skills and conduct in accordance with the needs of individuals and the society under conditions of modern rapid ICT development in the 21st century" (Strategy, 2020: 1). In order to understand the starting point of this research, as well as the difference between skills and competences, the European framework of digital competences will first be briefly described and how it is reflected in the national public policies. Then, the results of research on digital competence programs in Serbia that were offered in 2020 through formal and non-formal education will be presented. The research was conducted in two stages. In the first, relevant data were collected and this phase was completed on the last day of December 2020. The second was the analysis of data, the outcome of which is the report in front of you. The results represent the first comprehensive mapping of the current situation when it comes to digital competence programs in Serbia. The database is open for further additions and modifications. Finally, based on the mapped situation, recommendations were offered for possible further development of these programs along with promotion of cooperation between various stakeholders. We hope that the findings will be useful to all those who participate in the design of such programs for different social groups, researchers and decision makers.

European Digital Competence Framework

In the last two decades, great efforts have been made in academic and expert circles to understand, theoretically separate from other similar concepts and simplify the digital competence framework. Although they do not have the same meaning, digital competences are sometimes used in literature, public documents and public speech as a synonym for digital skills or digital literacy. Some authors take digital literacy as an umbrella term that thus understood as a broader term encompasses the

remaining two. The matter becomes more complicated when media, information and computer literacy are introduced into the discussion and attempts are made to define their place in the digital environment. On the other hand, an important task for researchers, scientists, decision makers, lecturers and other actors involved in the process of digital transformation of the society was to make the concepts of new literacy and competencies easy to understand, applicable, measurable and to enable monitoring of formulated goals and outcomes. Secondary analysis of documents, reports and theoretical papers on this subject indicates that the process of defining the European digital competence framework has lasted since the adoption of the Lisbon Strategy 2010-2020, which announced the digital transformation of society. One of the foundations is certainly the Recommendation of the European Parliament and the Council of Europe *for key competences for lifelong learning* (REC, 2006) which opened the door for redefining the learning system as it was known in the pre-digital age. It emphasizes the importance of developing eight key competencies, including the digital ones[1]. Competences are conceptualized as a set of knowledge (knowledge of existing facts, concepts, ideas and theories in a particular field), skills (ability to use knowledge to achieve specific goals) and attitudes (way of thinking, disposition, values, beliefs that shape (re)action to certain ideas, people and situation), (SWD/2018/014 final: 7). Digital competences are defined in Recommendation as those that involve the "confident and critical use of information society technologies (IST) for work, leisure and communication." (REC/2006: 6). They imply knowledge of IST and their possibilities of use in everyday life context. They are closely related to computer skills and information literacy, as they encompass the ability to use computers for a variety of purposes such as information retrieval, their assessment and evaluation, along with the development of critical thinking in the digital environment. They also refer to the storage and organization of information, their creation and presentation, exchange with others, through networking and communication, bearing in mind the potential risks and features of IST. Focusing on outcomes, and opening space for developing different approaches to learning, the Recommendation also defines the so-called "transversal" themes that overlap with key competencies and areas in which digital technologies are used, such as developing critical thinking and creativity, raising the ability for risk assessment and encouraging initiative, decision-making

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[1]Among the eight key competencies are: (1) communication in the mother tongue; (2) communication in foreign languages; (3) mathematical, scientific and technological competences; (4) ability to acquire new competencies; (5) digital competence; (6) social and civic competences; (7) entrepreneurship; (8) cultural awareness and expression (see more at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32006H0962).

and problem solving, and constructive management. (REC/2006). In response to this Recommendation and the objectives of the 2010 Education and Training Program (OJ C 142, 14.6.2002), the European Commission in 2018 adopted the accompanying working document for defining key competences (SWD/2018/014 final). It points out the need to update the competence frameworks covered by the *European Framework of Reference* in order to make them more specific, easier to implement into different public policies, and subsequently into formal and non-formal education systems. In this way, the starting point for formulating programs aimed at the development of digital competencies has been made more adequate to the needs of different categories of the population in a specific national context. These documents especially emphasize the importance of providing assistance for the acquisition of these skills and competencies to socially disadvantaged people, adults who need retraining to find a job, as well as senior citizens.

The Lisbon Strategy for the period 2010-2020, which marked the starting of the European Union's transition to the information society, reiterated the importance of investing in education, which would facilitate the transition to a knowledge-based economy, but also reduce social exclusion in member states. As many of the goals set by the Lisbon Agenda have not been met, and faced with the financial crisis at the end of the first decade of the 21st century, the European Commission in 2010 adopted the Strategy "EUROPE 2020: Strategy for Smart, Sustainable and Inclusive Growth" (COM(2010) 2020). It specifies five key areas for overcoming the crisis, thus continuing the process of transition to knowledge-based economies. In addition to climate change and sustainable energy, this development document highlights four other goals that are closely related to the development of digital competencies of citizens: employment, research and innovation, education and the fight against poverty. The goal of both strategies is, in essence, to encourage economic and social development, i.e. to incorporate the set goals into national reform programs in order to provide support to member states in designing effective responses to global challenges. Seven initiatives have been defined to support the implementation of the Europe 2020 Strategy, and directly important for this area are those related to the objectives (i) Smart Growth: *Youth on the Move* (focused on education and youth employment), *Digital Agenda* (strategy to help develop ICT infrastructure and digital technologies), *Innovation Union* (providing favourable financial conditions for research and innovation that will create new jobs) and (ii) Inclusive Growth: *Agenda for new skills for new jobs* i *European Platform against Poverty and Social Exclusion,* and

indirectly the other two that are related to the goal (iii) Sustainable Growth: *Resource efficient Europe* and *Industrial policies for the globalization era*. The sustainable development goals of the UN Agenda 2030 (UN, 2015) are also incorporated into this strategy. Its goals have been translated into the European initiative *Agenda for New Skills and Jobs* (EC 2011), which is part of the Europe 2020 Strategy, in which one of the main goals set for raising the employment rate of women and men aged 20-64 to 75% refers to development and improvement of necessary skills. This implies providing an adequate combination of knowledge, skills and attitudes to young people through the education system to facilitate their transition to the world of work; establishing more efficient programs for adult education and their lifelong learning; developing mechanisms for inclusion of socially vulnerable groups to achieve competitiveness in the labour market and enabling them to respond to technological change[2] . In cooperation with the European Commission and national experts, a common concept for the development of national digital skills strategies has been defined, called A New Skills Agenda for Europe (COM/2016/0381 final). With this document, member states are invited to start developing comprehensive digital skills strategies. The agenda was organized around 12 activities divided into four areas[3] as four cornerstones, with a set deadline for implementation by 2025. Whithin the first area *A call to join forces in a collective action* Action 1 (A2) is entitled - Formulation of A Pact for Skills. Second area, *Actions to ensure that people have adequate skills for jobs* include: (A2) Strengthening cognitive skills; (A3) EU support for strategic national upskilling actions; (A4) Proposal for a Council recommendation on Vocational Education and Training (VET); (A5) Rolling out the European University Initiative and upskilling scientists; (A6) Skills to support *twin* transitions; (A7) Increasing STEM graduates and fostering entrepreneurial and transversal skills; and (A8) Skills for life. Third area, *Initiatives and tools to support lifelong learning* encompass: (A9) Initiative on individual *learning accounts* that can be accumulated and spent on quality training services, guidance or validation services through the training entitlement system[4]; (A10) European approach to micro-credentials; and (A11) New Europass platform. Within the fourth area *Framework to unlock investments in skills* Action (A12)

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[2]Other goals refer to the functioning of the labour market, the creation of better jobs and better working conditions, and the development of public policies that would enable the creation of new jobs and regulate the demand for labour force. See more at: EC, 2011.

[3]See more at: https://ec.europa.eu/social/main.jsp?catId=1223.

[4] https://ec.europa.eu/social/main.jsp?langId=en&catId=1223&furtherNews=yes&newsId=9994

includes the work on the regulatory framework in this area. The Agenda is accompanied by a document entitled *A common European response to shared goals: A concept for tackling the digital skills challenges in Europe* (2017) addresses the key challenges along the way and offers a table of examples of good practice as possible solutions to specific problems that countries may face along the way[5]. In order to achieve the goals set by the Agenda, the European Commission has launched several initiatives, including the Coalition for Digital Skills and Jobs[6], national coalitions for digital skills and jobs[7], A platform for digital skills and jobs[8], action and monitoring Women in the IT sector[9], Digital Opportunity Traineeships funded through Horizon 2020 and implemented through Erasmus + to improve students' digital skills for a period of 2-12 months[10].

With the document *Future of Education and Skills 2030* (OECD, 2018), which builds on the UN 2030 global sustainable development goals (SDGs), the OECD defines, among other things, principles for the development of education in the next ten years that should contribute to greater well-being of citizens. In this model, which is defined within the DeSeCo Project (Definition and Selection of Competencies), key competencies for the future also rely on knowledge (in certain disciplines, interdisciplinary, epistemic, procedural), skills (cognitive and meta-cognitive, social and emotional, physical and practical) and values and attitudes (personal, local, social and global). Together, they contribute to the advancement of three key areas related to "transformative competences" that foster the development of awareness, innovation and accountability. The first area is a requirement for the following two and refers to taking responsibility for one's own actions, reflections on one's own views, values and behaviours along with developing the ability to cooperate with others. The second is focused on creating new values for different spheres of life and includes the development of adaptability, creativity, curiosity and an open mind. The third concerns the reconciliation of tensions and dilemmas. It implies developing the ability to take into account different positions, logics and attitudes; then, resolving contradictions and finding a

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[5] https://digital-strategy.ec.europa.eu/en/library/shared-concept-national-digital-skills-strategies.

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

[7] https://digital-strategy.ec.europa.eu/en/policies/national-coalitions

[8] https://digital-strategy.ec.europa.eu/en/news/european-digital-skills-and-jobs-platform-project-team-starts-work

[9] https://ec.europa.eu/digital-single-market/en/women-digital-0

[10] https://ec.europa.eu/digital-single-market/en/digital-opportunity-traineeships-boosting-digital-skills-job

balance between polarities such as equality and freedom, autonomy and solidarity, innovation and continuity, and the like. Digital literacy and data literacy are on a par with the physical health and well-being (OECD, 2018).

Following the experience with the Covid 19 virus and the mass transfer of jobs and schooling to the on-line space, the European Commission has formulated a *Digital Education Action Plan (2021-2027): Resetting education and training for the digital age*[11] which contains two specific goals: Fostering the development of a high-performing digital education ecosystems and Enhancing digital skills and competencies for the digital transformation. The first focuses on defining recommendations on the enabling factors for successful digital education, on-line and distance learning for primary and secondary education, connecting educational platforms, providing support to teachers through the Erasmus Teacher Academies and SELFIE[12] for Teachers and the development of ethical guidelines on artificial intelligence (AI) and data usage. Within the second goal, two directions are defined. One refers to basic digital skills and competencies from the earliest age and includes the development of digital literacy, the fight against disinformation, computer literacy, understanding of technologies that use data, such as AI. The second one refers to the development of advanced digital skills, especially for girls and young women, and ensuring their equal representation both in studies and careers that require different levels of digital competencies. In order to encourage the connection of different stakeholders and cross-sector cooperation at national and regional levels, the creation of a new *European digital hub* and within it a Digital Education Hackathon to support user-driven innovation has been announced. In that way, it will be possible to exchange experiences, define common standards and guarantee quality, but also monitor the implementation of the Digital Education Action Plan (2021-2027)[13], and other important activities for formulating future strategic steps in the EU countries. Several instruments have been made available to implement this action plan[14]. With the Digital Compass 2030, the European Union establishes the main directions of development in the field of digital

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[11] https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en#:~:text=The%20Digital%20Education%20Action%20Plan%20%282021-2027%29%20outlines%20the,action%20for%20stronger%20cooperation%20at%20European%20level%20to

[12] Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies

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

[14] https://digital-strategy.ec.europa.eu/en/policies/digital-skills-initiatives

transformation for the next ten years, grouped into four main areas: (1) digitally skilled citizens and highly skilled digital professionals; (2) secure and significant digital infrastructure; (3) digital transformation of businesses; (4) digitalization of public services.

Following the announcement of "Building Trust in Human Centric Artificial Intelligence" (COM(2019) 168 final) and adoption of "Ethics Guidelines for Trustworthy AI" (High Level Expert Group on AI, 2019), spurred by the Covid 19 virus experience, the European Commission issues another statement announcing its commitment to promoting the *development of artificial intelligence competencies* and a human centric approach to AI, aimed at increasing confidence in these technologies (COM(2021) 205 final).

Currently, one of the largest networks that brings together professionals in the field of digital competence development is ALL DIGITAL, comprising 25,000 digital centres across Europe. The Manifesto, formulated in 2021, reflects the needs and perspectives of teachers, educators, trainers and students at different levels and is designed to support exchange, dialogue, ensure implementation and increase the impact of European strategic and supporting documents in the field of digital education. The Manifesto of experts gathered around ALL DIGITAL contains five areas of action with key requirements to be met: (1) Education and training offer (relevant, holistic, transformative and lifelong); (2) Access to education and training (accessible, flexible, inclusive); (3) Quality of education and training (systematic, measurable, qualified); (4) A European approach to digital competence (Dig Comp, certified, quality assurance by developing "digital competence profiles", recognizable and mobile); (5) Sustainability and development (cooperation, infrastructure, investments, governance)[15]. In addition to the above, there are many initiatives in the EU countries and beyond, written manuals and publications to facilitate the implementation of European goals, as well as research analysing existing digital competence programs in formal and non-formal education, which offer examples of good practice for future initiatives of stakeholders in this field (e.g. Dalla Vecchia et al., 2015; McGinty, 2020).

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[15] https://all-digital.org/digital-competences-manifesto-text/

Research context: Serbia

For Serbia, whose EU accession process is underway, the Europe 2020 Strategy together with the South East Europe 2020 Development Strategy[16] represent an important framework for further alignment of national goals and ongoing reforms, taking into account challenges in specific national context. Namely, the harmonization of the regulatory framework with European standards also meant the definition of the Digital Agenda for Serbia[17]. It comprises the Information Society Development Strategy of the RS until 2020 and the Strategy for Development of E-Communications in Serbia from 2010 to 2020, and more broadly the Law on Electronic Communications adopted in 2010, the Strategy for the Development of Broadband Access in Serbia until 2012 (2009), and the Strategy for the transition from analogue to digital broadcasting, the Action Plan for the implementation of the eSEE + Agenda and other important regulations in the field[18]. Following the EU objectives, the Information Society Development Strategy 2020 highlighted six key areas for which digital skills are needed: (1) e-communications; (2) e-government (e-health and e-justice); (3) ICT in education; (4) e-commerce; (5) ICT business sector and (6) information security. The importance of ICT and raising the digital competencies of citizens are recognized in the Strategy for the Development of Education in Serbia until 2020[19], New Generation Network Development Strategy until 2023 (Section 5.2)[20], Strategy for the Development of the Public Information System in the Republic of Serbia for the period from 2020

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[16]After the OECD launched the initiative, the South East Europe 2020 Development Strategy was developed and adopted on 21 November 2013, with the support of the European Commission, with the goals derived from the Europe 2020 Strategy. Among the key development pillars, Smart Growth is highlighted with the following dimensions: human resource development (D), research, development and innovation (E), digital society (F) and culture and creative sectors (G). See more at:
https://www.gov.me/ResourceManager/FileDownload.aspx?rId=170649&rType=2&alphabet=cyr.

[17]In support of the digital transformation of the region, the European Commission launched on 6 February 2018 the Western Balkans Strategy when the launch of the Digital Agenda for the Western Balkans was announced. At the assembly held in Sofia on 17 May 2018, the priorities for the implementation of the Digital Agenda were emphasized, and among them were the digital infrastructure development, increasing cyber security and trust, strengthening the digital economy and e-government, supporting innovation and research, and encouraging the digital skills development among citizens in order to be able to respond to modern challenges and demands. The deadline defined for the implementation of these activities was 2018-2020. See more at: https://europa.rs/evropska-komisija-pokrece-digitalnu-agendu-za-zapadni-balkan/ and SWD(2018) 360 final.

[18] http://www.e-jednakost.org.rs/kurs-da/index.php/digitalna-agenda-u-srbiji

[19]"Official Gazette of the RS", No. 107/12.

[20]"Official Gazette of the RS", No. 33 of 3 May 2018.

to 2025 (Media Strategy (Sections 5.2 and 5.3)[21] and the Strategy for Education Development in the RS until 2030 (Specific goal 1.3)[22] . The strategy envisages an increase in the percentage of schools that provide hybrid and on-line education, the establishment of a public on-line primary and secondary schools, as well as monitoring of digital education development (Special goal 1.3). According to the Action Plan of the Education Strategy, further investments are planned in improving school infrastructures; equipping digital classrooms; revising interdisciplinary, specific and general competencies and standards; improving existing and developing new curricula; defining a set of indicators for long-term monitoring of digital education development; and revising the Framework of digital competencies of teachers until 2023.

Guided by the European Commission initiative for the development of Artificial Intelligence (COM(2018) 237), Serbia has also adopted the Strategy for the Development of Artificial Intelligence in the Republic of Serbia for the period 2020-2025.[23]. Among other problems, the Strategy emphasizes the insufficient number of staff, the need to develop digital literacy, but also to create conditions for the development of multidisciplinarity, education of researchers in the field of artificial intelligence and cooperation between universities. Therefore, among the set goals for this period was the need to integrate AI competencies into the development of digital competencies at all levels of education, support for researchers and the development of AI science, which includes the establishment of AI institutes. The Action Plan for the AI Strategy[24] states that within the current education reform, AI will be included in the curricula of all levels of education, including teacher training, inclusion of AI in existing study programs, support for organizing short courses, trainings and accompanying activities by the end of 2022.

The reform of the education system in Serbia is largely underway. In recent years, the state has taken many measures, launched various campaigns and supported many projects in the field of digital, information and media literacy. When we talk about the current state of digital competencies of the general population, several studies have been conducted that are important for

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[21]"Official Gazette of the RS", no. 11/2020.

[22] http://www.mpn.gov.rs/wp-content/uploads/2021/02/1-SROVRS-2030_MASTER_0402_V1.pdf.

[23] "Official Gazette of the RS", No. 30/18.

[24] http://www.mpn.gov.rs/wp-content/uploads/2020/06/akcioni-plan.pdf

directing further work in this area. According to a survey conducted by RATEL in 2018, the largest number of citizens first seek the information they need on the Internet (74.2%), while 59% of them rate their knowledge of digital technologies as mediocre, 29% as beginner, and only 12% as advanced (RATEL, 2018). In 2020, the Republic Statistical Office (RZS) recorded a slight increase in the number of users of computers (by 1.9%), the Internet (by 2%) and mobile phones (by 0.4%). However, there is still a large percentage of those who have never used a computer (19.8%) or the Internet (17.4%). Almost a fifth of respondents who stated that they do not use the Internet, said that the equipment (18.7%) or the Internet (10.3%) are too expensive for them or that they lack skills (10.3%). 6.5% of respondents aged 16 -74 stated that they attended on-line courses, while 81.3% said that they did not have any activities on that topic (Rajčević, 2020). Another survey shows that those who use the Internet highly value their media and digital skills. Namely, CeSID and Propulsion, with the support of the USAID Serbia, conducted a research at the end of 2019 within the program "Initiative for New Digital and Media Literacy". Its findings showed that Serbian citizens aged 12-60 rate their media and digital literacy with a high score. When it comes to the media literacy index with a value of 4.07%, the respondents got the score 4 on a scale of 1-5. The same score was recorded on a five-point scale when it comes to digital literacy, with a value of 10.97 out of a possible 15 (CESID and Propulsion, 2019: 20).

DESI report[25] from 2019, made for the needs of the European Commission, states within the dimension of *digital skills* that the percentage of Serbian citizens with basic digital skills (66%) is higher than the European average (57%). Eurostat findings show in more detail that 31% of Serbian citizens aged 16 - 74 have low, 26% basic (6% more than in 2017) and a fifth (a percentage more than in 2017) is above the basic level when it comes to digital skills. Only 1% of citizens stated that they do not have any digital skills[26] . Furthermore, DESI also shows that, for example, there are half less (2%) IT experts than the European average (4%)[27] and that Serbia, together with other

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[25]The Digital Economy and Society Index (DESI) by which the European Commission measures the process of digital transformation.

[26]The testing covered four areas: information, communication, problem solving and content creation. Data are presented for the period from 2015-2019. See more at: Eurostat 2021a - Individuals' level of digital skills. https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do.

[27]According to Eurostat, 75% of all IT experts employed in Serbia in 2020 were men and 25% women. See more at: Eurostat, 2021. Employed ICT specialists by sex. https://ec.europa.eu/eurostat/databrowser/view/isoc_sks_itsps/default/table?lang=en.

countries in the Western Balkans, lags behind the European average when it comes to the use of e-banking services (20% vs. 61% EU), on-line shopping (16% vs. 68%) and almost all aspects of e-government. On the other hand, the only dimension in which Serbia has an approximate score to the EU27 average is the *Business technology integration dimension performance*, (Tech4i2 & Time.lex, 2019:16). When it comes to the civil sector, organizations from seven countries, including the Centre for Education Policy from Serbia, in 2017, with the support of the Council of Europe and the European Commission, compiled a strategic document *Developing Competences for Democratic Culture in the Digital Era*. Relying on the guidelines of the Council of Europe (CoE, 2016) in which digital competencies are covered by the media ones[28]. This document indicates to the civil society organizations working in the field of formal and non-formal education in which direction it is desirable for them to invest further efforts to develop competencies for democratic culture in the digital environment (Centre for Development of Democracy, 2017) .

Methodology

Having all the above in mind, this research started from the question *Which digital competence programs are being developed and initiated in Serbia within formal and non-formal education?* Although relying on the goals set in the Digital Skills Development Strategy, 2020-2024, the research encompasses a broader concept of digital competencies with the idea of mapping the current range of programs offered by different social actors, available to a wider population of beneficiaries within formal and non-formal education.

It took a long time just to define the framework of digital competencies. In the process, various theorists, experts and practitioners have provided numerous models with the aim of facilitating the understanding of the concept and its application in practice. In 2017, Katalina Jordaš, Ilš Marien and Dorin Balden analysed the 13 most used and comprehensive models of digital literacy, identifying 39 overlapping indicators, demonstrating the need to specify a uniform framework as a starting position that allows for later mutual comparison. Guided by the work of Alexander van Deursen (2010), these authors took *digital literacy* as the umbrella name, which, according to

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[28] https://rm.coe.int/a-model-of-the-competences-required-for-democratic-culture-and-intercu/16809940c3.

them, includes *knowledge* (information, awareness, understanding), *skills* (practical, measurable application of knowledge) and *competences* (ability to apply knowledge and skills to specific situations) and presents "practical and measurable outcomes of media, information and digital literacy" (Iordache et al., 2017: 3). On the other hand, the European framework of digital competencies DigComp 2.0 (2017) took *digital competencies* that include knowledge, skills and attitudes as the umbrella name. In the analysis of expert opinion on the digital competences (Janssen et al, 2013), the importance of attitudes *(attitudes) was singled out,* as they are associated with outcomes that do not include only cognitive but also the affective dimension of the complex term of digital competences. "The fact that someone knows how to do something does not necessarily entail the obligation to love or want to do it. Conversely, one may be eager to use certain digital technologies without being skilled enough to use them." (Janssen et al, 2013: 479). Taking into account the still active debates that follow the definition of concepts important for understanding and living in a changing society under the influence of ICT development, as well as the previous contributions of Christie Ala-Mutka (2011), Anuska Ferrari (2013) in formulating DigComp, Rina Vuorikari et al. in defining DigComp 2.0 (2016), this research was guided by the framework set by DigComp 2.1. (Carretero et al., 2017). DigComp 2.1 recognizes 21 competencies, placing them in five key categories: (1) information and data literacy; (2) communication and cooperation; (3) digital content creation; (4) security; (5) problem solving.

Since this is the first mapping of the situation in the field, and the research was guided by the idea of covering the widest possible range of offers, the most convenient starting point was the framework defined by Clara Centeno and William O'Keeffe (2020). Based on research conducted with Stefan Kluzer (Kluzer et al., 2020), labour market intermediaries (LMIs) were divided into four groups. Type 1 includes LMIs focused on initial education (formal, non-formal and informal); Type 2, those working with the unemployed; Type 3, those working with employees and Type 4, those serving all target groups (See Table 1). The research in front of you is focused on digital competences programs within Type 1 (covering both teachers and students) and Type 4 (all target groups, more precisely 4.1.and 4.2)[29] thus leaving out neither the employed nor the unemployed.

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[29] The analysis related to type 4.3. and partially 3.2 was implemented by USAID in 2020. The research covered 109 companies, including job advertisements in the last six years (107,000) on the Infostud portal, with the aim of researching the labour market needs for digital competencies. The data showed that the demand for higher levels of

This research did not include LMIs Type 2[30] and Type 3 because the analysis in this domain requires conducting a separate research in cooperation with line ministries, association of employers, trade unions and other important stakeholders in this field.

Table 1: LABOUR MARKET INTERMEDIARIES (LMIs) within DigComp 2.0

DigComp 2.0 and LABOUR MARKET INTERMEDIARIES (LMIs)	
LMI type	**Description of LMI types and subtypes**
Type 1 LMIs focused on initial education	1.1. **Formal** education institutions providing formal (to some extent mandatory) schooling. They include: Primary and secondary schools, vocational education and training (VET) schools and higher education institutions.
	1.2 **Non-formal** education providers offering extracurricular activities that complement educational institution programs (e.g. foreign language course);
	1.3 **Informal** education providers facilitating students' independent learning in areas of interest, without the imposed subject structure, external requirements and assessments (e.g. school chess club).
Type 2 LMI primarily working with the unemployed	2.1 **Public employment services** (a public body, either part of the Ministry of Labour or, less frequently, a separate executive agency) providing comprehensive support to the unemployed and having legal obligations to them.
	2.2 **LMIs dealing with barriers to employment** - usually NGOs or social enterprises that target certain vulnerable groups in need of more intensive or specific professional support.
Type 3 LMIs primarily working with the unemployed	3.1 **Trade unions** (collective associations of employees).
	3.2 **Employers and associations of employers** (collective employers' associations).
Type 4 LMIs focusing all target groups	4.1 **LMIs providing adult education services** (formal, non-formal and informal): in person and on-line trainings, MOOC (Massive Open Online Course) platforms.
	4.2 **LMIs providing work-based learning** (WBL) and enabling the deployment of individuals in a real work environment: internship, apprenticeship, additional employee trainings, volunteering; programs of public jobs, social enterprises and cooperations.
	4.3. **Intermediaries facilitating the linking of jobseekers with vacancies:** job search websites (platforms used to share vacancy information and jobseeker profiles), short-term employment intermediaries (organizations that help individuals / employers find temporary jobs / workers) and private employment agencies (helping employers to fill their vacancies).

Source: Centeno et al., 2020: 7

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digital competences is growing with the level of education and the complexity of the job, and that it is in correlation with the demand for foreign language skills (USAID CFG, 2020).

[30]Data on the activities of the National Employment Service are available in the Digital Competences Development Strategy, "Official Gazette of the RS", No. 21 of 6 March 2020: 51-52.

Data were collected by searching online available programs during December 2020, followed by creation of the *Digital Competence Program Database* (hereinafter: the Database). The database includes digital competence programs in formal and non-formal education in the RS and covers **three sections** that can be supplemented and updated over time:

I Formal education and catalogues of accredited programs for additional education of teachers. It covers curricula of primary and secondary schools, public and private, IT profiles and departments, and catalogues of accredited programs: Catalogue of professional development programs of the Institute for the Advancement of Education (ZUOV), List of professional training programs approved by the Pedagogical Institute of Vojvodina, as well as the List of accredited programs of public interest in ZUOV. The latter was included in this database because it turned out that most of its digital competence programs are intended for teachers.

II Formal education - faculties, colleges and academies. It covers curricula, syllabi of the faculties of state universities in Belgrade, Novi Sad, Niš, Kragujevac, Novi Pazar and the University in Priština[31], private faculties and colleges accredited by the Ministry of Education, Science and Technological Development, at all levels of education in the field of: (1) social sciences and humanities, (2) IT profiles at the faculties of natural sciences, mathematics and technology, as well as (3) specialized programs of private academies.

III Non-formal education - courses. This section covers the courses offered within Mass Online Learning Platform (MOOC) - Kampster, a portal offering courses and trainings (Portal mladi (*youth*), Blic Master, LinkedIn, Obuke i kursevi (*training and courses*), etc.), and also providers within the private, public and civil sectors.

Where possible, we have tried to establish: *What key competencies are being developed and prioritized by these programs; who are the main providers of the program; which target groups*

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[31] Throughout this text, the University of Pristina temporarily seated in Kosovska Mitrovica will be referenced as University of Pristina. The official website of the University can be found here: https://pr.ac.rs/. In the research, all the names of educational institutions are listed as stated in the official documentation of the ministry from which they have received accreditation (source: Open-data Portal of Ministry of Education, Science and Technological Development, last update in October 2017). All references to Kosovo, whether to the territory, institutions or population, in this text should be understood in full compliance with United Nations Security Council Resolution 1244.

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they are intended for; whether they are related to other literacies, i.e. whether they include the development of critical digital literacy (media, information); how they are financed and whether they are sustainable; and finally, how we can classify them.

During the collection of data for primary, secondary and grammar schools, and on specialized IT classes and profiles, official documents and information from the website of the relevant ministry, the Institute for the Advancement of Education, data of existing analyses included in strategic documents related to this area were consulted, as well as the curricula of private schools.

In the analysis of the programs from Catalogue 2020 accredited by the ZUOV, the offered topics and contents were recoded into 21 digital competencies from the DigComp 2.0 framework, arranged in five thematic areas (See Table 2). In that way, it was possible to determine in which direction the previous additional training of teachers is moving when it comes to specific competencies, but also where space is left for designing new programs that will follow the needs of employees in preschool and school institutions. This was possible to perform because the information about the programs was sufficiently transparent, and on the other hand they were designed so that they could fit into the DigComp framework.

Table 2: areas of competencies and 21 digital competencies within DigComp 2.1

Area of competence	Digital Competences (DC)
I Information and data literacy	I.1 Browse, search, filter data, information and digital content
	I.2 Evaluation of data, information and digital content
	I.3 Data, information and digital content management
II Communication and cooperation	II.1 Interaction through digital technologies
	II.2 Exchange of digital technologies
	II.3 Involvement of citizens through digital technologies
	II.4 Cooperation through digital technologies
	II.5 Netiquette - net.ethics
	II.6 Digital identity management
III Digital content creation	III.1 Digital content development
	III.2 Digital content integration and processing
	III.3 Copyright and licenses
	III.4 Programming
IV Security	IV.1 Device protection
	IV.2 Personal data and privacy protection
	IV.3 Health care and well-being protection
	IV.4 Environmental protection
V Problem solving	C.1 Solving technical problems
	V.2 Identifying needs and technological responses
	V.3 Creative use of digital technologies

V.4 Identifying gaps in digital competence
Source: DigComp 2.0: 10-11.

When it comes to university education, the analysis included courses and study programs within state and private faculties in the social sciences and humanities field and arts, those that educate IT profiles, as well as colleges. The sample from the SSH (social sciences and humanities) field covers *courses* from the University of Belgrade and the University of Arts in Belgrade, then the University of Novi Sad, Niš, Novi Pazar, the University in Priština, and the private faculties within ComTrade ITS Link Group, Singidunum University, Educons, European University, John Naisbitt University. The levels covered by the analysis are undergraduate studies (OAS), master studies (MAS), doctoral studies (DAS), basic vocational studies (OSS), master vocational (MSS), specialist vocational studies (SSS). It should be borne in mind that faculty programs offer courses that develop digital competencies related to the professions for which students are educated, and that this cross-section indicates the current syllabi at the time of creating the database, i.e. by the end of 2020. Namely, during the interviews with the faculty staff in these areas, we were told that some professors had already innovated their courses during lectures, but that it was not possible to change the syllabus, which is why the adaptation of courses to new tendencies and needs is not visible in this way. Also, new accreditation is underway, so it is to be expected that innovations at these faculties will be more visible, and the offer will be enriched with more modern syllabi.

The analysis of IT courses at public and private faculties, as well as IT academies, included *study programs*, not individual courses at all levels of higher education, because it was assumed that the study programs include courses that are in line with them. All study programs containing in their title words IT, ICT, digital, software, new media, computer science, informatics and the like were searched.

The part of the Database related to non-formal education includes courses, trainings and programs of additional education of various providers of these services, from MOOC and portals offering trainings and courses, through private companies, private schools and institutes, associations and the like. Only programs which are shown on the websites of the course providers as active and available to everyone depending on personal preferences, material conditions and previous knowledge are included in the analysis. All programs offering the development of IT skills at

various levels and for different needs, improvement of digital competencies according to the DigComp model (which includes information literacy), creation of digital media content for various purposes, and those aimed at developing so-called "soft skills" were searched.

Research results: analysis of digital competence programs in the Republic of Serbia

I Formal education

The use of digital technologies in teaching, as well as the need to raise the digital competencies of teachers and students, have been exacerbated by the Covid 19 virus pandemic as schools have been forced to switch fully or partially to the online teaching. During the pandemic, the *Professional instruction for the organization and implementation of educational work in primary school in the school year 2020/2021* by the competent ministry provided schools with the guidelines for the organization and implementation of distance learning. During this period, ZUOV organized and implemented several different activities in order to improve the digital competencies of teachers, namely: *Training for the use of digital educational materials* (attended by 9492 primary school teachers); *Python programming language training* (1035 primary school computer science teachers); *Training for acquiring the basic level of digital competencies* (3389 primary school teachers). During 2019, the project *Curriculum content through a digital textbook / digital classroom* continued, as well as the training of teachers to use modern technology and digital textbooks (MPNTR, 2000).

In May 2020, during the pandemic, the Institute for the Advancement of Education (ZOUV), according to the School Education Gateway methodology[32], initiated a survey on the attitudes of teachers towards the implementation of distance learning. Until the first cross-section of the

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[32]European online education platform supported by the European Commission, link to the platform: https://www.schooleducationgateway.eu/en/pub/index.htm.

situation[33], 14,715 teachers, non-teaching specialists and principals of primary and secondary schools participated in the research. The findings showed that the necessity to teach online caught most teachers unprepared. Namely, 54.9% of respondents stated that conducting online classes during the spring of 2020 was their first experience of the sort, while 34% of them stated that they had had previous experience, but very limited one. As one of the biggest problems for distance learning, among other things, respondents mentioned the problem of availability of resources and technology both to students (52.3%) and a large number of teachers (37.4%), as well as the low level of digital competencies of students (33.5%), or teachers (25.3%). The need for more free resources and tools (54.1%), video materials / teaching materials / examples of good practice (50.2%) as well as educational TV programs (48.9%) was emphasized for this type of teaching. Last but not least, there was a great need to provide tools and software that could be used school-wide (55.2%), to provide easier access to ICT for teachers and schools (52.8%), and to organize systemic training of teachers to raise digital competencies (ZOUV, 2020).

The results of the research, related to the offer of digital competence programs in primary, secondary and grammar school education are outlined below. That part of the analysis included public and private schools. Then, the results of the analysis of the Catalogue of professional development programs of ZUOV, List of professional training programs approved by the Pedagogical Institute of Vojvodina and the List of accredited programs of public interest in ZUOV will be outlined.

I.1 Schools: primary, secondary and grammar schools; public and private

When it comes to primary schools, the application of the innovated curriculum began in the school year 2017/2018, when the subjects *Informatics and Computer Science* and *Techniques and Technology* were introduced in the second cycle of primary education, for the students to follow from the school year 2018/2019. From the school year 2020/2021, within the first cycle of primary education students study the subject *Digital World*, in addition to the elective subject *From Toys*

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[33]The first results of the research are available at: https://zuov.gov.rs/rezultati-ankete-sta-15-000-prosvetnih-radnika-misli-o-ostvarivanju-obrazovno-vaspitnog-procesa-putem-ucenja-na-daljinu/

to Computers, which is realized for I to IV grade of primary school. In private primary schools the situation is slightly different. In the Savremena Elementary School of the Link Group, from I to IV grade, as well as in VIII grade, mandatory *Cambridge ICT Starters* classes are held. Also, in addition to the mandatory subject *Techniques and Technology,* which is offered for the V grade, the following mandatory subjects are taught: *Technical and IT Education* (VI grade) and *Computer Science* (VII grade). International School (Link Group) offers two elective courses from subjects that are aimed at raising students' digital competencies: *Computer Science* and *Digital media*.

State secondary vocational schools that are not focused on the IT and digital sector have mandatory classes in *Computer Science and Informatics* only in the first year. Since digital competencies are important for performing almost any jobs today and the subjects are being introduced in primary education, and since they are recognized in various strategic documents as important competencies for life in the modern world, the question arises to what extent and in what way it is possible to strengthen this aspect in secondary vocational schools, whether by introducing new subjects or by developing interdisciplinary competencies.

New profiles have been introduced in technical schools according to the dual education model: technician for digital graphics and internet design, and electrical engineering technician for information technologies (Strategy, 2020: 18). In electrical engineering vocational schools, curricula are adapted to the profiles that these schools develop, such as: electrical engineering technician for computers, electrical engineering technician for information technology, computer network administrator, electrical engineering technician for multimedia and electrical engineering technician for telecommunications. In the public polytechnic school, the orientations are focused on the education of the profiles: robotics technician, computer aided design technician and computer controlled (CNC) machine technician. Private Information Technology High School - ITHS of ComTrade and Link Group, develops profiles such as: electrical engineering technician for information technology, network administrator, electrical engineering technician for multimedia, mechatronics technician, electrical engineering technician for telecommunications and electrical engineering technician for computers[34].

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[34] https://www.iths.edu.rs/obrazovni-profili/

Mandatory classes in grammar schools, from I to IV grade, are in the subject of *Computer Science and Informatics*, while for the III and IV year, the elective subject of *Modern Technologies* is offered. In the private Savremena grammar school (Link Group), the curriculum from I to IV grade also envisages classes in *Computer Science and Informatics,* but also in the subject of *Information Technologies,* and both subjects are mandatory. Public grammar schools that specialize in computer science and mathematics have a much larger offer of programs that are aimed at developing various competencies, such as: programming, broader understanding of the role of technology in society, creation and manipulation of databases and the like. Thus, for example, the Računarska (*computer science*) Gymnasium in Belgrade offers 11 courses, among which are mandatory *Computer Usage* (I-IV), *Computer Systems* (I), *Programming and Programming Languages* (I-III), *Operating Systems and Computer Networks* (II), *Models and Databases* (III-IV), *Advanced Programming Techniques* (III-IV), *Computer science and Society* (III); as well as elective courses: *Modern Information Technologies* and *Application of Information Technologies* during all four years, then *Geometry and Visualization* (III), *Microprocessor Systems* (III). The public Matematička (*mathematical*) Gymnasium teaches mandatory subjects *Computer Science and Informatics* (I-IV), as well as *Programming and Programming Languages* (III-IV). According to the data from the Digital Skills Development Strategy, from the school year 2019/2020 there are 55 IT classes in grammar schools, while the website of the Ministry of Education, Science and Technological Development lists 49 grammar schools across the country[35]. This data shows that it is necessary to update such lists more regularly so that future students and their parents, especially from smaller towns, are informed on time about the educational opportunities in their environment. Thus, for example, the School for Part Time Secondary Education, Additional Education and Retraining of the Oxford Academy, in cooperation with the Računarska (*computer science)* Gymnasium, holds classes for all who want to complete the IV degree of this vocation in various cities in Serbia. The same goes for cooperation with the Matematička (mathematical) Gymnasium, as well as for other educational profiles.

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[35] http://www.mpn.gov.rs/gimnazije-specijalizovana-it-odeljenja/

I.2 Catalogues of accredited programs

According to the *ZUOV Catalogue of Professional Development Programs*, the total number of accredited programs aimed at developing digital competencies of teachers is **188**. Out of this number, **139 accredited programs were held**, i.e. a total of **1267 trainings** within those 139 education programs. Until the end of 2020, these programs were **attended by 28,570** teachers, non-teaching specialists, andragogy assistants and teaching assistants from preschool institutions, as well as from primary, secondary, secondary vocational schools, art schools, and grammar schools. 85 were organized **in person**, while 54 seminars were held **online.** Most seminars are organized to boost **digital competencies**[36] P1 (154), where the offer for developing basic skills and mastering many programs and applications is very diverse. Then, in a much smaller number for P3 (25), P4 (7) and the least for the competencies P2, related to work with children from vulnerable groups and children with disabilities, where only one seminar was held related to boosting digital competencies or using technology in teaching. Only five implemented programs were related to the protection of children from digital violence and security, two to critical reading and the development of language culture, and one in which digital competencies are developed indirectly through motivation and inclusion of children in the learning process. Among the seminars for the more specific field of raising digital competencies of teachers and students - P1, the largest number of programs was focused on the development of specific competencies[37] relating to teaching and learning - K2 (66), then on competencies for the specific professional field - K1 (34), competencies for communication and cooperation K4 (17) and the least for the development of competencies to support the development of child's and student's personality - K3 (3). 92 implemented programs had some form of evaluation, such as knowledge testing,

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[36] According to the Catalogue categorization: P1 Improving digital competencies of students and teachers and the use of information and communication technologies in the realization of the educational process; P2 Methodology of work with children/students who need additional educational support (work with children from vulnerable groups, children with disabilities, migrants ...); P3 Improving the competencies of teachers in the field of planning and realization of outcome-oriented teaching (raising the level of methodical knowledge relevant to the goals and outcomes of the course/area); P4 Strengthening the educational role of the educational institution through the development of programs for the prevention of violence, discrimination, abuse and neglect

[37] According to the ZUOV Catalogue, they are defined as: K1 competencies for the specific professional field; K2 competencies for teaching and learning; K3 competencies to support the development of child's and student's personalities; K4 competencies for communication and cooperation.

competitions, discussions, systematization and evaluation after training, in a narrow sense, while 47 did not have any.

When it comes to the organizers of the programs, they are all organized in cooperation with educators of different levels of education and areas of operation, as well as educators and teachers from preschool and school institutions. The programs lasted from 1, 2, 3 days to 2, 3, 4 and 5 weeks. The prices of the program range from 1,000 dinars to 10,000 dinars. The most expensive was organized by the Association of Mathematicians of Serbia, and was attended by 858 participants. Only two programs organized by the Tempus Foundation and attended by 236 participants, were free[38]. **The most diverse offer was in Belgrade** - 47 organizations, centres, associations of teachers and faculties from Belgrade with 77 offered programs; then in Niš - 8 organizations with 15 programs, and in Novi Sad - 8 organizations with 13 programs. Immediately behind them are the Education Centre from Bor (24) and the Regional Centre for Professional Development of Employees in Education from Novi Pazar (14). In other towns the offer is much more modest[39] . The largest number of participants (18,378) had 46 programs that were organized **live/in person, in more than three towns** (763 trainings were held in different cities of Serbia)[40] . Most of them covered the development of competencies P1 (38), followed by P3 (7) and P4 (1).

When these programs from the Catalogue offer are **viewed through the prism of 21 DigComp competencies**, we can see that most of the offered programs are aimed at developing one
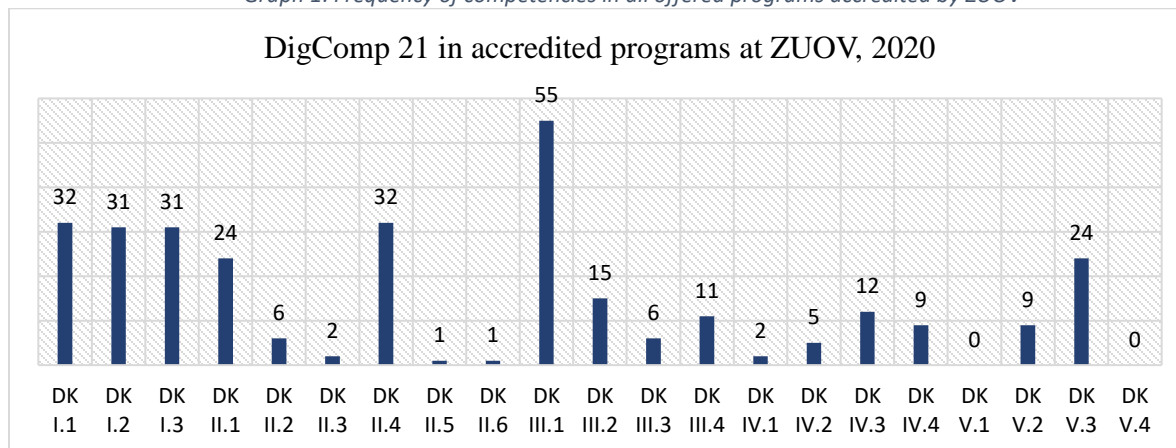
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[38] 45 programs were held for between 1000 and 2000 dinars, i.e. a total of 334 seminars, attended by 8051 participants. 76 programs were realized for between 2001 and 4000 dinars, 642 seminars were held, attended by 14014 participants. 13 programs were realized for between 4001 and 6000 dinars, 220 seminars were held for 5394 participants. The price for specialized program of KUMA Politehnika - school for new technologies from Belgrade was 9600 dinars and it was attended by 17 participants.

[39] Other towns had one to two organizations that organized a small number of offered programs and seminars: Open educational initiative from Jagodina (8), from Kragujevac, High Technical School of Vocational Studies (1) and Center for Professional Development of Employees in Education (4), Secondary Technical School from Sombor (4), Center for Professional Development in Kikinda (3), from Leskovac Center for Education and Social Inclusion (1) and the Agency for Education Marina and Jovan (3), Youth Research Center Gimnazijalac from Kraljevo (2), Creative Pedagogy from Pozarevac (2), Center for Professional Development from Šabac (2), from Sremski Karlovci - Karlovac Grammar School (1) and the Association of Informatics Teachers of Serbia (2), Preschool Gimnazion, Čačak (1), Teachers' Association Leskovac (1), Center for Education and Development Mionica (1), Association of Teachers VET Forum from Paraćin 1), Teacher Education Faculty in Prizren - Leposavić (1), Regional Center for Professional Development of Employees in Education from Smederevo (1), Preschool Institution Naša radost from Subotica (1), Mathematical Society of Serbia - Branch Velika Plana (1), Preschool Milka Dimanić from Vlasotince (1).

[40] Of the programs that were implemented directly, 23 were organized in one town and 12 in two.
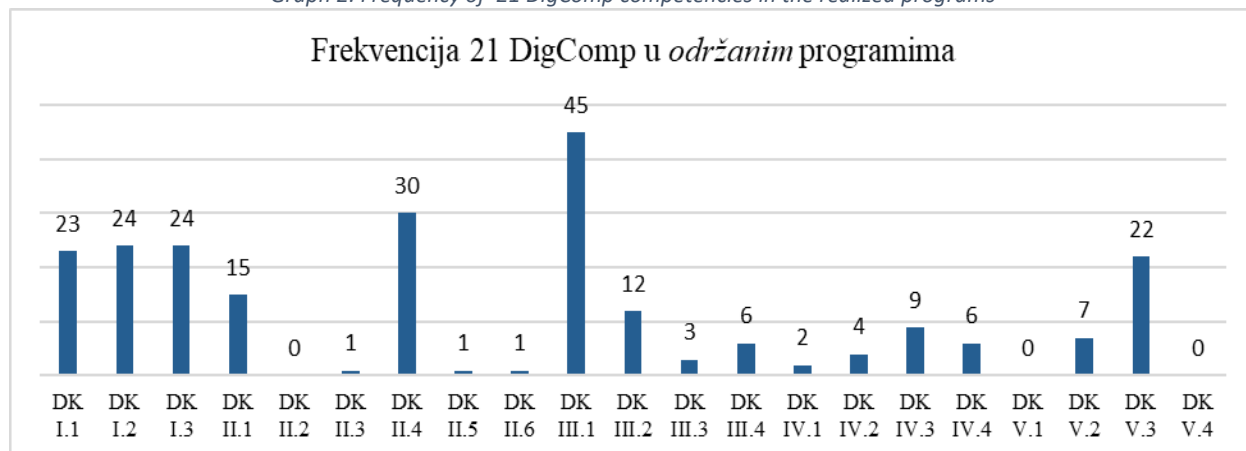
competence (115), much smaller numbers at two (34), three (19), four (18) and five competencies (1). It would be advisable to take into account linking several competencies when designing future programs. The most frequent competence in the program offer is III.1 (digital content creation), which can be seen in Graph 1. This finding is expected since in the first wave of the introduction of these programs, the greatest demand was for materials that teachers can use when working with students. Accordingly, it is not surprising that most of the programs are concentrated on the entire first area within DigComp, which relates to information and data literacy, then within the second area on interaction and cooperation through digital technologies (DK II.4). It is similar with the frequency of competence from the fifth area (safety) which refers to the health care and protection of well-being, mainly of children. Interestingly, none of the offered programs contained competence V.1 (solving technical problems) or V.4 (identification of the gap in digital competencies). Also, the competencies contained in Nettiquete (II.5), as well as digital identity management were found in only one offered program. Two of all the offered programs highlighted the competence related to digital citizenship (II.3) and device protection (IV.1). A small number of programs also offered the development of competencies related to protection of personal data and privacy (IV.2). On the other hand, although it is shown here that few programs offer the development of competence II.2 (sharing through digital technologies), it seems that this competence is in some way contained in competence II.4, which implies not only the sharing of content by teachers or students, but also involvement and cooperation in the joint learning process. Please see Graph 1. One third of the programs from the entire offer are dedicated to digital media, social networks and mobile phones. In this way, in addition to information, media literacy is implicitly included in the offer.

DigComp 21 in accredited programs at ZUOV, 2020

32	31	31	24	6	2	32	1	1	55	15	6	11	2	5	12	9	0	9	24	0
DK I.1	DK I.2	DK I.3	DK II.1	DK II.2	DK II.3	DK II.4	DK II.5	DK II.6	DK III.1	DK III.2	DK III.3	DK III.4	DK IV.1	DK IV.2	DK IV.3	DK IV.4	DK V.1	DK V.2	DK V.3	DK V.4

When it comes to the **realized programs**, most of them were focused on the development of competencies III.1 - digital content creation (45), and II.4 - cooperation using digital technologies (30). Programs that developed competence I.2 (evaluation of data, information and digital content) mainly had as one of components - development of critical thinking, while those that integrated competence I.3 contained elements of data management for different purposes. Please see Graph 2.

Frekvencija 21 DigComp u *održanim* programima

23	24	24	15	0	1	30	1	1	45	12	3	6	2	4	9	6	0	7	22	0
DK I.1	DK I.2	DK I.3	DK II.1	DK II.2	DK II.3	DK II.4	DK II.5	DK II.6	DK III.1	DK III.2	DK III.3	DK III.4	DK IV.1	DK IV.2	DK IV.3	DK IV.4	DK V.1	DK V.2	DK V.3	DK V.4

In Vojvodina, according to the *List of professional development programs approved by the Pedagogical Institute of Vojvodina[41]* out of a total of 129 accredited programs in minority

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[41] http://www.pzv.org.rs/index.php/seminari

languages, only **9** relate to boosting digital competencies. There is no information that any of them has been realized. It is important to note that among them, seven are offered in Hungarian, one in Slovak and one in Croatian, which indicates the need for their development in minority languages.

According to the *List of accredited programs of public interest* in ZUOV, out of 287 accredited programs of public interest[42] implemented during 2021, **38** are closely related to the development of digital competencies, more specifically to: digitization and improvement of primary and secondary schools performance (4); work with eSchoolDiary (1); raising basic digital competencies of teachers, professors and other school employees for the purpose of applying digital technologies in teaching (10) and implementing the Digital Classroom program (2); self-evaluation of digital competencies - SELFI (2); developing interdisciplinary competencies, including digital ones (2); prevention of digital violence (2) and safety of children on the Internet (1); using IT to improve professional teaching (2); through the realization of subjects provided for in the curriculum. One program was offered for the first cycle of primary education and the subject Digital World. In the second cycle of primary education, 5 programs were offered for the subject of Informatics and Computer Science, and two for the subject of Techniques and Technology. For secondary vocational schools and the subject Computer Science and Informatics, there is one program on offer, and one for grammar schools, i.e. a program of elective subjects that also include the development of digital competencies. And finally for working with the IT class in grammar schools, also one. The organizers of the trainings are not transparent enough, but according to the e-mail addresses of the contact persons for their implementation, it can be seen that most trainings are conducted or managed by persons employed in the ministry, the Institute for Evaluation of Education Quality, and in a much smaller percentage in VET program for adult vocational education[43], organization Druga šansa (*second chance*) [44], while Kulturkontakt, Petlja, Oxford Academy implemented one program. Anyway, it is not possible to make a more detailed analysis of these programs not only when it comes to organizers, but also when it comes to duration,

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[42]ZOUV Programs of public interest approved by the Minister's decision, conclusive with 2021: https://zuov.gov.rs/lista-programa-od-javnog-interesa-koje-resenjem-odobrava-ministar/.

[43] http://www.vetserbia.edu.rs/

[44] http://dru gasansa.oshrs.edu.rs/

possible scoring, price and number of people who attended the offered programs, because other data are not included in the ZUOV list.

II Formal education: faculties and colleges

This section presents the findings related to education within public and private faculties and colleges, divided into two segments. The first covers courses that include any form of digital competencies at the faculties of social sciences, humanities and arts. The other covers IT majors at other faculties and IT academies.

II.1 Digital competencies in the field of social sciences, humanities and arts

The faculties of social sciences, humanities and art of all state universities offer **725** different courses **at basic academic (OAS) or basic vocational studies (OSS)** during all the study years, which are related to raising the digital competencies of the profiles they educate. More than half of all courses (mandatory and elective) at the basic studies are offered by faculties within the University of Novi Sad - as much as 58.07%, University of Kragujevac follows with 14.07%, then University of Belgrade with 13.79% (of which 40% provided by the University of Arts in Belgrade), the University of Niš with 6.76%, and the lowest are the University in Priština with 3.72% and the University of Novi Pazar with 3.59% (See Graph 3).

Graph 3: Digital competence programs at the state faculties of SSH and Arts - OAS in %
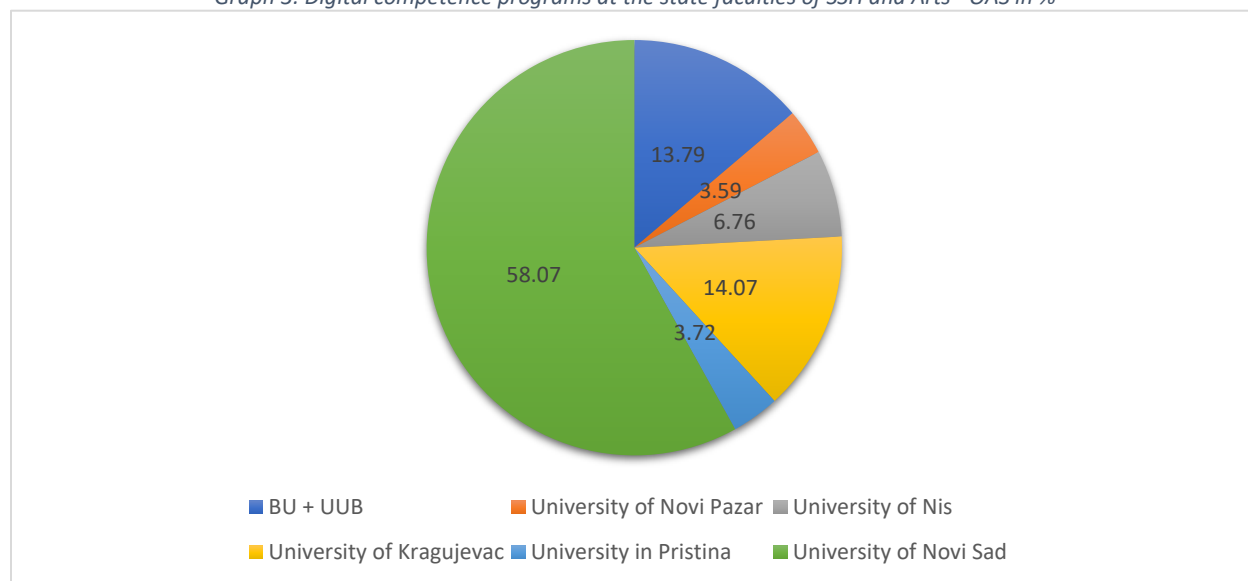
Among them, 362 have the status of mandatory and 363 of elective courses. For example, within the University of Novi Sad, out of 421 courses offered, 194 are mandatory and 277 are elective. Within the University of Kragujevac, out of 102 courses, 40% are mandatory and 60% are elective. The University of Belgrade, together with the University of Arts, offers 100 courses, of which 47 are elective and 53 are mandatory. At the University of Niš almost half of the 49 courses are mandatory. The situation is similar at the University in Priština, where 27 courses are offered, while in Novi Pazar, which has the fewest courses on offer (26), the largest number of them is mandatory (See Graph 4).

Graph 4: Digital competence programs at the state faculties of SSH and Arts - OAS - mandatory and elective in %
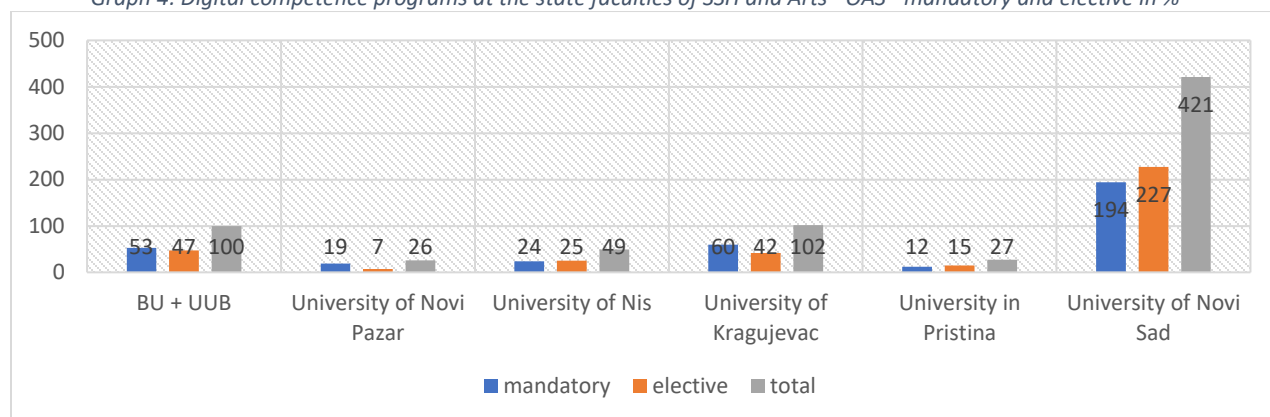
When it comes to **master academic studies (MAS), the** faculties of social sciences, humanities and arts of all universities in the RS offer a total of **254 courses** that include the development of various digital competencies, depending on the curriculum. Graph 5 shows in percentage that one third of such courses at the master level are provided by the University of Belgrade (together with the University of Arts) - 33.73%, and the University of Kragujevac (33.73%). Half less is offered by the University of Niš (16.47%), slightly less by the University of Novi Sad (13.73%) and the least by the universities of Novi Pazar (1.57%) and in Priština (0.78%).

Graph 5: Digital competence programs at the state faculties of SSH and Arts – MAS in %
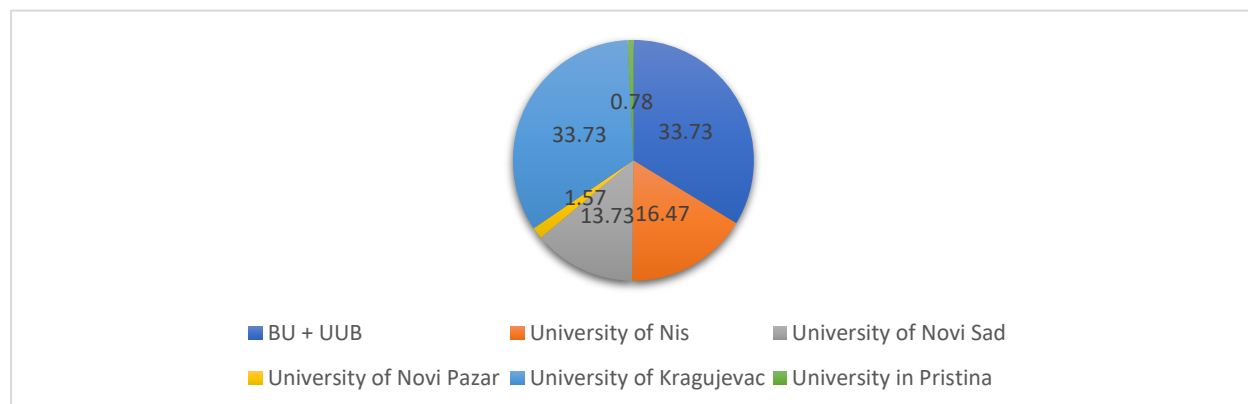
In the entire offer, 63 courses are mandatory and 192 are elective. The elective programs are distributed as follows: 39.58% BU, 31.25% University of Kragujevac, 14.58% University of Niš, 12.50% University of Novi Sad, 1.56% University of Novi Pazar and 0.52% University in Priština. See in Graph 6 how they are distributed within each individual university.
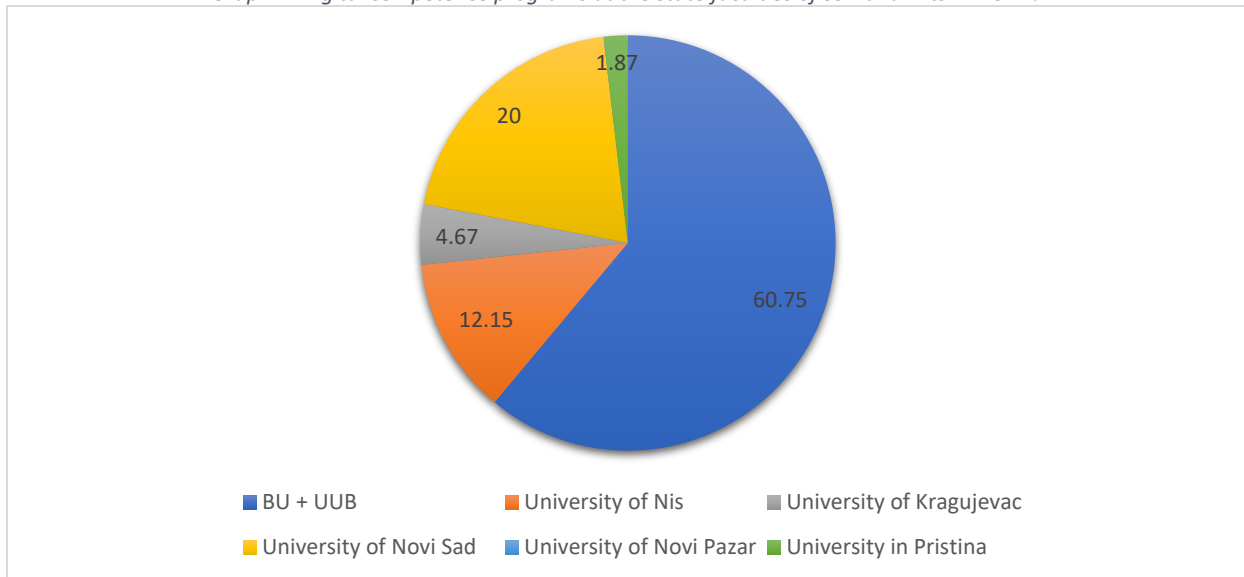
Graph 6: Digital competence programs at the state faculties of SSH and Arts - MAS - mandatory and elective
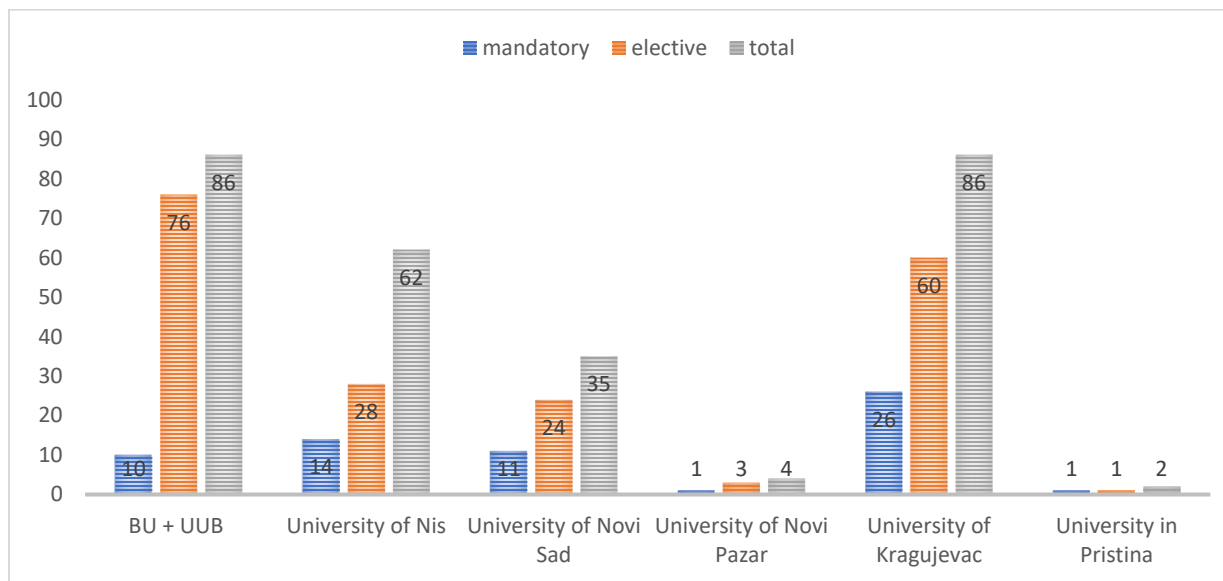
It should be noted that the Multidisciplinary Studies at the University of Belgrade (BU), offer the Master Academic Studies (MAS) *Computer Science in Social Sciences* with 31 courses related to the development of digital competencies necessary for work in the social sciences. Among them are two mandatory ones (Modern Computer Technologies and Quantitative Modelling in the Social Sciences) and 29 electives. Since digital competencies at these faculties are developed first in accordance with the specializations and primary scientific disciplines, it can be said that the programs intended for future teachers, educators and others who are preparing to work with children, then future economists, lawyers and the like, are focused on the development of basic competencies and their integration into existing curricula. On the other hand, faculties and academies whose main activity is related to the media are developing entire modules for raising the digital competencies of their students under more complex curricula, with more diverse and modern courses on offer.

At the level of **doctoral studies** (DAS) at the state universities of SSH and Arts, there are **107** courses on offer, 25 mandatory and 82 elective. The highest percentage of courses (60.75%) are from the University of Belgrade, 20% in Novi Sad and 12.15% in Nis. Please see Graph 7.

Graph 7: Digital competence programs at the state faculties of SSH and Arts– DAS in %

Legend:
- BU + UUB
- University of Nis
- University of Kragujevac
- University of Novi Sad
- University of Novi Pazar
- University in Pristina

The University of Belgrade, together with the University of Arts in Belgrade, offers the largest number of such courses, as many as 65, of which 25 are mandatory and 40 are elective (See Graph 8). Research of these programs shows that the need to innovate existing and create new courses that would include digital media, information technology and related competencies has been recognized at the universities in three major cities. Certainly, the new accreditation will show in which direction these programs will develop in the next few years, what challenges they have managed to respond to, and what obstacles they have yet to face. One of the transitional solutions to help bridge the current gap can certainly be to offer interdisciplinary programs for II and III level of higher education at each university, as done by the BU.

Graph 8: Digital competence programs at the state faculties of SSH and Arts - DAS - mandatory and elective
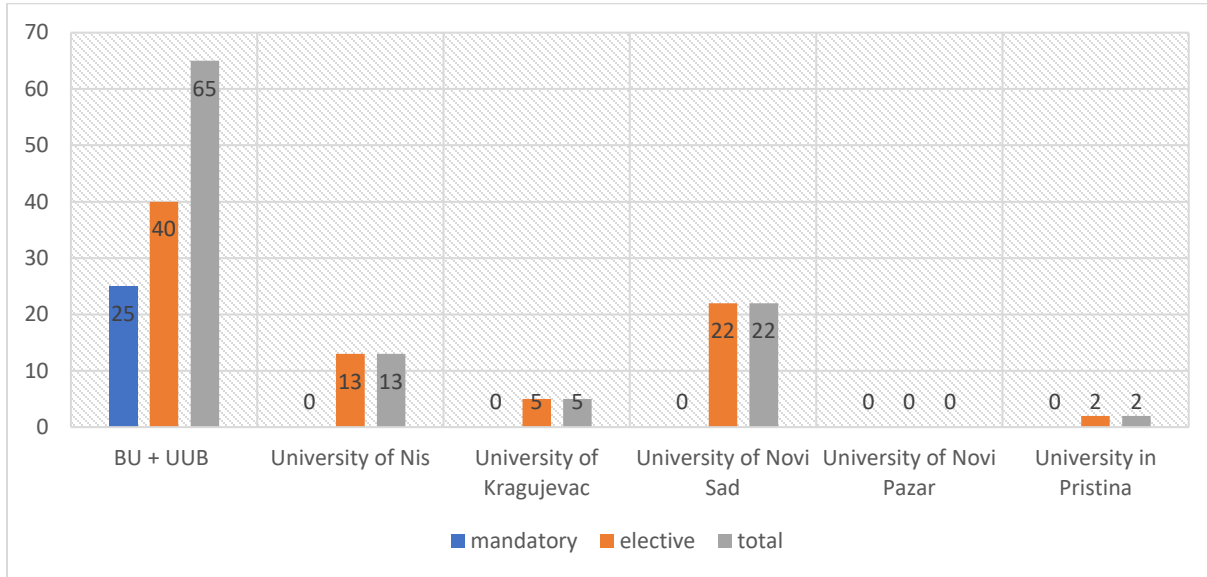
In these programs, at all levels of education, **other literacies** related to the development of digital competencies are almost equally represented, such as: information (34.17%), which also represents the first of the five key areas within DigComp, followed by media (34.5%) and computer (31.78%) literacy. Please see Graph 9.
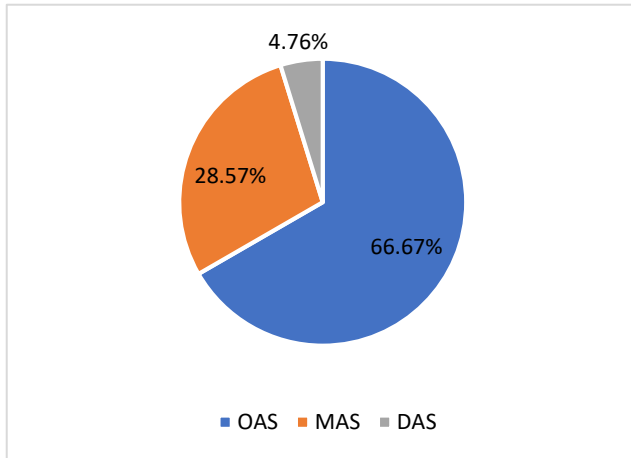
Graph 9: Digital competence programs at state faculties of SSH & Arts and other literacies

Representatation of information, computer and media literacy frequency in %
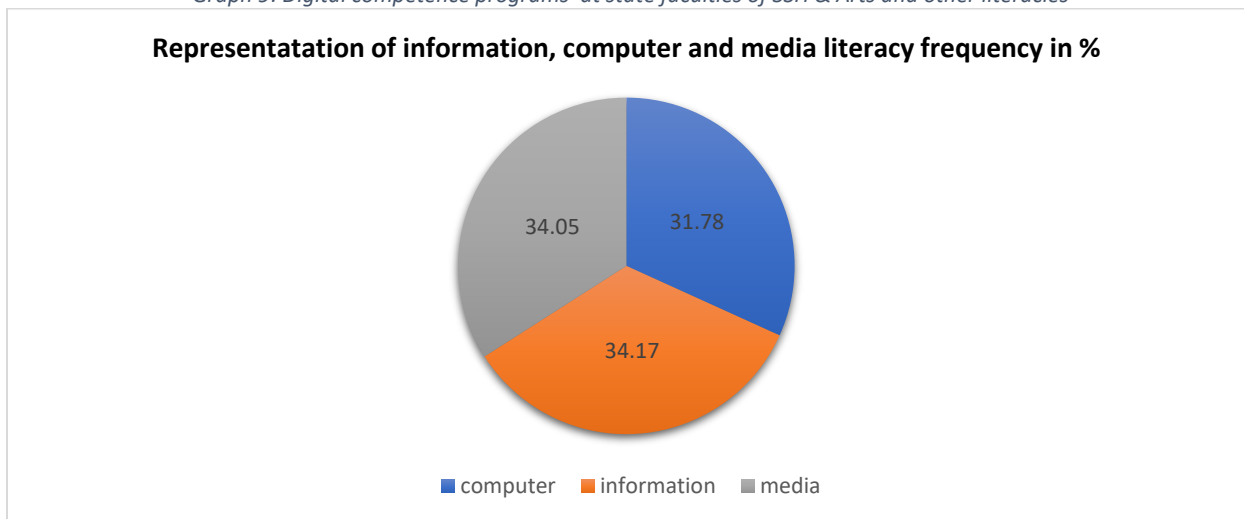
When it comes to digital competence courses at **privately owned faculties** of social sciences and humanities **and art academies,** Graph 10 shows that the offer is the highest at the basic academic

level of education. In developing these programs at all levels of education, ComTrade ITS Link Group and John Naisbitt University are at the forefront, as shown in Graph 11.

Graph 10: Digital competencies in all study programs of all private faculties of SSH and Arts in %

Graph 11: Digital competencies according to the study programs of private faculties of SSH and Arts in Serbia
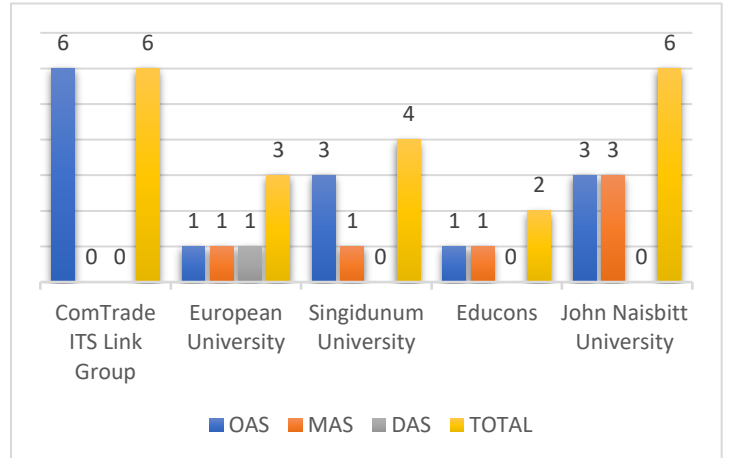
## II.2 IT specializations: state and private faculties

According to available data, faculties and colleges in Serbia offer **273 study programs in the field of IT**. As can be seen in Graph 12, 66.21% of study programs belong to state faculties, and a third to the private ones. Also, 83.33% belong to state colleges, while the remaining 16.67% belong to the private College of Vocational Studies in Information Technology and the SAE Institute, which has four three-year study programs in the field of digital technologies.

Graph 12: IT study programs at faculties and colleges in Serbia in %
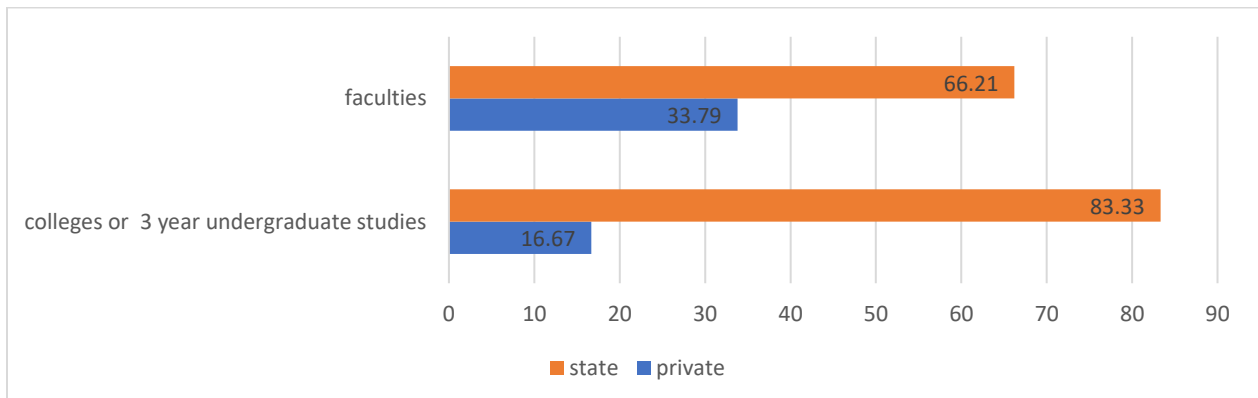
When it comes to study programs in the field of informatics, computer science, programming, etc., most of them are offered at the state faculties. Thus, for example, basic academic studies (OAS) offer a total of 102 study programs, of which 80 at state and 32 at private faculties. Of the 73 master academic study (MAS) programs in IT, 43 are at state and 30 at private faculties. Also, of the current 35 programs within doctoral academic studies (DAS), 21 are at state and 14 at private faculties (See Graph 14). Basic, master and doctoral vocational studies, as well as specialist studies in this field are predominantly developed at state colleges in various cities in Serbia, namely Arandjelovac, Belgrade, Čačak, Kragujevac, Kruševac, Niš, Novi Sad, Požarevac, Subotica, Trstenik, Užice, Zrenjanin and Šabac.

Graph 13: IT study programs at faculties
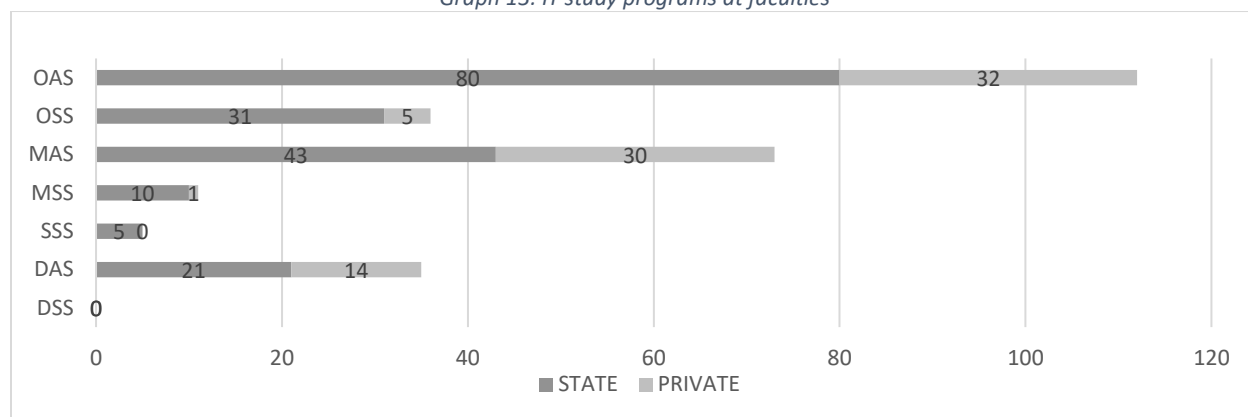
In addition to the study programs that have been singled out, most state faculties of natural-mathematical, technical-technological and medical sciences offer modules or curriculum packages of subjects that put ICT in the foreground, and which students can choose according to their preferences and specializations. Also, the private sector offers shorter specialization programs in programming, design, IT business and administration that last one year and are open to anyone who can pay. The price of such programs is on average 2000 Euro. The IT Academy has the most extensive offer, within which lectures take place both in person or online.

III Non-formal education: courses, trainings, additional education

The database of available courses for the general population in the field of non-formal education currently includes **1083** different programs of all levels of education (basic, intermediate, advanced). Among the course providers, large private companies with their various learning centres are leading (47.7%), followed by private schools and private institutes (28%), and portals,
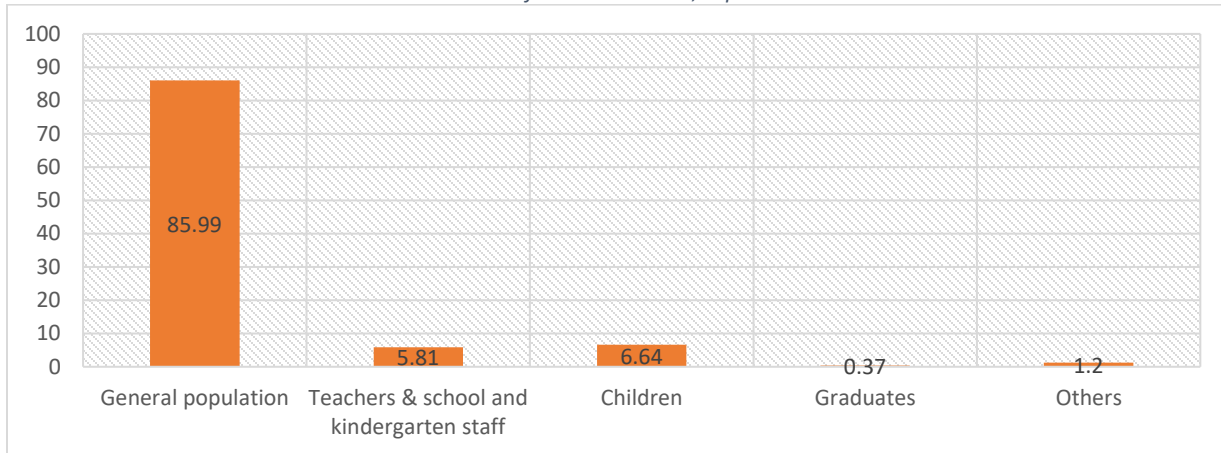
i.e. platforms with mass open online courses (MOOC) and portals with courses and trainings (12.9 %). Limited liability companies (59) and corporations (19) have a much smaller number of offers, followed by business associations, foundations and agencies (29), and the smallest one is by public institutions and state faculties (20).

*Graph 14: Providers of digital competence courses in non-formal education, expressed in %*
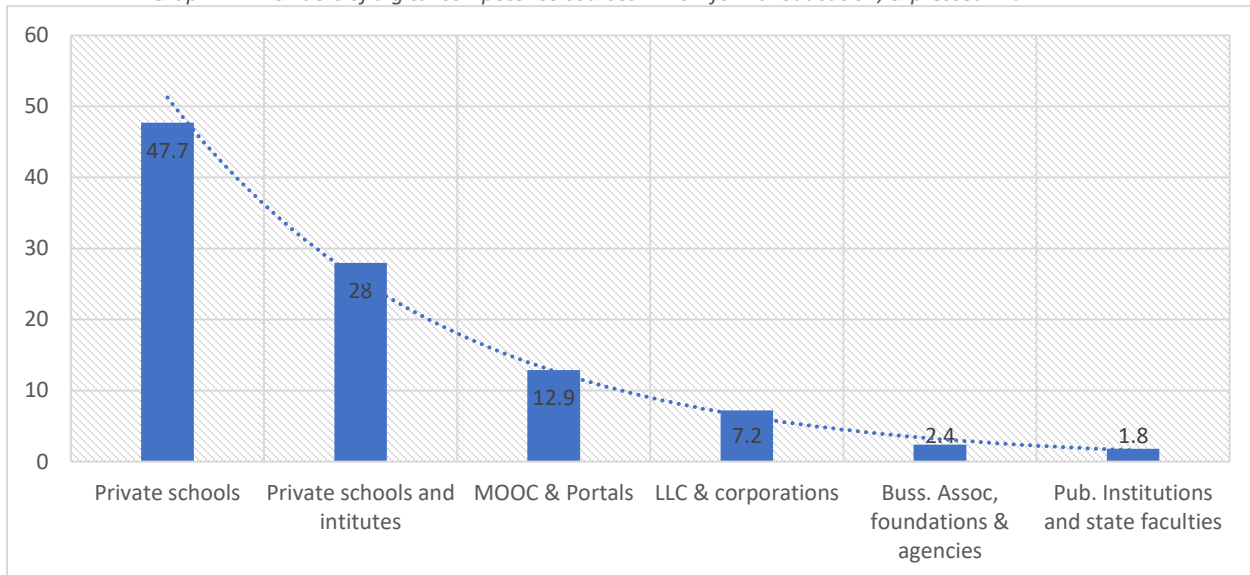
A largest number of these programs is, as shown in Graph 15, intended for to the general population (85.99%) who can set aside money for the additional training and specializations offered. 5.81% (explicitly stated) is intended for teachers and school staff, one of which is free for secondary school teachers and students, available on the website e-nastava.rs, while the rest are part of the offer of the Institute for Modern Education. 6.64% of all courses are intended for children of different ages, only 0.37% for secondary school graduates. None of them is explicitly intended for secondary school students, which does not mean that programs intended for the general population are not available to them. 1.20% is intended for others, such as companies and the like.

Programs often cover more than one area, such as web programming or music design for video games. To determine which areas are most common, they are grouped into several larger areas. Some programs cover more than one area, which is why their occurrence frequency was measured. Of all the areas found in the offers of courses and trainings, programming takes the first place (27.36%). Then, one after another courses for IT security and administration (14.93%), Web and Web design (12.51%) and basic digital skills and so-called "soft skills" (11.62%). Each fifteenth course was intended for boosting competencies in the field of digital marketing (6.46%), each seventeenth in the field of graphics and graphic design (5.81%) and each twentieth in the field of games and applications (5.00%), creating databases and data analysis (4.92%) and animation and modelling (4.92%). The least offered ones are trainings that include the creation and manipulation of audio and video material (1.53%) and specific trainings that did not find a place in the previous categories (1.45%).

Graph 16: Area frequency in digital competence courses, presented in %
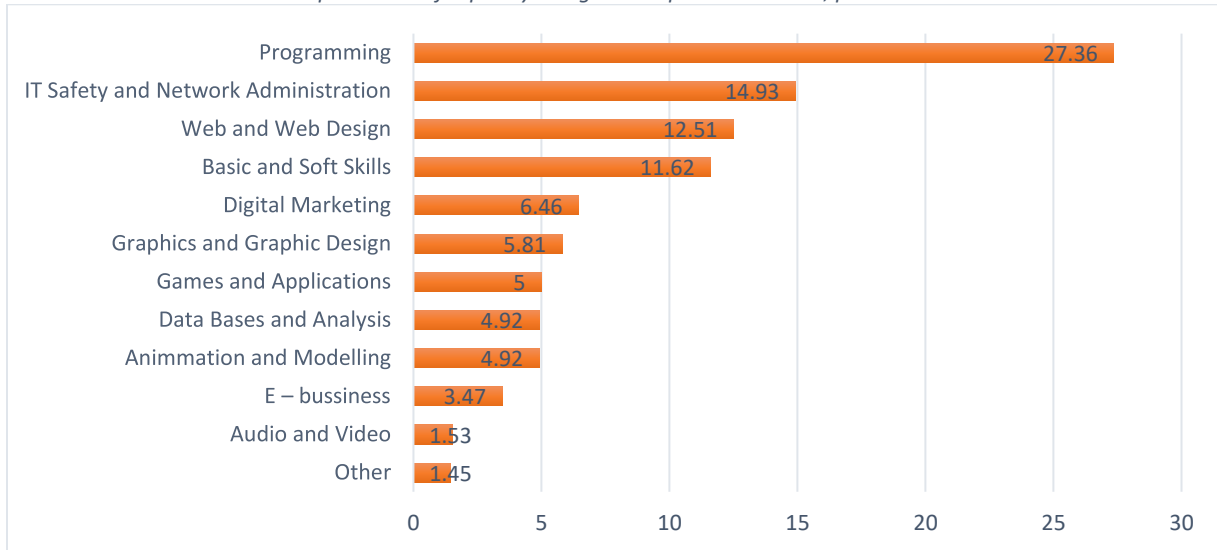
Also, almost a third of the courses (29.73%) within non-formal education offered 2 or three levels of training with the same title, while for a quarter of them it was not possible to determine the exact number due to the lack of information. The most offered trainings are for beginners (42.30%), one fifth are intermediate level trainings, while one tenth is intended for advanced level, which can be seen in Graph 17.


Graph 17: Levels of training in non-formal education - frequency shown in %
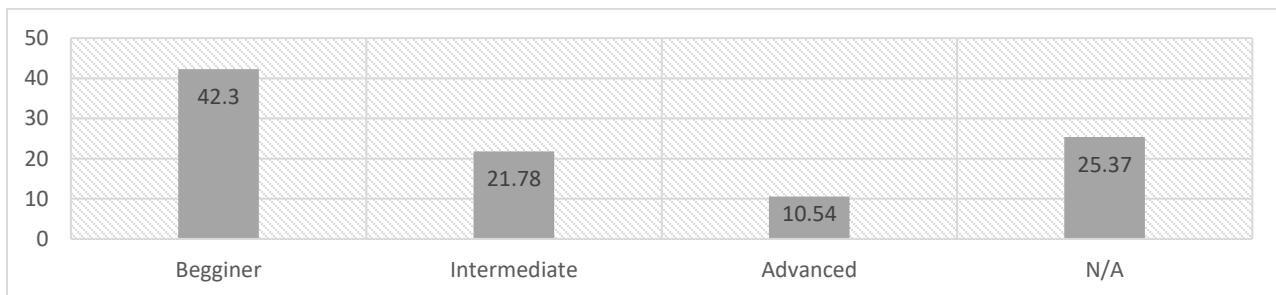
Most of these programs are paid. Only 5.36% of them are free and they are mostly offered as part of the Mass Open Online Courses (MOOC), while price information for almost a fifth of all courses on offer was not available on the website. Where there were more prices offered, depending on the number of educators, a lower one was entered, referring to smaller groups (4-5 individuals). Prices for individual lessons are higher and courses last less days or hours. Since the prices are diverse, shown in dinars and euros, they were grouped. As shown in Graph 18, a quarter of the offered

courses are available for a price between 101-200 Euro, while for almost every fifth it is necessary to set aside between 201 and 500 Euro. There is a similar percentage for the available courses for 1-50 Euro, or 501-1000 Euro. All programs whose price is above 500 Euro come from the private sector. The viability of these programs could not be established because the data on the number of those who completed them are not available.

Graph 18: Courses shown by price, expressed in %
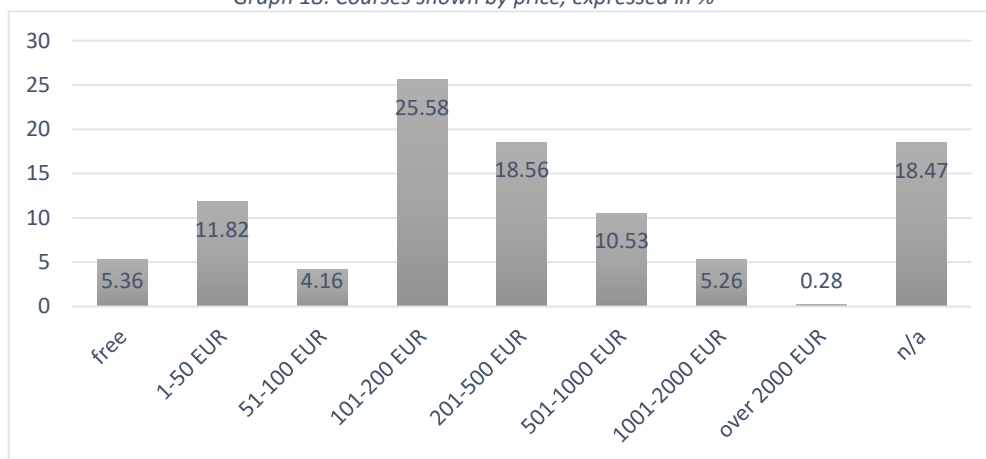
Graph 19 follows what could be seen also from the presentation of key areas covered by these courses and trainings, where the largest percentage of them cover specialized IT competencies, but often other literacies are integrated into them as well, depending on the area wherefrom the training is offered. Consequently, most courses develop computer literacy (49%), information literacy as an important element of digital competencies is covered by 31% of the trainings offered, while media literacy is covered by each fifth of them.

Graph 19: Digital competence and other literacy courses

Representation of computer, information and media literacy, in %
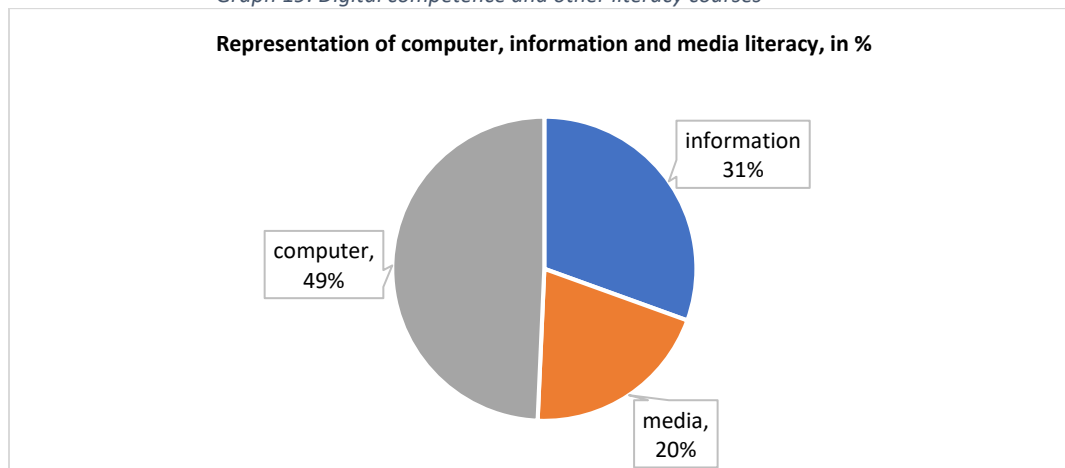
When it comes to the unemployed and people with disabilities, it should be noted that the National Employment Service in 2021 plans to support specialist IT training of 1000 unemployed people in cooperation with licensed providers, in accordance with the needs of the labour market. On that occasion, the unemployed women who are in the records of the Service shall take priority[45]. The Republic Institute for Social Welfare offers a program for employees in social welfare institutions - Application of information technology (IT) in working with persons with intellectual disabilities, as part of the 39 initiatives to support persons with disabilities[46].

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[45] http://www.nsz.gov.rs/live/trazite-posao/edukacija/obuke_za_tr_i_te_rada.cid545.

[46] http://www.zavodsz.gov.rs/media/1528/primena-informacione-tehnologije-u-radu-sa-osobama-sa-intelektualnom-ometenoscu.pdf.

Conclusion and Recommendations

This research data indicate a trend of strengthening *specializations in the IT* field in education, both formal and non-formal. This trend can be followed from specialized schools and classes for mathematics, computer science and technology, through faculties and colleges of technical-technological and natural-mathematical sciences to the strong influence of the private sector when it comes to offering specialized programs within IT academies and courses whose attendance depends from the personal financial abilities and preferences of the attendants.   These findings indicate the determination of the state to increase the percentage of IT experts in the country, but also to strengthen the link between IT specializations and the private sector.

On the other hand, the findings show a proliferation of programs that offer the development of *basic digital competencies* for specific target groups such as teachers and other employees in preschool and schooling institutions. However, when it comes to university students off social sciences and humanities and arts, the offer of courses that include digital competencies depends on the geographical position of the university. As can be seen from the findings, the University of Novi Sad dominates with the offer of courses at basic (*undergraduate*) studies, then the University of Belgrade with the offer of courses and programs at doctoral studies and equally the University of Novi Sad and Kragujevac with the offer of courses at master studies. To what extent such an offer suits students and what competencies are needed by the employed teaching staff at the faculties is an important topic of a future research.

By comparing the findings related to available courses for the general population with different surveys of digital skills of citizens, we conclude that the dominance of supply for acquiring basic levels of digital skills does not meet the needs of those citizens who need higher levels of digital competencies in various areas of creative industry and exploitation of social media capacity, with the exception of specific programming courses and trainings. Also, having in mind the goals of the Strategy for the Development of the Artificial Intelligence until 2022, there are almost no trainings in the field of artificial intelligence for any target group and for any amount of money. Also, when it comes to courses and trainings for the general population, it is important to note that the financial aspect plays a significant role. The current situation indicates that less money is

needed for basic digital skills courses. However, if we look at the results of previous research, most citizens who use the Internet and digital technologies already possess basic digital skills. This further means that every subsequent investment in one's own education in this area requires setting aside at least a half of the average monthly salary, and sometimes even much more. In other words, the financial aspect creates an additional gap between those who have the money to invest in development of their digital competencies and those who do not. At this point it seems very important to reopen the question of how it is possible to reduce the deepening of the digital divide among the population by influencing its economic dimension, developing affordable courses and training for intermediate and advanced digital competencies.

Another important finding is that a very small number of courses and trainings for the general population are dedicated to the ethics and value aspects of digital competencies, as well as security, regardless of whether it refers to the device, data, identity, health and well-being or environmental protection. This also applies to the courses for teachers. When it comes to children, the current picture shows that they are expected to learn about these topics from teachers and parents. However, the data from the research Children of Europe on the Internet (Kuzmanović et al., 2019) indicate that such expectations are not met and that it is necessary to design programs (inside and outside the school) intended for children and adolescents of different ages and with various topics that are part of their daily lives, and which are currently almost non-existent in the offer of courses, except through projects of civil society organizations that are limited to a certain number of children and adolescents, and with the duration of the project. Also, the involvement of the elderly population in the digital transformation of society by boosting their digital competencies has proven to be very important in the last year during the Covid 19 virus pandemic. Since the research shows that they have a considerable aversion to technology, it would be important to design not only affordable (or free) courses to meet their needs (e.g. use of e-services), but also a campaign to raise awareness of the important aspects of digital transformation, opportunities to overcome obstacles and benefits for their daily lives. Finally, the question of bringing digital competence programs closer to those without the access to digital technologies remains open. On the one hand, this could be enabled by opening local centres in cooperation with local communities, clubs, associations and the like, but also by organizing incentive campaigns for citizens and companies, together with computer equipment and mobile telephony companies. They would imply giving old

devices to those who do not have any in exchange for vouchers that could be used to purchase another device.

Since the digital competence program providers analysed in this research are very heterogeneous, similar to their programs, and not all can be tracked through the model offered by DigComp, one way of classifying them at this time is offered in this report structure: formal education - schools and catalogues of accredited programs for teachers; formal education - faculties and colleges, and finally courses - that can be classified according to key areas. The recommendations based on this research are divided in the same way.

RECOMMENDATIONS

SCHOOLS:

1. *Expand the offer of digital competence subjects in secondary vocational schools* (not specialized in computer science and mathematics) or put emphasis on them through existing subjects by developing interdisciplinary competencies of teachers and students.

2. *Update the lists of secondary schools that offer the possibility of enrolling in IT classes* regularly in all cities of Serbia on the website of the Ministry of Education, Science and Technological Development.

3. Support the design and accreditation of digital competence programs implemented *in the languages of all national minorities*.

4. Organize a *List of programs of public importance* according to DigComp competencies in order to facilitate the design of programs that link different competencies and areas aimed at mastering more complex tasks in the digital environment. This raises trust in digital technologies and self-confidence in the lifelong learning process.

5. Update the *List of Programs of Public Importance* and make it more transparent and detailed, as has been done with the Catalogue of Accredited Programs for Teachers, to enable interested organizations, partner coalitions and institutions to more easily design programs that will advance the strategic development of digital competencies at all levels, and for all target groups.

6. Increase the number of courses for teachers that include competencies related to the *ethics and value aspects of digital competencies, digital identity and security* (including health and well-being, device, personal data and privacy protection, and environmental protection, as shown in DigComp).

7. Raise the offer of courses that include a competence related to *digital citizenship*, especially for teachers whose subjects are closely related to this competence.

8. Boost the number of programs for teachers dedicated to *digital media, social networks and mobile phones,* because these technologies are part of the everyday life of children and secondary school students. This is also one of the ways to link media literacy with digital competencies.

9. Expend the offer of *VET programs for adult vocational education* that link different digital competencies and correspond to different levels of knowledge.

FACULTIES

10. Promote the development *of knowledge innovation programs* at state faculties and colleges, as a product of cooperation of several faculties in all relevant scientific fields that would be more affordable to interested citizens and target groups.

11. Support the *implementation of seminars and workshops for raising digital competencies of teaching staff* at the faculties of social sciences and humanities in accordance with their research needs and opportunities to integrate these competencies into their syllabi, especially in areas where there are very few courses for the general population, such as datafication, artificial intelligence and the like.

12. Invest in the technological equipment of the faculties (including software licenses) of social sciences and humanities in order to *open digital laboratories* for the realization of experiments, practical exercises and projects with students so that after graduation, regardless of the economic status, they could be competitive in the European labour market with their digital competencies and knowledge already acquired in these studies.

13. Encourage inter-university cooperation of teachers and students in the same and similar studies (e.g. media) with IT experts in order to digitally advance both teachers and students.

14. Form *a SSH Digital network* whose goal would be to encourage cooperation, exchange of knowledge and experiences of researchers in the social sciences and humanities, create joint innovative projects and interdisciplinary programs that include the development and application of digital competencies.

15. Design interdisciplinary programs for II and III degree of higher education *at the level of each state university in Serbia* as a transitional solution to bridge the gap that exists in the current offer of faculties, especially those that link modern technologies with the field of social sciences and humanities and arts.

16. Foster the organization of *doctoral summer and winter schools*, as well as *post-doctoral studies* linking the fields of social sciences and humanities and the use of technological solutions and software for research purposes.

17. Create incentives for *hiring IT experts in the status of "non-employed lecturers"* stipulated by the Law on Higher Education, at interested faculties of social sciences and humanities and arts in order to raise digital competencies of teachers and students, i.e. facilitate digital transition in these areas.

GENERAL POPULATION

18. Form a *uniform platform* with available programs and forms of education whose goal is to raise the digital competencies of different social groups, which would be categorized by areas, target groups and levels of competencies they achieve. The platform would also include providers, prices, and various payment and sub-financing options and would be regularly updated.

19. Support the cooperation and *affiliation of supply and demand of potential partners* who would participate in the design and implementation of digital competence trainings for different target groups through a special segment of the platform intended for public calls.

20. Advocate for the development of accessible digital competence programs *in parts of the country where such an offer is non-existent or scarce*, in cooperation with the local community, libraries, cultural institutions and the like.

21. Increase the number of training packages and courses *for companies and interested groups of employees* in accordance with their professional needs and work tasks.

22. Encourage the development of accessible programs in the field of digital marketing, graphic design, video games and applications, manipulation of video and audio material and the like, as part of a broader project for developing media literacy in the digital environment through raising digital competencies.

23. Stimulate the development of sustainable and accessible programs *for children and adolescents of different ages* in the field of ethics and value aspects of digital competencies, security including their health and well-being, as well as digital identity management.

24. Foster the development of accessible programs, seminars and workshops for all citizens in the field *of Internet security, safe and responsible use of digital technologies and e-government systems and e-services*, in order to raise confidence in the digital transformation of society.

25. Prompt, where possible, the *online* implementation of courses, seminars, trainings, meetings, workshops, thus reducing the costs and attracting a larger number of citizens through various forms of education.

26. Establish *indicators* for measuring the effectiveness of course realization and their *certification.*

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