EDU-GATE

EDucational University GATeway to enhance innovative E-learning capabilities, resilience and new best practices

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Output 1

Impact and diffusion of digital education in Higher Education Institutions: a research on innovative solutions, methods, skills and best practices to enhance the EU Digital Education Action Plan

Research on National Policies and Practices in Greece

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Contents

1. STATISTICS ABOUT THE COUNTRY

Country and Population

Greece is a country in southeast Europe that is made up of the mainland in addition to 3,000 islands scattered in both the Ionian and Aegean seas. The land itself is very mountainous. The cumulative area of Greece is 131,957 square kilometers, of which land area is 130,647 square kilometers, and internal waters (lakes and rivers) account for 1,310 square kilometers,. Greece has a population density of 82 people per square kilometer), which ranks 97th in the world.

Based on the Demographic and social characteristics of the Resident Population of Greece (ELSAT, 2021[1]) the Resident Population of Greece is 10.816.286, of which 5.303.223 male (49,0%) and 5.513.063 female (51,0%).

The largest city and capital is Athens. Athens has an urban population of 3 million with a metro population of 3.75 million. Athens is the most densely populated region of Greece. About 60% of Greek people live in urban regions. Along with Athens, other major cities include Thessaloniki (788,000), Patra (214,000), and Heraklion (174,000).

Resident Population by gender and by Region

Description	Totals			Percent share	
	Total	Male	Female	Male	Female
GREECE, TOTAL	**10.816.286**	**5.303.223**	**5.513.063**	**49,0**	**51,0**
REGION OF EASTERN MAKEDONIA, THRAKI	608.182	299.643	308.539	49,3	50,7
REGION OF CENTRAL MAKEDONIA	1.882.108	912.693	969.415	48,5	51,5
REGION OF WESTERN MAKEDONIA	283.689	141.779	141.910	50,0	50,0
REGION OF IPIROS	336.856	165.775	171.081	49,2	50,8
REGION OF THESSALIA	732.762	362.194	370.568	49,4	50,6
REGION OF CENTRAL GREECE	547.390	277.475	269.915	50,7	49,3
REGION OF IONIAN ISLANDS	207.855	102.400	105.455	49,3	50,7
REGION OF WESTERN GREECE	679.796	339.310	340.486	49,9	50,1
REGION OF PELOPONNISSOS	577.903	291.777	286.126	50,5	49,5
REGION OF ATTIKI	3.828.434	1.845.663	1.982.771	48,2	51,8
REGION OF NORTHERN EGEO	199.231	99.984	99.247	50,2	49,8
REGION OF SOUTHERN EGEO	309.015	155.865	153.150	50,4	49,6
REGION OF KRITI	623.065	308.665	314.400	49,5	50,5

Figure 1: Resident Population by gender and by region

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[1] https://www.statistics.gr/

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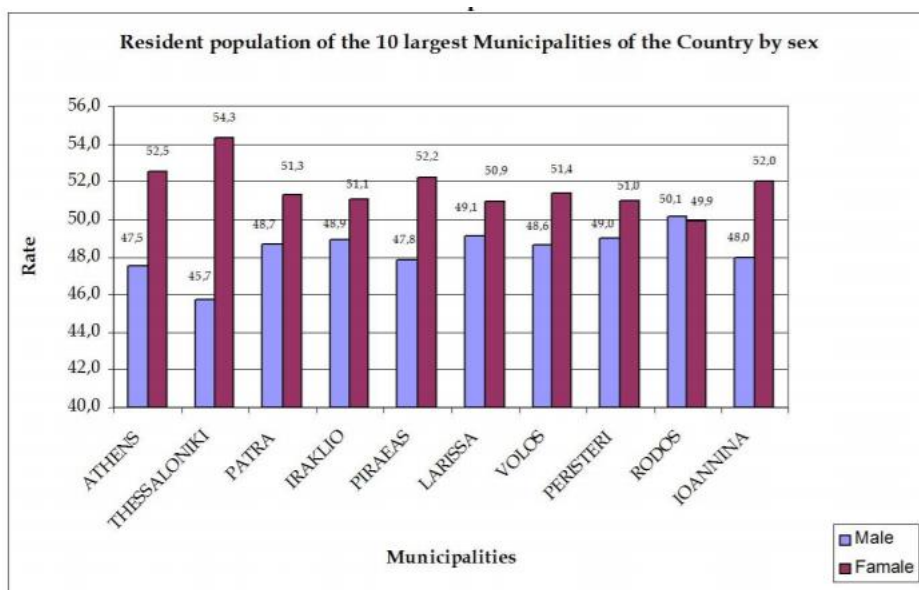
Figure 2: Resident population of the 10th largest Municiplalities of the Country by sex

"Since 2005, Greece has experienced a population decline, dropping from 11.23 million people to 10.86 million in 15 years. The most recent projections show a continuation of this decline, resulting in a population of 9.03 million by 2050 and 6.61 million by 2099.

From 2019 to 2020, Greece's population declined 0.48%, losing over 50,000 people. The main reasons for Greece's population declining are a very low fertility rate of 1.3 births per woman, financial crisis, emigration, and an aging population. The decline in the birth rate can be caused by education levels, the economic crisis, women's unemployment, and the government's inability or unwillingness to encourage fertility.

With fewer people in Greece, there is less economic stimulation, fewer people working due to an aging population, and more people emigrating to other nations, creating a cyclical effect on the population decline" (Review, 2021).

The age distribution of the Greek population has the following structure. (Index Mundi, 2021)

Age	%	Males	Females
0-14	14.53%	794,918	745,909
15-24	10.34%	577,134	519,819
25-54	39.6%	2,080,443	2,119,995
55-64 years	13.1%	656,404	732,936
65 years and over	22.43%	1,057,317	1,322,176

Figure 3 Age distribution of the Greek population

Statistics: Staff and students in Greece

Institutes in Greece run in the form of lectures or workshops, and most of the courses last one semester, that is, at least 13 weeks. Most university departments in Greece offer one-year or two-year postgraduate courses, as well as the opportunity to pursue a doctoral degree. Students may also enroll in the Hellenic Open University for graduate or postgraduate studies, where they pay tuition fees, and are admitted through an annual lottery system.

The following statistics (ELSAT, 2021) are indictive of the current situation in Greece.

- The number of registered undergraduate students in the academic year 2017/2018 compared to 2016/2017 increased by 4.1% in all educational institutions in Greece (from 409,413 to 426,058)

- The teaching staff in the academic year 2017/2018 showed an increase of 7.8% compared to 2016/2017, in all educational institutions in Greece. An increase is observed in all educational institutions except the University of Patras and the International University, which have experienced a decrease in educational staff of 0.4% and 10.3% respectively.

- The number of registered undergraduate students who received a degree in the academic year 2017/2018 compared to 2016/2017 increased by 0.1%. The most significant increase in absolute values was observed at the Hellenic Open University (from 1,513 to 1,744) and at the University of Thessaly (from 1,343 to 1,565) while the most significant decrease was observed at Panteion University (from 1,446 to 1,173) and at the University of Athens (from 5,487 to 5,308).

- Registered postgraduate students increased by 7.6% in the academic year 2017/2018 compared to 2016/2017. The largest increases in absolute prices are presented at the Hellenic Open University (from 20,120 to 23,804) and at the University of Macedonia (from 2,244 to 2,872). In contrast, the largest decreases are observed at the University of Peloponnese (from 2,054 to 1,504) and at the National Technical University of Athens (from 1,656 to 1,329).

	TOTAL			MEN		WOMEN	
	2016/2017	2017/2018	% variation	2016/2017	2017/2018	2016/2017	2017/2018
TOTAL	409.413	426.058	4.1	198.617	206.093	210.796	219.965
National and Kapodistrian University of Athens	88.302	89.138	0.9	37.673	38.172	50.629	50.966
University of the Aegean	14.457	15.632	8.1	6.588	7.000	7.869	8.632
University of Thessaly	13.074	13.854	6.0	6.553	6.861	6.521	6.993
Aristotle University of Thessaloniki	68.965	72.737	5.5	32.652	34.133	36.313	38.604
Democritus University of Thrace	21.878	23.393	6.9	10.315	10.921	11.563	12.472
Ionian University	4.801	4.978	3.7	1.977	2.126	2.824	2.852
University of Ioannina	18.590	19.852	6.8	8.305	8.631	10.285	11.221
University of Crete	17.200	18.975	10.3	6.766	7.452	10.434	11.523
University of Patras	30.274	32.510	7.4	16.432	17.681	13.842	14.829
Athens University of Economics and Business	20.609	21.408	3.9	12.893	13.382	7.716	8.026
Panteion University of Social and Political Sciences	19.336	18.619	-3.7	7.407	6.730	11.929	11.889
University of Piraeus	21.823	23.208	6.3	13.661	14.392	8.162	8.816
University of Macedonia	15.280	16.121	5.5	8.356	8.837	6.924	7.284
Agricultural University of Athens	6.065	6.342	4.6	3.367	3.470	2.698	2.872
Athens School of Fine Arts	1.783	1.852	3.9	575	611	1.208	1.241
Harokopio University	2.333	2.472	6.0	1.117	1.210	1.216	1.262
University of the Peloponnese	6.397	6.501	1.6	2.787	2.857	3.610	3.644
University of Western Macedonia	2.583	3.135	21.4	1.282	1.521	1.301	1.614
Hellenic Open University	17.644	16.942	-4.0	7.799	7.605	9.845	9.336
International Hellenic University							
Technical University of Crete	5.196	5.740	10.5	3.545	3.892	1.651	1.848
National Technical University of Athens	12.823	12.650	-1.3	8.567	8.609	4.256	4.041

Figure 4 Number of students[2]

[2]

https://www.statistics.gr/el/statistics?p_p_id=documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN&p_p_lifecycle=2&p_p_state=normal&p_p_mode=view&p_p_cacheability=cacheLevelPage&p_p_col_id=column-2&p_p_col_count=4&p_p_col_pos=1&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_javax.faces.resource=document&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_ln=download

	TOTAL			MEN		WOMEN	
	2016/2017	2017/2018	% variation	2016/2017	2017/2018	2016/2017	2017/2018
TOTAL	**13923**	**15003**	**7.8**	**9155**	**9674**	**4768**	**5329**
National and Kapodistrian University of Athens	2061	2065	0.2	1233	1240	828	825
University of the Aegean	439	491	11.8	296	331	143	160
University of Thessaly	730	755	3.4	471	495	259	260
Aristotle University of Thessaloniki	2493	2575	3.3	1588	1618	905	957
Democritus University of Thrace	744	765	2.8	511	522	233	243
Ionian University	162	175	8	106	120	56	55
University of Ioannina	630	642	2.9	437	441	193	201
University of Crete	596	640	7.4	397	425	199	215
University of Patras	920	916	-0.4	655	639	265	277
Athens University of Economics and Business	274	278	1.5	198	195	76	83
Panteion University of Social and Political Sciences	246	268	8.9	148	153	98	115
University of Piraeus	222	241	8.6	175	186	47	55
University of Macedonia	318	334	5	225	227	93	107
Agricultural University of Athens	248	253	2	162	164	86	89
Athens School of Fine Arts	47	70	48.9	31	39	16	31
Harokopio University	77	79	2.6	40	42	37	37
University of the Peloponnese	210	232	10.5	117	138	93	94
University of Western Macedonia	131	167	27.5	81	94	50	73
Hellenic Open University	2088	2735	31	1328	1645	760	1090
International Hellenic University	224	201	-10.3	177	148	47	53
Technical University of Crete	292	300	2.7	208	221	84	79
National Technical University of Athens	771	821	6.5	571	591	200	230

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Figure 5 Number of staff [3]

According to the Greek Constitution (article 16), higher education is public. It is provided only by institutions which are legal entities of public law.

Higher Education Institutions enjoy full self-administration and academic freedom. They are subject to state supervision. The government finances them. No private Higher Education Institutions exist in the country. Admission of students has to do with their performance in the national pan-hellenic exams at the end of grade C of lykeio (upper secondary school).

List of Greek Institutions of Higher Education

National and Kapodistrian University of Athens
University of the Aegean
University of Thessaly
Aristotle University of Thessaloniki
Democritus University of Thrace
Ionian University
University of Ioannina
University of Crete
University of Patras
Athens University of Economics and Business
Panteion University of Social and Political Sciences
University of Piraeus
University of Macedonia
Agricultural University of Athens
Athens School of Fine Arts
Harokopio University
University of the Peloponnese
University of Western Macedonia
Hellenic Open University
International Hellenic University
Technical University of Crete
National Technical University of Athens

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[3]

https://www.statistics.gr/el/statistics?p_p_id=documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4l
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x.faces.resource=document&_documents_WAR_publicationsportlet_INSTANCE_qDQ8fBKKo4lN_ln=download
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The Hellenic Open University is an independent and fully self-governed Higher Education Institution in the form of legal entity of public law. Its seat is in Patras. Its mission is to provide high-quality university education via distance learning at both undergraduate and postgraduate level. Law 2552/1997 regulates its operation.

The International Hellenic University is an independent and fully self-governed Higher Education Institution . It has registered offices in Thessaloniki. It operates as an academic unit of the institution called "University Centre of International Programmes Studies", stipulated by law 4610/2019 with the aim to provide higher education in a foreign language to Greeks and foreigners.

In 2002, the technological sector merged the School of Pedagogical and Technological Education (ASPETE). It was established in Athens to substitute the former School of Vocational and Technical Teacher Training Institute (SELETE). It includes 3 departments of engineering educators of various specialisations. It offers technological excellence to graduates. It also has a pedagogical department. Its mission is to provide knowledge to undergraduates in the field of humanities and science studies.

Law 4521/2018 established the University of West Attica. It is the merger of two technological educational institutes:

•   TEI (Technological Educational Institute) of Piraeus

•   TEI (Technological Educational Institute) of Athens.

In addition, law 4559/2018 introduced two more mergers:

1.   The merger of the TEI (Technological Educational Institute) of Epirus with the University of Ioannina

2.   The merger of the TEI (Technological Educational Institute) of Ionian Islands with the Ionian University.

According to law 4610/2019:

1.   The International Hellenic University has merged with:

•   The TEI (Technological Educational Institute) of Thessaloniki

•   The TEI (Technological Educational Institute) of Central Macedonia

•   The TEI (Technological Educational Institute) of Eastern Macedonia and Thrace.

2.   The University of Western Macedonia has merged with the TEI of Western Macedonia

3.   The Greek Mediterranean University has been established and has merged the TEI of Crete

4.   The University of Patras has merged the TEI of Western Greece (except for 4 departments)

5.   The University of the Peloponnese has merged the TEI of Peloponnese and 4 departments of the TEI of Western Greece

6.   The University of West Attica has merged the National School of Public Health (ESDY).

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According to law 4589/2019, the following are being completed:

• The merge of University of Thessaly and the TEI of Thessaly

• The merge of the TEI of Central Greece with the University of Athens, the University of Thessaly and the Agricultural University of Athens (Geoponiko Panepistimio Athinon).

The Military Educational Institutions (ASEI) are equivalent to those of the university sector. They offer equivalent higher education and degrees (law 3187/2003).

Merchant Naval Academies (AEN) are state institutes of higher education under the Ministry of Shipping and Island Policy. Since 2005-2006, AEN are equivalent to TEIs.

Last, the state offers vocational and other specialized training in institutions of higher learning. The duration of studies does not exceed 3 years. The following fall under this category:

• The Higher Schools for Dance and Theatre, under the Ministry of Culture and Sports

• The Higher Schools for Tourism Education, under the Ministry of Tourism

• The Higher Schools for Petty Officers, under the Ministry of National Defence

The Higher School for Policemen, under the Ministry of Citizen Protection

In Greece, there is no University Faculty or Department with the sole purpose of providing initial education to the academic – teaching staff. However, a PhD title as well as the relevance of the candidates' doctoral thesis or research work to the cognitive field of the position announced constitute the formal qualifications required from the candidates in order to pursue teaching or research work in HEIs (Higher Education Institutions).

Law 4009/2011 pertains, inter alia, to issues of appointment and advancement of the academic – teaching staff. According to the said law, Higher Education Institutions ' Teaching and Research staff belong to the following ranks: professors, substitute professors, assistant professors and lecturers.

In addition to the three above-mentioned academic staff categories, adjunct professors are employed by institutions under a fixed-term contract governed by private law lasting from one to three academic years and subject to renewal without however exceeding five academic years overall.

Enhancing internationalisation is a common goal for the state and Higher Education Institutions.

Law 4485/2017 stresses the need to prioritise internationalization. It states that Higher Education Institutions have the mission, among others, to promote:

• Cooperation with other educational institutions and research bodies in the country and abroad

• The effective mobility of academic staff, students and graduates.

Companies providing digital education services

Computer Technology Institute and Press DIOPHANTUS

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Web: https://www.cti.gr/el/

The Computer Technology Institute and Press (CTI) was founded in 1985 as the Computer Technology Institute with headquarters in the city of Patra, Greece, as a Non Profit Private Legal Entity, supervised by the General Secretariat of Research and Technology, (Presidential Decree 9/1985).

Since 1992 CTI has been supervised by the Greek Ministry of Education and Religious Affairs as a financially, administratively and scientifically independent institution. In 2001 it was renamed as Research Academic Computer Technology Institute (Law 2909, art. 2).

Under the new law 3966/2011 its name was changed to Computer Technology Institute and Press and it was established as the technological pillar supporting CTI in education and as the publishing body of Greek school books and electronic educational materials.

CTI is also responsible for the administration of the Greek School Network, the largest user network in Greece.

CTI is the technological pillar for the support of ICT in education, it is responsible for the publishing of printed and electronic materials, and for the administration of the Greek School Network. Among its main goals is to conduct basic and applied research in ICT.

All the activities of the organisation are conducted through the Operational Production Units (Research Units and Information Society Directorates) and are supported by the services of Operational Support Units.

GRNET

Web : https://grnet.gr/en/company/

GRNET – National Infrastructures for Research and Technology, provides networking and cloud computing services to academic and research institutions, to educational bodies at all levels, and to agencies of the public, broader public and private sector. It is responsible for promoting and disseminating network and computing technologies and applications, as well as for promoting and implementing Greece's Digital Transformation goals. Thus, GRNET leverages the educational and research activity in the country, towards the development of applied and technological research in the fields of telecommunication networks and computing services.

GRNET holds a key role as the coordinator of all e-infrastructures in Education and Research. With twenty-plus years' experience in the fields of advanced network, cloud computing and IT infrastructures and services, and significant international presence, GRNET shall advise the Ministry of Digital Governance on issues relating to the design of advanced information systems and infrastructures.

GRNET develops synergies with other agencies which provide digital services in the Greek public sector, by sharing best practices and know-how on advanced information systems and it represents the national research and technological community within the European Union's Research Infrastructures. GRNET contributes to the country's Digital Transformation via in-depth analysis, technological studies, standard solutions and specialized know-how, serving at the same time

hundreds of thousands of users on a daily basis in the strategic fields of Public Administration, Education, Research, Health and Culture.

GRNET is also the National Research and Education Network (NREN).

In order to reach its goals, GRNET undertakes projects, initiatives and other activities related to information technology, digital technology, communication, e-governance, new and open technologies, including new big data technologies, artificial intelligence and machine learning, and in general, to the promotion, dissemination and transfer of know-how regarding network and computing technologies and their applications, to research and development, education and to the promotion of Digital Transformation.

FlexLearn

WEB: https://www.flexlearn.com/profile/what-is-flexlearn/

FlexLearn is a Learning Management System (LMS), which has been developed according to the latest technologies and aims to provide integrated and customized solutions in education.

It is a new innovative, cloud-based, platform that provides training, assessment and certification solutions for companies and educational institutions. It is composed by three key features: theory, exercises and exams. Other features refer to statistics, tracking, reporting and communication.

FlexLearn's aim is to revitalize the way of education and transform it into a creative process. It creates a new digital environment in education, where all users have easy and secure access wherever they are, whenever they wish. It provides unlimited choices in training and testing in order to achieve the best results in education.

According to the principles of the adult education, FlexLearn aims to provide integrated and customized solutions in education. Flexlearn creates a new digital environment, which enables the organization of educational material, the course management, the assessment, while it offers a range of communication and collaboration tools.

Additionally, FlexLearn is flexible and user friendly. It provides unlimited choices in training, so that the student follows successfully the steps of learning, training, testing, and hence improving.

DigiMagix

WEB: http://www.digimagix.gr/en/

DigiMagix holds experience in the design, the implementation and the evaluation of corporate e-learning programs. DigiMagix has already developed more than 150 course titles for its clients in many different topics (Sales, Marketing, Banking, Induction Courses, Desktop Computer Skills, Customer Facing Skills etc.), for all educational levels (school education, university education, lifelong learning). DigiMagix has also developed its own e-library with courses for Primary Education and Lifelong Learning.

Besides the development of custom e-learning courses, DigiMagix has developed an e-library for school learning as well as lifelong learning. The development team of DigiMagix cooperates with the subject experts in each thematic field and, after receiving the original content, it transforms

it in order to be suitable for distance learning and turns it to a rich, interactive digital educational content that attracts the interest of the trainees and enhances their mood for learning.

Greek National Coalition for Digital Skills and Jobs

Web: https://www.nationalcoalition.gov.gr/en/national-coalition_en/

The Greek National Coalition for Digital Skills and Jobs is a cooperation platform between various entities, public or otherwise, which seek to promote digital skills in Greek society.

The objectives of the National Coalition are:

The cooperation between all parties in order to introduce actions with the aim of enhancing digital skills. The goal is to address the issue of digital gap in every sector of the Greek economy and society.

The dissemination of EU policies on digital skills in Greece

The organizational Structure of the National Coalition

To achieve the above objectives and in accordance with the European Commission's Digital Skills and Jobs Coalition, the following four (4) groups have been established

1. Education: Enrichment and digital transformation of the learning and teaching process for pupils and students. Integral part of this effort is the provision of incentives for the continuing training of teachers.
2. Training: Development of digital skills of employees, unemployed and businessmen in order to promote digital economy.
3. Information and Communications Technology Professionals: Promotion of high-level digital skills for ICT professionals in all industry sectors.
4. Citizens: The objective is to enhance digital skills to enable all citizens to be active in our digital society.

Dimensions and background of online teaching experiences and digital educational programs in the country

During the lockdown period, where Greek citizens were ordered to stay at home (quarantine), all Greek universities and schools were closed. Under the covid 19 pandemic the government suggested emergency remote teaching as a short-term solution in all educational levels.

Despite that "Greek higher education institutions have demonstrated a deep commitment to creating the best possible learning environments for their students, being quick to replace face-to-face lectures with online learning. Using technology, institutions were able to combine existing asynchronous teaching platforms with synchronous distance learning. Based on official data gathered by the Ministry of Education and Religious Affairs from tertiary education institutions nationwide, the University of Crete and Harokopio University offer 93% of their courses via distance learning.

Furthermore, in many higher education institutions, the move to distance learning has been an opportunity to expand flexible learning modalities, setting the stage for a sustained shift towards more online learning in the future.

Changes that would typically take many years because of differing managerial regulations were presented quickly within a limited number of days. This transformation has upgraded the digital competence of all parties involved, enhancing their collaborative and organisational knowledge within the high-tech framework of hyper-connectivity.

It is important to note, that despite the covid 19 pandemic "in 2015, the Hellenic Open University (HOU) designed and delivered its first introductory training course offered in the form of a Massive Open Online Course (MOOC) to enhance the skills of its tutors through the modern pedagogical paths of e-learning and adults' education principles. The MeaeX courses where offered between 2015 and 2017 and all tutors had to participate in the training process and to be certified.[4]

Another important aspect is the Study in Greece (SiG)[5] initiative . This aims to improve the international image of Greek higher education institutions and creative interaction between Greek and foreign academic institutions. To this end, SiG has created an information portal which provides all information related to the Greek academic world.

Eighteen universities in Greece offer around 140 masters programmes taught in a foreign language (mainly English) which provide foreign students with the opportunity to choose between a broad range of disciplines – from theoretical fields such as archaeology and classics to scientific fields such as medicine or biology and physics as well as technology-related subjects like IT, computer science and engineering, among others.

Showcasing the wide variety of English-taught programmes offered by Greek universities, SiG also acts as a bridge between Greek and international academic communities by facilitating the creation of academic networks as well as by fostering synergies between Greek and foreign university departments in diverse disciplines.

Furthermore, in the new era which the pandemic of COVID-19 inaugurated, the Institute of Educational Policy (IEP) assigned to Hellenic Open University and University of Aegean the implementation of a new MOOC which is titled "Teacher Training in the Methodology of Distance Education ". The specific MOOC ran via the Moodle platform, and was open for educators of primary and secondary level education. In the same vein, the University of Aegean[6] designed its MOOC, "School Distance Education". This strategy proved of utmost importance as plenty of educators are training until now, testing, improving and expanding their skills in the field of e-learning under the urgent conditions that the COVID-19 pandemic has created" (Karachristos, 2020).

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[4] https://mooc.eap.gr/

[5] https://studyingreece.edu.gr/

[6] https://elearn.aegean.gr/

2. REGULATORY, LEGAL FRAMEWORK AND MAIN ACTORS

The legal framework

According to the European Commission (EC)'s Digital Economy and Society Index[7] (DESI), even though Greece has one of the least advanced digital economies in the EU, during the past few years there has been remarkable progress in promoting investments in digital technologies and integration of digital technology by private and public organizations. The EC's Country Report Greece 2020 confirms that integration of digital technology by businesses in Greece is relatively slow, with the exception of the use of big data and electronic information sharing, which are higher than the EU average.

Greece has committed to advancing new digital technologies in line with the Digital Europe programme (The EU's programme to drive the digital transformation of Europe, covering supercomputing, artificial intelligence, cybersecurity, etc.) and to investing strategically in digital technologies through EU coordinated programmes. During the past few years, Greece has adopted legislation to support digital public administration; the Ministry for Digital Governance has a leading role in coordinating relevant government measures and in delivering several major information technology projects.

The legal framework currently in place covers, inter alia, digital governance (Law 4727/2020 and Law 4623/2019 on digital governance, also covering the accessibility of the websites and mobile applications of public sector bodies); access to public information (Law 4727/2020 on reuse of public sector information); electronic identification (eID) and Trust Services (eIDAS Regulation (EU) No 910/2014); security aspects related to digital governance (Law 4577/2018 on security of network and information systems, Greek National Cyber Security Strategy); eProcurement (Law 4601/2019 on electronic invoicing, Public Procurement Law 4412/2016); and e-commerce (Presidential Decree 131/2003).

Law 4727/2020 (Official Government Gazette 184/A/23-09-2020) has been published on March 20th, 2020 under the title "Digital Governance (Integration of the Directive (EU) 2016/2102 and the Directive (EU) 2019/1024 into Greek Law) Electronic Communications (Integration of the Directive (EU) 2018/1972 into Greek Law) and other provisions". Articles 109-223 of the new L. 4727/2020 incorporate the European Electronic Communications Code ("ECE") into Greek law, as established by Directive (EU) 2018/1972. By virtue of the new statutory provisions, Greek legislation adapts to contemporary developments in the electronic communications sector, with emphasis on 5th generation (5G) networks. Part B (Articles 109-223) of the new Law incorporates into Greek legislation Directive (EU) 2018/1972, which establishes the European Electronic Communications Code (EECC). The EECC consists one of the key pillars of the EU's Single Digital Market. It endorses a major revision of the existing EU Package of Directives, which dates back to 2009. The purpose of the EECC is to adapt the EU legislation to current developments in the electronic communications sector. The new Law generally annuls the prior framework of Law 4070/2012 as well as any other statutory or regulatory provisions (Presidential Decrees, Ministerial Decisions and National Telecommunications and Postal Commission decisions) that may be contrary to the provisions of the Law. This new law aims at consolidating EU's internal electronic communications market, ensuring quality of electronic

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

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communications services at an affordable price, protecting the rights of end-users, and using radio frequencies effectively.

The Ministry of Digital Governance has issued the Digital Transformation Whitepaper 2020 - 2025[8]. This is the manual that describes the country's strategy for the transition to Digital Greece, in accordance with the Law on Digital Governance and Electronic Communications 4727/2020, through which it was adopted.

Digital Transformation Whitepaper presents the objectives, guidelines, strategic intervention axes, systems architectural design, governance model and project design and implementation mechanism to be followed. Also, more than 400 projects are described in detail, which are the horizontal and vertical interventions that implement the digital transformation of Greek society and economy for the period 2020 - 2025.

Digital Transformation Whitepaper intends, among other things, to promote the digitization of processes and the interoperability of information systems including a series of IT investment projects to upgrade public administration. Digital Transformation Whitepaper refers to Law 4727/2020 which introduces the policy for the management of cloud computing for the information systems of the Research and technology Sector in Greek National Network of Technology and Research Infrastructure (EDYTE S.A.).

All electronic applications and central information systems of the Ministry of Education and Religions, its supervised bodies, as well as the applications and services offered by the Ministry of Education and Religions in the educational and research community must be installed in the Government Cloud of Research and Education Sector (RE-Cloud) by 2023. Meanwhile, steps are being taken as regards flagship projects that address the launch of a unified platform for electronic services, the issuing of digital identity cards for all citizens, the development of infrastructure on 5G networks, and the spread of ultrafast broadband coverage.

The National Broadband Next Generation Access Plan is the roadmap for the development and availability of modern broadband infrastructure throughout Greece and for the use by citizens and businesses of high-speed and ultra high-speed broadband services. The Access Plan aims at the creation of a favourable environment for private investment in next-generation networks, as well as at public support in areas with little or no interest for investors. In this context, the objectives of the Digital Agenda for Europe 2020 (one of seven flagship initiatives of the Europe 2020 strategy) consist the backbone of the national strategy for the deployment and service availability of high- and ultra high-speed broadband connections, i.e. fast broadband (over 30 mbps) and ultrafast broadband (over 100 mbps). The Access Plan is based on two main pillars, with the first pillar including legislative and regulatory support (for instance, Law 4463/2017 includes measures to reduce the cost of deploying high-speed electronic communications networks in harmonization with EU Directive 2014/61) and the second pillar including government support initiatives and actions, e.g. in Greek regions where the investment interest is low.

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[8] https://digitalstrategy.gov.gr/

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Cloud service strategy

To assure digital transformation a cloud strategy is needed to tackle the local business and regulatory challenges. There are specific international and European guidelines, standards and regulations, such as HIPAA (USA Health Insurance Portability and Accountability Act), ISO 27000, PCI Data Security Standard for credit card safe transactions, and General Data Protection Regulation (EU regulation 679/2016) to protect the privacy of personal information, that organizations have to follow and comply with. An overview of the standards that formalize information guidelines are elaborated by the International Organization for Standardization (see Table 1). The Information Security Management Standards (ISMS) "family" aims at:

• defining requirements for an ISMS and for those certifying such systems;

• providing direct support, detailed guidance and/or interpretation for the overall process to establish, implement, maintain, and improve an ISMS;

• addressing sector-specific guidelines for ISMS; and

• addressing conformity assessment for ISMS.

The ISO/IEC 15504 Information technology family of standards addresses process assessment issues in the contexts of both process improvement and process capability determination. In other words, Software Process Improvement and Capability Determination (SPICE), is a set of technical standards documents for the computer software development process and related business management functions. It is an outcome of the collaboration of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). ISO/IEC 15504 has been superseded by the ISO/IEC 33001:2015 as of March, 2015.

Table 1. Information management standards and guidelines

Standard code number	Title
ISO/IEC 20000-1:2018	*Information Technology – Service management – Part 1: Service management system requirements*
ISO/IEC 27000:2018	*Information technology – Security techniques – Information security management systems – Overview and vocabulary*
ISO/IEC 27001:2013	*Information technology – Security techniques- Information security management systems – Requirements*
ISO/IEC 27002:2013	*Information technology – Security techniques – Code of practice for information security controls*
ISO/IEC/IEEE 90003:2018	*Software engineering – Guidelines for the application of ISO 9001:2015 to computer software*
ISO/IEC/IEEE 12207:2017	Systems and software engineering – Software life cycle processes

ISO/IEC 33001:2015	Information technology – Process assessment – Concepts and terminology
ISO/IEC 33002:2015	Information technology – Process assessment – Requirements for performing process assessment
ISO/IEC 33003:2015	Information technology – Process assessment – Requirements for process measurement frameworks
ISO/IEC 33004:2015	Information technology – Process assessment – Requirements for process reference, process assessment and maturity models
ISO/IEC TR 90006:2013	Information technology – Guidelines for the application of ISO 9001:2008 to IT service management and its integration with ISO/IEC 20000-1:2011
ISO/IEC 27013:2015	Information technology – Security techniques – Guidance on the integrated implementation of ISO/IEC 27001 and ISO/IEC 20000-1

Furthermore, a cloud service provider may outsource part of its operations or its infrastructure to third parties. Organisations need to have a complete understanding and evaluate the relationship of the cloud service provider with these third parties. In compliance with data protection regulation, Greece has developed and implemented a National Strategy on Cybersecurity and has also transposed the NIS Directive (EU) 2016/1148 in the Greek legal system (Law 4577/2018). Legal act 4577/2018 has introduced measures to enhance security of network and information systems in critical service sectors, including energy, logistics, banking, financial consulting, construction, healthcare, water supply and distribution, and digital infrastructure sectors and to Digital Service Providers (online marketplaces, online search engines, and cloud computing).

General Data Protection Regulation

Digital transformation is substantially affected by applicable data protection laws in Greece, most importantly the General Data Protection Regulation (GDPR). Certain GDPR requirements (e.g., on security of processing, on the use of data processors, transfers of personal data to third countries, etc.) directly affect the relationship between organizations and digital transformation service providers.

According to the GDPR accountability principle, an organisation (under the capacity of controller) is responsible for, and must, at all times, be able to demonstrate compliance with the GDPR principles relating to processing of personal data (lawfulness, fairness and transparency, purpose limitation, data minimisation, accuracy, storage limitation, integrity and confidentiality). Compliance with the accountability principle can be a challenging exercise when processing of the data is outsourced to third-party data processors (like cloud service providers). The general principle is that where processing is to be carried out on behalf of a controller (as could be the case of procuring cloud services), the controller must use only processors (cloud service providers) providing sufficient

guarantees to implement appropriate technical and organisational measures in such a manner that processing will meet the GDPR requirements. The content of the data processing agreements between the organisations and the cloud service providers are regulated by the GDPR. In practice, the exercise of the organisation's right (and obligation) to audit the cloud service provider's compliance with the GDPR and the data processing agreement can often be quite challenging.

GDPR terms on data transfers to third countries and industry specific legislation imposing data localisation rules, can also affect and determine the choice of cloud service provider. In principle, transferring of personal data to a third country may take place where the European Commission (EC) has adopted an adequacy decision or, in the absence of a decision, if the transfer is subject to the safeguards of Article 46 of the GDPR, e.g., Standard Contractual Clauses (SCC) adopted by the EC. Notably, the recent *Schrems II* landmark judgment delivered by the Court of Justice of the EU (CJEU) (Case C-311/18) had a significant impact on data transfers to third countries, including to the US, where major cloud service providers are located. *Schrems II* essentially declared the EU–US Privacy Shield invalid and, most importantly, questioned and put into perspective the extent to which EU-based organisations can still rely on the SCC for data processing outsourced to certain providers in the US and globally. The CJEU found that, before a transfer of data may occur, there must be a prior assessment of the context of each individual transfer, that evaluates the laws of the country where the recipient is based, the nature of the data to be transferred, the privacy risks to such data, and any additional safeguards adopted by the parties to ensure that the data will receive adequate protection, as defined under EU Law. Further, the data importer is required to inform the data exporter of any inability to comply with the standard data protection clauses. If such protection is lacking, the parties are obligated to suspend the transfer, or terminate the contract. While the Standard Contractual Clauses remain valid, their continued validity is subject to an additional step: the obligation to conduct the equivalent of a data protection impact assessment to ensure that the adequate protection is and will be provided and, subsequently, continuously monitored.

Moreover, industry-specific regulation can impose an obligation for organizations to retain and store certain data locally. For instance, there is typically an obligation for telecom providers (providers of publicly available electronic communication services or of public communication networks) to carry out in-country data retention (in physical media which are located exclusively in Greece) of traffic data and location data and the related data necessary to identify the user (Law 3917/2011 transposing Data Retention Directive 2006/24/EC). However, in the light of the CJEU judgment invalidating the EU Data Retention Directive (Cases C-293/12 and C-594/12) and also considering very recent CJEU judgments, delivered on 6 October 2020 (Cases C-623/17, C-511/18, C-512/18, C-520/18), the validity and enforceability of the Law 3917/2011 is questionable, although it is still technically in force.

Digital education in Greece

During the recent COVID-19 outbreak, education in Greece has undergone certain transformation processes that were necessary for schools and universities to keep on providing education services to students of all levels. Several digital platforms have been used. Diophantos (ITYE) is the primary organization in Greece that provides digital education services to students of secondary education.

Higher education institutes have used various digital tools to provide remote education services to students of tertiary level. Online live courses have been conducted via zoom, MS teams and google meet. For the semester exams universities have used moodle and e-class.

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Digital transformation in Education

The basis axis for the digital transformation on Education can be summarized as follows:

Registers and Open Data

At the core of the digital strategy lies the transition from document-centric solutions to data-centric solutions. An integral part of this approach is the foundation of the basic registers of Education and gradually the redesign of the respective information systems. These registers relate to categories of natural persons (Student, Student, Teacher, etc.), to education and administration units (Schools, Universities, IEK, etc.), and generally to information structures that acquire primary status in the field of Education (Learning, Curriculum, Book/Sygram, etc.).

Digital learning culture

The main objective is to develop digital skills throughout the educational community, which requires the creation of a digital learning culture. The digital learning culture focuses on the development of digital content, the development of tools and platforms for modern and asynchronous e-learning, as well as the infrastructure and equipment of physical training spaces at all levels (e.g. equipment with interactive tables, equipment for the next generation amphitheatre, etc.).

Interconnection with the labour market

Education as a form of systematic training for skills acquisition is often assessed in the narrow light of the vocational rehabilitation opportunities it provides. For this reason, early detection of labour market needs is becoming a crucial tool for planning education policy. Information technologies are shaping new opportunities in this landscape for systematic and effective analysis of labour market data. The conclusions of these studies will contribute to the modernisation of curricula and retraining programmes, to the development of up-to-date and targeted apprenticeship programmes, and more generally to the effectiveness of any digital action aimed at bringing the learner into contact with the real economy.

Internationalisation and extroversion

Internationalisation and extroversion, especially in the field of higher education, is an expansion strategy with no option of abstention. This direction is also confirmed by the European Union's policy on the future of higher education, which promotes the development of foreign-language curricula, student mobility between different countries and the creation of trans-European curricula. The aim is for Greek higher education institutions to be actively involved in this new landscape and for their digital infrastructure and services to be another comparative advantage in this effort.

Organization and Administration

Digital transformation is not limited to the image of services that the end user perceives directly. It concerns an ecosystem of behind-the-scenes services and administrative flows, the modernisation of which is a component of digital transformation and an integral part of the Digital Education Strategy. Simplification, automation of administrative work and ultimately the digitisation of Administration with a view to the optimal management of human and economic resources is one of the goals.

Services to the citizen

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An important dimension of digital transformation for Education is the upgrading of the services offered to the citizen. Services for the citizen student, parent or guardian must be redesigned with the citizen in the core of the strategy, utilizing those digital tools that will henceforth allow for better, faster and safer distance service.

Information system for the national higher education authority

It refers to the upgrading of the information system of the National Education (ETHAE) and supporting its new role in shaping the national strategy in Higher Education. The action focuses on the following areas:

• Upgrading the HEI evaluation and management services of the Registry Experts.

• Development of an open access platform, for semantic foundation and pre-formalisation of higher education data and metadata; with a view to a common understanding of evaluation metrics and methodology data collection.

• Monitoring, studying, evaluating and presenting statistics and key performance indicators (KPIs) of Greek Higher Education as a whole, but also individual HEI, on the basis of planning agreements.

• Effective data collection for quantitative and qualitative indicators quality assurance units and the Operational Intelligence of HEI.

Digital Services of Academic Institutions

Modernisation of administrative support services for education in all HEI's in the country. The action at its core has the information systems and traineeships.

At the same time, it is flanked by horizontal interventions in the regions:

(a) management of network accounts,

(b) interoperability of data and services and

(c) analytical data for the production of statistical reports.

In particular, the development of new digital services in HEI will contribute to:

• Universal coverage of the student population (undergraduate, postgraduate, PhDs), from the HEI 's students' studies as well as to the extension and upgrading of the digital services provided throughout the course of study, from the registration until the award of a title.

• Universal ability to identify and authenticise its members academic community through the development of digital identity infrastructures (Identity Management) in universities, with the aim of modernising management services of their members' online accounts.

• Development of interoperability services with a view to safe and reliable transmission of student 'student record' data to the national and European network of universities, as well as the development of interoperability between HEI and the Public Administration.

• Upgrading the OPERATIONAL Intelligence Hub of HEI with the aim of collecting, synthesis and statistical analysis of the quantitative data available in the infrastructures of HEI information systems.

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Expansion of quality assurance and evaluation systems for Universities

Improvement the services provided through a process of evaluation of the educational and research work of each department. In this context, the extension of the safeguard systems will be financed quality and evaluation of the work of the Universities of the country with regard to their teaching, research, academic and administrative function.

Further the aim is to continuously improve university work and the functioning of higher education institutions with quality criteria in all sectors; accountability of public educational institutions to the social all they serve. However, in order to have a comprehensive assessment of the the work of public universities is not sufficient to be assessed only in terms of quality parameters but also in the relationship between the result produced and the resources they're consumed. This concerns the efficiency criterion, which is a key pillars of evaluation in the public sector. The proposed projects will be have the ability to combine information on metric data of the Universities held in information systems (e.g. ETHAE, MODIP) and analytical cost data to enable the provision of information on decision-making, accountability to the community, information to members the resources used to make the best possible management of the as well as to be able to request more resources if they have significant results and will allow for targeting with a view to achieving the maximum efficiency with the resources available.

The system will be developed with the aim of providing reliable information to the administration of universities for decision-making purposes as well as accountability to society and the Ministry of Education. The system will allow monitoring resource consumption, cost management and use the property of public educational institutions and will be fully compatible with the obligations to make open data available.

Upgrading the information systems of HEI'S

The following information systems operate in Universities:

• Finance Management: There are commercial solutions in all Universities.

• Personnel Management/Payroll: There are commercial solutions in all Universities.

• User Management System: Installed and operated in most Universities system developed by GUnet.

• Electronic Document Transfer System: Most institutions have installed or are in the process of installing commercial systems to connected to the CSEDE.

• Modip management systems, Interconnection Offices and Practical Exercise.

It is necessary to extend and upgrade all information systems in order to operate with each other and with the central systems public sector. The projects will be designed by the Universities and the ETHAE in cooperation with EDYTE, GUNET and the relevant departments of the Ministry of Education.

Management and supervision of traineeships of higher education students

It concerns the improvement of the management of student traineeships, which will contribute to linking education and training processes with the market for work, by upgrading the role of the traineeship of the students of the higher education, to enhance access to employment and ensuring the first work experience.

In particular, the extension of the ATLAS system will be implemented with a primary the aim of upgrading the role of the student in the system and integrating functions to facilitate the use of the system by the offices of the Traineeship.

In particular, they will include:

• Ability to post CVs and register fields interest from students and access to them by the host institutions traineeship.

• Possibility for students to declare preference for PA positions through the System.

• Possibility of the practice host declaring the completion of a position and the creation of a certificate.

• Study of redefining position objects based on European standards.

• Study and implementation of interoperability with third parties (AADE, ERGANI, OAED) to reduce the red tape of traineeships and traineeships.

• The need to link the Practical Exercise (ATLAS) with the new Student Register, with the labour market (Interconnection Offices) as well as with the Intelligent Business Intelligence (BI).

Management of distribution of academic literature to students of higher education

It concerns the upgrading and strengthening of the management of the distribution of academic literature with a view to improving and simplifying the selection mechanism and making writing available to students, promoting the use of digital as well as automating the costing process of and the process of compensating issuers for financial services of the Ministry of Education.

New possibilities will also be provided for in the management of the literature for undergraduate students of all academic Institutions. The main functions to be covered by the system upgrade 'EYDOXOS PLUS' distribution are as follows:

• Upgrading the payment and costing system for publishers of university literature.

• Improving the usability of Eudoxos applications (publishers, students, secretariats, distribution points).

• Study and pilot integration of publishers' ability to have in digital form, with safeguarding their copyright.

• Provision of electronic writings.

• Linking the system to e-class and open academic writings, so that students have free access to them.

Its upgrading will be achieved through:

(a) the development of a reliable mechanism creation and availability to students of digital literature on the basis of the technological developments, by safeguarding the copyrights of issuers and the support of multiple compensation models,

(b) the interconnection with students' PSOs for the direct cross-checking of course declarations and choice of letters.

Digital Educational Content and e-Learning Services

The strategy to strengthen e-learning services is supported by two pillars of actions. The first focuses on development of digital content, while the second in the modernisation of horizontal platforms and services for the promotion and exploitation of content.

Digital content concerns digital courses and educational resources, both both open and controlled access, aimed at target groups. The development of the content concerns:

1. The development of specifications for the structure, content and metadata of digital courses of curricula.

2. Support synergies for the joint development and use of content and digital courses related to trunk lessons.

3. The development of Mass Open Internet Courses (MOOCs) for special purpose focusing on thematic areas of international interest.

4. The development of special purpose courses and content e.g. digital skills, career guidance, health, etc.

At the same time, the upgrading and management of central platforms and services for the integration and efficient use of the digital content and resources in the educational process of all Academic Institutions of the country.

Horizontal platforms include:

1. The National Portal of Digital Academic Courses and Educational Resources that will be provides metadata aggregation and teacher search capabilities content and resources.

2. The e-Learning and Development Support Platforms and Services, distribution of digital educational content and Modern Services e-learning.

Online Student Registrations

The action concerns a number of interventions in the student registration process and in the development of a one-stop platform that will functionally cover all individual registration, transfer, student account performance, and application flows for the version of the student card, implementing the digital registration version of a student (University Student Digital – On Boarding) from an entry point. The platform will consists of horizontal subsystems covering the central functions of the such

as the processing of applications and the issuance of results carried out by directorates of the Ministry of Public Service, as well as vertical subsystems, e.g. registration in the and the performance of a web account, the responsibility for which will be Universities in order to be able to adapt the process on the basis of the most specific needs of each institution and department.

Digital Academic Identity Acquisition and Management Service

Concerns the upgrade and extension of the Electronic Acquisition Service Academic Identity that EDYTE S.A. has developed and operated since 2011 for on behalf of the Ministry of Education as technological developments now require the radical restructuring of the information infrastructure. At the same time, new functionalities to serve foreign beneficiaries, such as students Erasmus, as well as the provision of additional uses and services to existing holders (students, professors, researchers and staff of the institutions) of the academic identities.

The extension of the digital solution will also ensure the online certificate of student status of a citizen-student. The service will be available after the consent of the student, but also in the form of an ex officio audit in real time by authorised public information systems; thus removing the need for paper attestations. The identity will also exist as a application on mobile devices. Initially it will focus on students of the first cycle comprehensive coverage, and will gradually include the students from other circles.

In order for identities to acquire additional uses and services, such as example use them to access controlled access areas (access control) or use them as an electronic, require:

• Integration into the academic identities of a special antenna and microprocessor Mifare type with similar software.

• Add new functionality to the existing Central Information System (CSP) to support the entire life cycle of the new microprocessor, upgrading the CSP interface with a production contractor and distribution of identities, the interconnection of the CSP with the public transport support academic identity as a means of storing tickets and unlimited route cards, the interconnection of the CSP with entities wishing to implement services supported by the new microprocessor (e.g. Access control).

Upgrading an Electronic Voting System in HEI

It concerns the promotion and support of the digital electoral process (online),in the field of HEI. The action focuses on the "Zeus" platform and in particular its connection to the digital infrastructures of institutions. Hub of the electoral process is the establishment of the electoral roll and ensuring that the only those who have the right to vote participate in it. This is a responsibility of the Electoral Commission, the work of which will be facilitated by developing in the "Zeus" platform tools for extracting data from electronic primary registers of the institution. Similarly, in control of access to the digital ballot box, the objective of the is the adoption of the Authentication as a Service (Authentication as a Service). In this context, the platform will define the level of security required by the electoral process, and it will be the responsibility of the institution to choose the mechanisms (SMS, One time Passwords, digital certificates, etc.), which will be or their combinations to achieve

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the desired objective. With these interventions reinforce the integrity of the digital electoral process; confidence in the Zeus platform is increasing, and the digital culture for the citizens of the future.

Transform applications and services as part of a service (PaaS)

EDYTE develops, operates and provides the infrastructures in which it is hosted a large number of applications and services, both those for which it carries the responsibility for the technical and operational operation, as well as others belonging to cooperating and benefiting entities. In the light of international developments in the development of applications in a cloud-computing environment, the evolution of cloud infrastructure and services, as well as the architecture adopted for the rapid development and availability of new digital governance services with the assistance of EDYTE, GSGPs and stakeholders, this action concerns the development of a roadmap for transforming the application hosting environment with based on the principles of native cloud computing so that they can develop the services provided in the direction of providing mature, platform services as a service (Paas) and to the owners of the respective applications will be given the opportunity to develop them with a view to adopting flexible life-cycle management techniques (e.g. continuous integration), as well as the greater reliability and services.

Advanced Audio, Voice and Image Services for Academic Members and Research Community

The service **e:Presence** enables the members of the Greek research and academic community and throughout the Public Administration to organise and conduct online teleconferences, which are characterised by a high quality and interactivity. The service was recently extended on the occasion of the pandemic conditions, so as to provide high security and ease of access to communication. The service significantly facilitates the operation of collective academic institutions, in particular in the case of universities that are distributed in more than one location, enabling their members to meeting without the need for travel. The high quality of image and sound as well as high interactivity, ensure for remote users participation on equal terms with participants who are physically in the place of of the conference.

The Live Transmission Service provides direct access to audiovisual material of high cultural, educational and scientific value; and is developed by the EDYTE. The DIAYLOS service supports live streaminglectures, seminars, artistic events and other events of important cultural, educational and research institutions of the country, via the Internet.

Educational and Technological Institutions, Centres and Bodies of Culture, Museums, Music Megara, Exhibition and Conference Centers, cooperate with EDYTE S.A. for the transmission of their events through the live online service transmissions, DIAYLOS. During a live webcast, the sound and image taken from the venue of an event, are promoted digitised and encoded through the EDYTE network, with high-quality capabilities quality and analysis. They are then distributed to online viewers, who can attend the event via computers or smart Mobile.

Taking into account the current conditions of the pandemic and the extension of the teleworking as well as modern e-learning, it is necessary to upgrade the services or the design of new services to follow the requirements of social developments, in order to satisfy a larger number of users and bodies

and improve the bouquet of functions provided and their tools, with particular emphasis on supporting the reliability and protection of the data recorded in them.

Upgrading the Information System of the Ministry of Education

It is necessary to modernise the PS of the Ministry of Education (General Directorate Higher Education) for its interconnection with the PSOs of the Institutions and the PSOs of other Ministries (e.g. Finance, Interior, Development, etc.) through:

• Development and use of a single system for purely electronic management cases falling within the competence of the Directorate-General for Higher Education Training and extension of IT document and flow management infrastructure fully interoperable with the other systems (PAPYROS, etc.).

• Development of a personnel management subsystem comprising the set of institutions and supervisory bodies (service status of all staff, evolution, etc.) and recording of economic data.

• Establishment of a subsystem to inform citizens about the progress of requests, after they have been authenticed using the codes; credentials of the General Secretariat for Public Information Systems Administration of the Ministry of DigitalGovernance (taxisnet).

• Strengthening infrastructure and supplying related equipment to the Ministry of Health.

• Education and support for users of the Ministry and regional services to make full use of the inter-functioning management systems documents and workflow, using digital signatures for the entire staff of the General Assembly Directorate.

• Have a PS for the processing of statistical data and indicators for the training at all levels and monitoring the progress of the implementation of the Strategic planning of Ministries and Special Strategies.

Interoperability

The action concerns the simplification of procedures and the digitisation of the physical archive of the IOTAP (Interdisciplinary Organisation of Academic and information), as well as the organisation of digitised information with in a way that will allow it to be integrated into an information system in order to be able to usable in a G2G (Governmentto Government) interoperability model. Physical archive has numbered more than 96,000 physical files since the time of DIKATSA (1979-2005) and more than 100,000 by the successor body of the IOTAP (2005-2019) with content on average 20 discrete documents to be used for the issue of of the Recognition Act. Since May 2019 the physical files have been removed and are deposited on aneDoatap platform.

The digitized information will be included in the new version of https://eDiplos. gr.

This platform will be extended to operate in accordance with the relevant IOTAP units of the Member States of the European Union by the EDYTE in cooperation directorates of digital governance of universities, GUNET and the competent departments of the Ministry of Education.

Upgrading research and education infrastructures

In accordance with Law 4623/2019 No. 58 GRNET (National Infrastructures for Research and Technology) "has the central role of coordinator of all digital infrastructures for Education and Research" and "is the national representative of the research and technological community in the research infrastructures of the European Union" and in accordance with Law 4727/2020 No. 87, the GRNET "manages the Government Cloud of the Research and Education Sector (RE-Cloud)". In Greece, GRNET is the main provider in terms of Cloud computing and storage infrastructure for Research and Education. GRNET operates the infrastructure by offering them as an Infrastructure as a Service through large data centers (135 racks, over 1,800 servers, 7,000 active virtual machines and 5 Petabytes of storage), which are integrated into the European Open Science Cloud. At the same time, GRNET manages a large part of European Open Science Cloud related services such as service monitoring, authentication and authorization (AAIs), provision of pan-European permanent data identifiers (PIDs), etc.

3. ORGANIZATIONAL ASPECTS

Higher education institutions response to covid-19

On 11 March 2020, the World Health Organization declared the coronavirus (COVID-19) outbreak a global pandemic. Education systems across the world have felt the force of the crisis as confinement measures triggered widespread closures of education institutions. Following some localized closures, on 10 March 2020, Greece announced the closure of all educational structures, with immediate effect. Greece progressively reopened educational institutions to students from 11 May 2020.

In light of work of the Education Policy Outlook in 2020[9] in the context of the pandemic, this spotlight offers an insight into system readiness and immediate responses across five key areas.

1. Ensuring continued access to smooth and permeable pathways through the education system: During closures, schools were expected to continue educating their students through synchronous and asynchronous methods. To support them, the Ministry of Education and Religious Affairs (MofERA) issued Guidelines for Distance Education, and collated a list of available resources. Greece mobilised pre-existing digital resources, such as online libraries of digital textbooks, digital lesson plans and digital education platforms and introduced new digital platforms for synchronous online teaching, initially for upper secondary students and schools in regions first affected by closures. Distance teaching was quickly rolled out nationally across all school levels. Special online training was provided to teacher support groups, who were then tasked with disseminating training among the wider teaching community. The Greek branch of the eTwinning project ran regular webinars to support teachers in the transition to distance education. Greece also introduced educational broadcasting via state television, principally for primary level students. At tertiary level, students received free textbooks and two digital platforms for distance and interactive learning were made available. To minimise disruption to tertiary admissions procedures, the application process took place remotely

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[9] https://www.oecd.org/education/policy-outlook/country-profile-Greece-2020.pdf

and Greece limited the content of admissions examinations to the topics taught prior to closures. Also at tertiary level, examinations would take place remotely whenever possible.

2. Strengthening the internal world of the student: The Centre for Educational Psychology published multiple reports guiding parents and teachers on how to support children and foster emotional resilience during the pandemic.

3. Providing targeted support and interventions for vulnerable children and families: To facilitate access to digital education resources, the MofERA, in collaboration with mobile network providers, ensured free access through telephone landlines, mobile phones and tablets. The MofERA issued specific guidelines for providing distance learning to students with special educational needs and staff from the Educational and Counselling Support Centres continued to support schools and children with special educational needs remotely. Digital features to enable access for those with disabilities were added to the digital learning platform. To support refugees and asylum seekers living in Greece, the UNHCR and UNICEF provided educational material, essential items such as solar lamps and, in collaboration with the MofERA, translated the guidelines for distance education into 11 languages and dialects.

4. Harnessing wider support and engagement at local and central level: The MofERA secured commitments from several private companies to donate technological equipment to educational institutions, which in turn assigned them to students, prioritising those from low socio-economic backgrounds. In collaboration with three major technology companies, which provided services free of charge, the MofERA launched three digital platforms enabling institutions to run synchronous online lessons. Higher education institutions were granted the financial autonomy to spend EUR 60 000 on facilitating distance education.

5. Collecting, disseminating and improving the use of information: During the period of closures, the MofERA regularly published participation and engagement statistics.

Organizational advantages and issues of digital educational programs – Focus on Universities vs students relationship

"The quarantine has allowed the dynamics of the Greek university – the students, the professors, the administrative staff – to emerge emphatically. Every department and faculty has stories to tell about the success of distance learning. It was an important experience. However, it should not be overlooked that face-to-face interaction was lacking. This is where the work is done, in the contact of the teacher with the student, in the question and the explanation", observes Thomas Sfikopoulos, professor of the Department of Informatics and Telecommunications of the University of Athens, and with a key role in the coordination of e-learning at the institution.[10]

More specifically, based on the data of the Ministry of Education, **96.35% of undergraduate courses were delivered through modern distance education, which in some HEIs reaches 99.7%.**

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[10] https://www.kathimerini.gr/society/1081660/aristeyse-i-tilekpaideysi-sta-aei/

"On March 11th, Greek universities were confronted with the new reality. The legacy of the pandemic at the Aristotle University of Thessaloniki is not only a success story for us, it is a legacy for the future", observes the Rector of the Aristotle University of Thessaloniki, Nikos Papaioannou, adding that the HEIs did the obvious: they used the infrastructure that was built with taxpayers' money and faced the weaknesses and technical difficulties that were presented. "We have gone from the "I" of every professor to the 'WE' of the university community. The Ministry of Education trusted us and supported us and we proved that we can and so we claim "more self-government". Distance learning will never replace face-to-face teaching. But it is a tool of extroversion, which enshrines our place on the map of internationalized higher education, which is changing radically".

In fact, in the institutions, there were students of theoretical studies who sought online courses and lectures of foreign professors, in addition to those organized by their professors. Something similar happened with teachers. Indicatively, The Assistant Professor of Cardiology of the Aristotle University of Thessaloniki, Georgios Giannakoulas, addressed not only his students but also his health professionals by conducting seminars, since the current summer semester does not teach a course. "This was an educational seminar and the participation of students and doctors was impressive" and midst the quarantine, students were mobilized to seek other pathways of learning.

The positives

"In the beginning there were, understandably, technical difficulties. However, along the way there was a special dynamic during the e-learning process", stressed Diomedes Spinellis, president of the Department of Management Science and Technology of the Athens University of Economics and Business. "In the digital classroom, participation can be more organized and greater. For example, if someone wanted to interrupt me, they could ask a question that I was seeing and answering. Also, students could express their feelings with the well-known emoji symbols (ideograms – faces). In the auditorium, the professor does not know the reason for the interruption. On the other hand, there the professor can distinguish which student understands the lesson, who gets excited, who gets bored,"he adds. "Moreover, students who had completed their basic course of study but owed some courses, were able to attend these remaining courses again from their permanent place of residence," observes Vassilis Apostolopoulos, a student at the Department of Naval Architecture engineering of the University of West Attica, in fact, he cites the benefits of e-learning for students (e.g. saving rents, etc.).

As he estimates, "e-learning is here to stay. I am talking about its opt-in, complementary application. I am talking about an entirely new addition to our university experience so far, with the lectures being delivered as normal while at the same time being broadcast live, for all interested students."

Benefits for the teaching staff

There was also a gain for teachers who were not familiar with e-learning. "We did great with distance learning. Of course, we missed what we call "amphitheater intoxication", we were saddened that we stopped seeing our students, but the work was done. We gained something unpredictable, the great and explicitly expressed gratitude of the children. We have also gained increased mutual aid and solidarity among us. How many times have we not resorted to the lights of the most trained of us, and how many times have they and they did not devote time and effort to introduce us to the mysteries of technology!" said Angela Kastrinaki, Professor of Modern Greek Literature at the University of Crete. He adds: "In our teleconferences, some colleagues once appeared against the backdrop of

exotic landscapes and palm trees. Now that we have finished the lessons, all of us, with swollen eyes from exposure to the radiation of the screen, want to disappear in a place where the Internet does not reach. Instead we will dedicate ourselves to tele-exams!"

Certification processes for the quality technological aspects of digital education programs

The certification of HEIs and their individual units/departments, curricula and internal quality assurance systems is a quality assurance procedure; it is based on specific, predefined, internationally accepted and pre-publicized quantitative and qualitative criteria and indicators.

Specifically, the purpose of the certification is to assure that an institution, an individual academic unit, a curriculum, or an internal quality assurance system complies with the minimum quality criteria set by the HELLENIC AUTHORITY OF HIGHER EDUCATION.; these criteria are also in line with the principles and guidelines of the European Higher Education Area. Ensuring the quality of higher education promotes the increase of the efficiency and transparency of the overall HEIs work.

Thematic evaluation is a quality assurance procedure for higher education, composed of systematic, documented and detailed evaluation; it aims to highlight and record the work of HEIs or their academic units by using objective criteria, as well as critical analysis and identification of existing weaknesses and gaps related to their academic profile, goals and mission. Thematic evaluation reports are posted on the Authority's website.

Regarding the online exams and certifications each University issued detailed instructions. All students had a university e-mail account and they had to register for each exam by filling in a specific registry and they had to follow given instructions, outlined in a handbook. The handbook (developed and created by each University and departments, based on areas of study) covered all areas of remove learning. If students had a technical problem they had the option to retake the exam. Students had also to verify their identify with the use of the camera.


Figure 6 Instructions for students and teaching staff

Θα μεταφερθείτε στην αίθουσα εξέτασης στην οποία θα δείτε τον διδάσκοντα ή και τον επιτηρητή και κάποιους ακόμα φοιτητές.
Μείνετε συνδεδεμένοι μέχρι να ενεργοποιηθεί ή γραπτή εξέταση με ανοιχτή κάμερα και μικρόφωνο φροντίζοντας να κάνετε ησυχία ώστε να ακούσετε τις οδηγίες του διδάσκοντα ή του επιτηρητή.
Ο διδάσκων ή ο επιτηρητής στο χρονικό διάστημα μέχρι την έναρξη της γραπτής εξέτασης (Quiz) θα προβεί σε έλεγχο ταυτοπροσωπίας καλώντας τους φοιτητές με προσωπική κλήση βίντεο σε «Αίθουσα Ψηφιακής Αυθεντικοποίησης».

Εικόνα 7
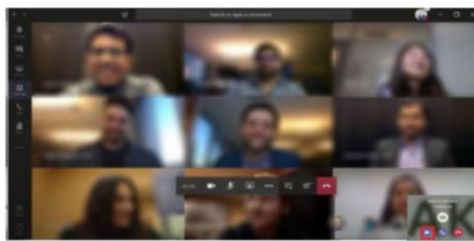
Πέραν του αρχικού ελέγχου, ο έλεγχος ταυτοπροσωπίας δύναται να γίνει και οποιαδήποτε στιγμή κατά την διάρκεια της εξέτασης.

Αν κληθείτε για έλεγχο ταυτοπροσωπίας, θα εμφανιστεί στην οθόνη σας ειδοποίηση για κλήση βίντεο την οποία θα πρέπει να την αποδεχτείτε πατώντας το εικονίδιο της κάμερας.

Figure 2: Face verification for exams

Current needs in national digital education in terms of skills and competencies

According to the DESI Report for 2018[11], Greece is ranked as 26th in the "Human Capital" dimension. According to the Report, 46% of people have basic digital skills, much lower than the average rate of the EU (57%). Greece also, has a lowest number of ICT professionals in the EU, just 1.4 per 1000 employees and faces the problem of "brain leakage", which means lack of capacity to digital transform the economy. The lack of ICT specialists though is of vital importance for the digital transformation of the economy.

Also, according to the Women Digital Scoreboard for 2018[12], Greece is ranked in the 26th position with a score of 36.1 compared to 49.1, the average rate of the EU. It is important to note that women graduates are 13.7 per 1000 people aged 20-29, which is the 8th position in the EU level, but women ICT specialists are just 0.4% of the total of employment, which ranks Greece in the 28th position. The gap in the salary of women compared to men is 22%.

The Ministry of Administrative Reconstruction had published the Action Plan 2019[13] for the promotion of innovation and digital skills.

The Action Plan has taken into account 21 digital skills which are reflected in 5 competence areas:

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[11] https://digital-strategy.ec.europa.eu/en/library/digital-economy-and-society-index-2018-report#:~:text=The%20Digital%20Economy%20and%20Society,Digital%20Public%20Services%2C%20and%20more

[12] https://wayback.archive-it.org/12090/20210728212943/https://ec.europa.eu/digital-single-market/en/women-digital-scoreboard

[13] https://www.nationalcoalition.gov.gr/wp-content/uploads/2019/06/NC-Action-Plan-2019_EN-v5_272178237_signed.pdf

Co-funded by the
Erasmus+ Programme
of the European Union

1. Information and data literacy

2. Communication and collaboration

3. Digital content creation

4. Safety

5. Problem solving

Regarding the improvement of digital skills in education, they fall under the 3rd priority, and they highlight different areas such as coding, new technologies, digital platforms for teaching, creation of digital material for pupils with special learning needs, European agenda for adult education, training for students interested in working in tourism.

Effective teaching and interaction

While good course design transcends modality, it is important to acknowledge the inherent differences associated with each. Teaching in an online environment is different than teaching in a F2F environment. Research[14] offers insight into these differences:

- Instructor role adjustment: The instructor role shifts to have a larger emphasis on facilitation. While live sessions offer an opportunity for direct instruction (e.g., lecture, discussion), the creation of asynchronous materials requires time to be spent on developing and leading learning experiences that happen both in and out of the live session experience. Examples include the creation of recorded mini-lectures (chunking of content into smaller portions), monitoring discussion forums, and supporting student work through off-line communication.
- Learner autonomy: Online courses tend to focus on students' learning decisions. The students often can choose when / where / how they will utilize the course materials. Therefore, students must be actively engaged in thinking, dialogue, writing, and/or reflecting to construct their own knowledge. This engagement relies upon the creation of effective stimuli for learning activities. Additionally, all items related to course activities will require clarity of purpose and detail. Succinct directions and clear deadlines will be beneficial.
- Content flexibility: Learner autonomy, the vast number of online resources, and content adaptability to multiple devices dictate that online courses use multiple resources. However, it might be overwhelming for learners to cope with the abundance of materials. The instructor should establish a weekly rhythm and prioritize content. Flexibility is a positive attribute, but it does require a guiding structure for consistency.
- Asynchronous/Synchronous communication: Clear communication is even more critical in an online environment. A blend of both asynchronous and synchronous communication can positively impact the learning environment. As students work in an online environment, clear messages from the faculty will help to strengthen their understanding of the content and the overall flow of the course.

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[14] https://resilientteaching.nd.edu/policies-practices/effective-online-teaching/

Benefits of Online Teaching

Teaching in an online environment has been linked to benefits that impact both online and F2F teaching[15]. Examples include:

Strengthens teaching awareness. Preparing and designing online courses before launching them increases awareness of what strategies work better for students and allows for improvement. Making design decisions in this way requires an intentional focus and connection to the overall learning goals of the course. This process leads to an increased awareness of the alignment and connection of course content.

Opportunity for reflection. In the online course environment, faculty have an opportunity to capture and reflect upon their teaching techniques and student learning activities. This visualization and recording of your teaching allows you to come back and reflect more easily than in your face-to-face classes.

Increased creativity. Teaching online can also be a gateway to creative ideas as you adjust to the medium for your online courses. These creative ideas can often be brought back to the F2F environment or offered in a blended format.

Wider connections: Online courses allow you to interact with students from all over the world and collaborate with instructors or institutions far away. The natural format of the digital space offers a flexible approach that might not be as available in the F2F environment.

Evolution of digital interaction and new identified methodological approaches

The "Applying Best Practice Online Learning, Teaching, and Support to Intensive Online Environments: An Integrative Review"[16] suggests that online modes of study have been found to be equivalent to on-campus environments with respect to key outcomes such as student academic performance (Magagula and Ngwenya, 2004; McPhee and Söderström, 2012) and student satisfaction (Palmer, 2012).

Institutional and research-based efforts to characterize the competencies required for effective online instruction suggest[17] a degree of overlap in the conceptualization of the core teacher competencies required for effective online instruction. Some of the most important online teacher competencies drawn from the aforementioned studies include:

• communication skills;

• technological competence;

• provision of informative feedback;

• administrative skills;

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[15] https://resilientteaching.nd.edu/policies-practices/effective-online-teaching/

[16] https://www.frontiersin.org/articles/10.3389/feduc.2017.00059/full#B34

[17] http://ibstpi.org/

• responsiveness;

• monitoring learning;

• providing student support.

Regarding the methodological approaches, online programs are designed to convey the same knowledge and skills as face-to-face based programs, so teaching staff can adapt the same instructional methods to the online teaching environment. In some cases, on-line delivery enriches the learning experience and outcome.

The following are being used as new methods[18]:

- On-line fora and on-line class discussion can actively support the learning process.
- Video demonstrations. Students can watch those videos in order to master a specific subject.
- Simulations delivered in a realistic digital environment allow online students to test practical skills and knowledge remotely. Professors can also search open source educational resources (OERs) like Merlot for compatible simulations made freely available by their creators.
- Gamification. Educational technology developers like Distance2Learn integrate game-building applications directly in the LMS to simplify the design process.
- Case studies are another instructional method that places students in an active learning role while promoting research, problem-solving, and high-level cognitive skills. When used in a collaborative way, these exercises present another opportunity for online students to connect and learn from one another. It can be helpful for instructors to suggest reputable online resources students can consult for information.
- Problem-based learning (PBL) encourages students to practice many of the same skills as case studies while actively solving problems.
- Guided design is an inquiry-based instructional method that encourages online students to familiarize themselves with resources available in their local communities. In guided design, learners are tasked with solving open-ended problems.

4. TECHNOLOGICAL ASPECTS

Analysis of administrative information systems to meet the interoperability requirements

E-Learning can be thought of as the learning process created by interaction with digitally delivered content, services and support. E-Learning involves intensive usage of information and communication Technology (ICT) to serve, facilitate, and revolutionize learning process.

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[18] https://www.onlineeducation.com/guide/instructional-methods

Researchers[19] , have identified three learning models: traditional (face-to-face learning), distance learning (instructor and students are separated by location) and blended learning (combination of traditional classroom practice with E-Learning practices).

A system that can be used for administrative information is the Student Information System (SIS) which is responsible for managing students' data within the faculty and/or university. SIS typical student record includes ID, SSN (Social Security Number), Name, Age, Gender, Address (Street, City, Country), Email, Username, Password, DOB (Date Of Birth), Faculty, Year, Department

Adopted standards and technical rules for online teaching programs and supporting services

The Faculty Information System is responsible for managing and automating managerial activities related to Instructors, Employees, Courses, and intersection between them. A typical faculty information system database record includes Faculty data; ID, Name, Departments, Courses data; Course ID, Name, Description, Instructors data; ID, SSN (Social Security Number), Name, Age, Gender, Address (Street, City, Country), Email, Username, Password, DOB (Date Of Birth), Faculty, Year, Department; and Employees data; same as instructor's data with customized data about job.

Open access and interoperability of developed online learning contents

The following web site (https://opencourses.gr/index.xhtml;jsessionid=9542EFD6299CD3858588F6D762F9F151?ln=en) is offering online courses from 26 Institutions in Greece. The project is offering 4234 courses. Courses taught at Greek universities and technological institutes have been adapted to the digital environment, and they are freely accessible and freely available over the Internet for everyone.

Platforms and services

Open eClass & Open Delos platforms

Partner institutes use the Open eClass and Open Delos platforms to host open digital courses and rich media educational resources, such as video lectures. In addition to specialized functionalities that both platforms support, technical aid is provided to the administrators of the platforms. Training concerning the use and management of the platforms, user and admimistration manuals in Greek and communication services are also offered to institutes.

National Repository

GUnet has designed and developed the National Repository which was launched in November 2014. The National Repository collects information (metadata) for all open courses available from the partner institutes' platforms, that is the Open eClass, Moodle and Open Delos installations. Users can

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[19] https://www.researchgate.net/publication/228622853_E-learning_and_management_information_systems_for_E-universities

browse all the open courses available on the National Repository, or search by using either institute name and subject area or various keywords.

Further services are provided to institutions and staff involved over the Partners' Collaboration Service, "Open Courses – Horizontal Project" collaboration:

- Collaboration and communication service among the horizontal support team (national level) and the institutional central support teams
- Help Desk for users regarding the provided services
- Wiki system to collect references about Open Educational Resources (OER)

Authentication tools for electronic identification of professors and students (smart cards, biometric access systems, digital IDs, etc.)

In the last five years, commercial solutions have been developed and are available that utilize innovative techniques for, among other things, the certification of the student's identity and his/her remote supervision during an examination. These tools have so far been mainly used in certification exams of organizations that offer Massive Online Open Courses (MOOCs) and from a small quick review, mainly in the last two years, there is a pilot use of these in various universities in Europe and America to test whether these tools could partially replace or complete the written face-to-face supervised examinations.

The solution of the online supervised examination seems to be very promising mainly for MOOCs. There are recent studies (Weiner & Hurtz, 2017) that show that the examinees are not negatively or positively affected psychologically by the method of examination compared to the traditional (closely supervised) evaluation. In fact, there are studies where the examinees express themselves positively as they feel more comfortable, have less stress, find the examination environment quieter than in an auditorium (Jefferies, 2017).

Some e-proctoring tools:

Smowl

Proctorio

ProctorEdu

Examus

Tophat

Eproctoring

Inspera

ProctorExam

ProctorU

Examity

All the above tools and methods pose questions regarding issues of data protection which have not been yet evaluated.

Different Universities and different department have developed protocols for online classes and types of exams.

The following is an example (https://www.ece.uop.gr/guidelines-teachers/) which outlines the process.

1. Online registration for exams
2. Identification of students (id card, passport, etc)
3. Types of exams (oral, written multiple choice, written essay, compination of types)
4. Special provisions are made for students with disabilities
5. Selection of online tool (MS Teams, Webex, Zoom,etc) for student verification.
6. Good practices and suggestions for students

The IT departments are available to support and assist the above processes.

The university of Ioannina (https://www.uoi.gr/wp-content/uploads/2020/06/d2-ejetaseis_me_ms-teams-amp-forms.pdf) have also created an online handbook for online exams, which explains in details the processes.

Also the Aristotle University of Thessaloniki has created a handbook for the online evaluation of students (http://www.lib.uth.gr/LWS/el/el_files/Hlektroniki_Axiologisi_AUTH_May_2020.pdf

Digital expertise and other technical needs for professors

Professors and educators should respond to the challenges posed by the digital society. It is necessary to improve the development of the professor's competences related with technology. The digital competence of educators (DCE) can be defined as the set of knowledge, abilities and/or skills about Information and Communications Technology (ICT) related to the teaching profession, that can help them to resolve professional and/or pedagogic problems found in the society of knowledge.

Different competence frameworks have been proposed to analyze the specific competences implied by digital competence, based on different studies. One of those is frameworks is the European Framework for the Digital Competence of Educators: DigCompEdu.

The DigCompEdu framework is directed towards educators at all levels of education, from early childhood to higher and adult education, including general and vocational training, special needs education, and non-formal learning contexts. It aims to provide a general reference frame for developers of Digital Competence models, i.e. Member States, regional governments, relevant national and regional agencies, educational organisations themselves, and public or private professional training providers.

EDUGATE

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and new best practices**

The European Framework for the Digital Competence of Educators (DigCompEdu) responds to the growing awareness among many European Member States that educators need a set of digital competences specific to their profession in order to be able to seize the potential of digital technologies for enhancing and innovating education.
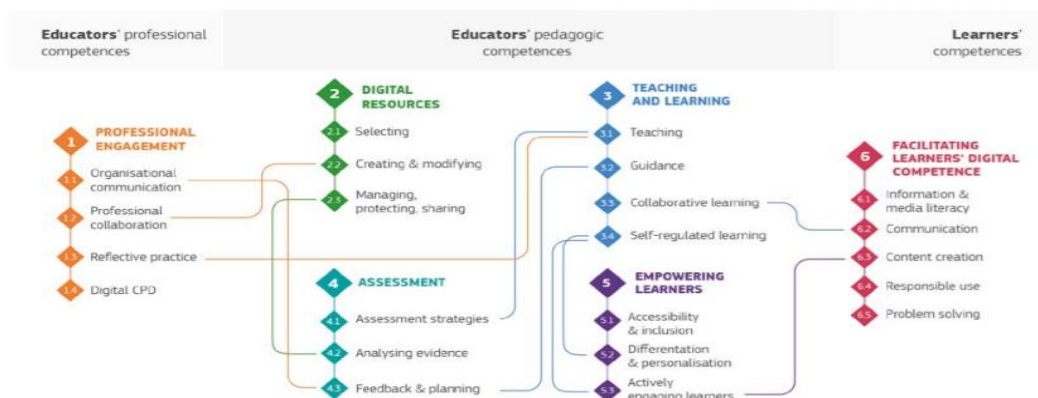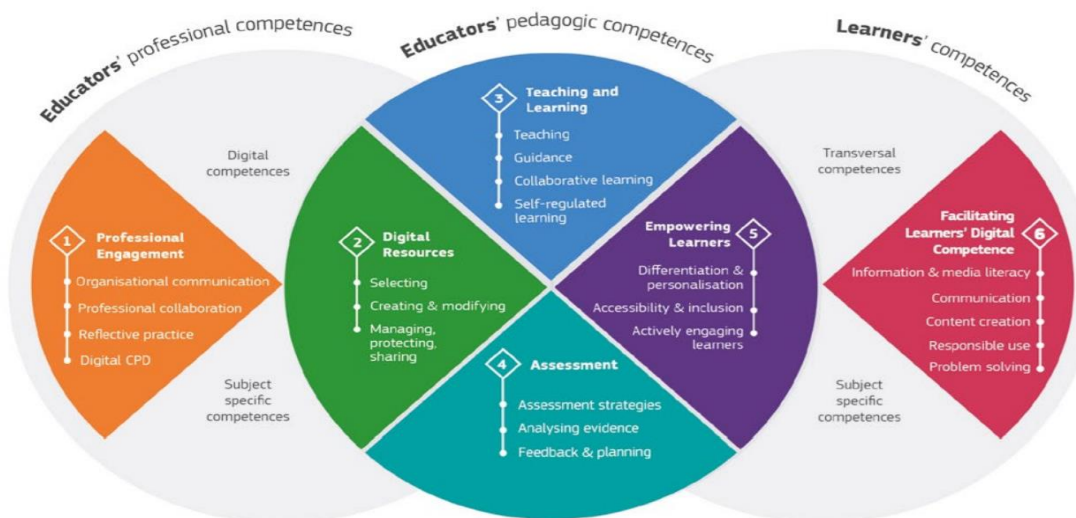

FIGURE 1: THE DIGCOMPEDU FRAMEWORK

1 Professional Engagement

- Organisational communication (To use digital technologies to enhance organisational communication with learners, parents and third parties. To contribute to collaboratively developing and improving organisational communication strategies)

Educational University
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and new best practices

- Professional collaboration (To use digital technologies to engage in collaboration with other educators, sharing and exchanging knowledge and experience, and collaboratively innovating pedagogic practices.
- Reflective practice (To individually and collectively reflect on, critically assess and actively develop one's own digital pedagogical practice and that of one's educational community)
- Digital Continuous Professional Development (CPD) (To use digital sources and resources for continuous professional development.)

2 Digital Resources

- Selecting digital resources (To identify, assess and select digital resources for teaching and learning. To consider the specific learning objective, context, pedagogical approach, and learner group, when selecting digital resources and planning their use)
- Creating and modifying digital resources (To modify and build on existing openly-licensed resources and other resources where this is permitted. To create or co-create new digital educational resources. To consider the specific learning objective, context, pedagogical approach, and learner group, when designing digital resources and planning their use)
- Managing, protecting and sharing digital resources (To organise digital content and make it available to learners, parents and other educators. To effectively protect sensitive digital content. To respect and correctly apply privacy and copyright rules. To understand the use and creation of open licenses and open educational resources, including their proper attribution.)

3 Teaching and Learning

- Teaching (To plan for and implement digital devices and resources in the teaching process, so as to enhance the effectiveness of teaching interventions. To appropriately manage and orchestrate digital teaching strategies. To experiment with and develop new formats and pedagogical methods for instruction).
- Guidance (To use digital technologies and services to enhance the interaction with learners, individually and collectively, within and outside the learning session. To use digital technologies to offer timely and targeted guidance and assistance. To experiment with and develop new forms and formats for offering guidance and support)
- Collaborative learning (To use digital technologies to foster and enhance learner collaboration. To enable learners to use digital technologies as part of collaborative assignments, as a means of enhancing communication, collaboration and collaborative knowledge creation)
- Self-regulated learning (To use digital technologies to support learners' selfregulated learning, i.e. to enable learners to plan, monitor and reflect on their own learning, provide evidence of progress, share insights and come up with creative solutions)

4 Assessment

- Assessment strategies (To use digital technologies for formative and summative assessment. To enhance the diversity and suitability of assessment formats and approaches)
- Analyzing evidence (To generate, select, critically analyse and interpret digital evidence on learner activity, performance and progress, in order to inform teaching and learning)
- Feedback and planning (To use digital technologies to provide targeted and timely feedback to learners. To adapt teaching strategies and to provide targeted support, based on the evidence generated by the digital technologies used. To enable learners and parents to understand the evidence provided by digital technologies and use it for decision-making).

5 Empowering Learners

- Accessibility and inclusion (To ensure accessibility to learning resources and activities, for all learners, including those with special needs. To consider and respond to learners' (digital) expectations, abilities, uses and misconceptions, as well as contextual, physical or cognitive constraints to their use of digital technologies).
- Differentiation and personalisation (To use digital technologies to address learners' diverse learning needs, by allowing learners to advance at different levels and speeds, and to follow individual learning pathways and objectives)
- Actively engaging learners (To use digital technologies to foster learners' active and creative engagement with a subject matter. To use digital technologies within pedagogic strategies that foster learners' transversal skills, deep thinking and creative expression. To open up learning to new, real-world contexts, which involve learners themselves in hands-on activities, scientific investigation or complex problem solving, or in other ways increase learners' active involvement in complex subject matters).

6 Facilitating Learners' Digital Competence

- Information and media literacy (To incorporate learning activities, assignments and assessments which require learners to articulate information needs; to find information and resources in digital environments; to organise, process, analyse and interpret information; and to compare and critically evaluate the credibility and reliability of information and its sources.)
- Digital communication and collaboration (To incorporate learning activities, assignments and assessments which require learners to effectively and responsibly use digital technologies for communication, collaboration and civic participation)
- Digital content creation (To incorporate learning activities, assignments and assessments which require learners to express themselves through digital means, and to modify and create digital content in different formats. To teach learners how copyright and licenses apply to digital content, how to reference sources and attribute licenses).
- Responsible use (To take measures to ensure learners' physical, psychological and social wellbeing while using digital technologies. To empower learners to manage risks and use digital technologies safely and responsibly)

- Digital problem solving (To incorporate learning activities, assignments and assessments which require learners to identify and solve technical problems, or to transfer technological knowledge creatively to new situations)

Digital expertise and other technical needs for technical staff

There is a lack of knowledge and understanding around the role of the technician – they are the 'unknown' professionals of HEI[20]. They lack recognition, often to the extent that they may not be included in HEI strategic plans. Yet the technicians of today are experts in their own right, highly experienced with skills and expertise, and in some cases highly qualified.

They offer their services in a wide range to activities

Media services

The central purpose is to provide a complete audio-visual media and reprographics service for the HEI. The basic functions are:

1. To support teaching and learning through the provisions of audio-visual materials and equipment

2. to produce teaching and learning materials in collaboration with teaching staff

3. to run the HEI's printing and reprographics services

4. to provide a graphic design service for the production of learning materials, publications and inward and outward publicity

5. to collaborate with learning methods in offering appropriate in-service training in the use of audio-visual resources, and with the library in supplying learning materials, particularly stored on video and photographic media to staff and students.

6. to teach a wide range of media skills on award-bearing and other courses.

7. to engage in income-generating activity to further the application and development of educational media through secondment of academic staff from the facuties to the unit

Computer services

The objective of the services are:

1. Central computer services. To manage and develop a reliable central computer service for HEI, which takes account of the time-critical nature of some applications and ensure that adequate levels of personnel support are provided.

2. Networks. (a) to manage and develop the university's electronic data communications networks in cooperation with such other internal and externa; agencies as may from time to time be appointed,

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[20] https://nationaltechnicianscentre.ac.uk/wp-content/uploads/2019/02/TDMReport.pdf

and to facilitate ease of access to them. (b) to provide guidelines for all aspects of networking and communications within the HEI and to oversee their implementation.

3. Evaluation and standardization. (a)to evaluate hardware and software and to determine standards with a view to advising and assisting staff and students of the HEI on their information technology needs, requirements and problems, on a proactive as well as reactive basis.(b)to advise and assist staff and students of the HEI on problems as they arise.

4.Procurement support.(a) to offer its services as advisor to staff and students, when appropriate, in the procurement of appropriate goods and services.(b) to assist through the HEI where requested in support of faculty computer facilities.

5. Staff development (a) to encourage and facilitate the engagement of staff of the unit in research activities, consultant and participations in external professional activities, in accordance with such guidelines as may be laid down from time to time. (b) to maintain an adequate level of staff awareness by encouraging staff to develop their own professional knowledge through approved visits to formal training courses, conferences and shows.

6. Training and learning. (a) To provide a range of staff develpomnet courses with the objective of improving the general standard of individual computer compentences among the staff of HEI. (b) To promote and support the application of information technology in the teaching and learning situations through the provisions of documentations, resources and open access areas.

7. Academic Support. (a) to provide teaching support for faculties as requested from time to time, subject to the availability of staff and materials. (b) to work closely and sympathetically with boards of study and other committees that may appointed from time to time within the HEI and to which staff of the division are appointed or co-opted.

8. External activity. To generate income from the HEI , either through one of the methods outlined in item 5 above, or through the provision of fee-paying short courses for members of the public.

9. General. (a) to provide as much as possible of the above within the budgetary constraints laid down by the institution's senior management. (b) to review and update the above objectives in the light of current needs, practices and experiences.

State of the art of national Learning Management Systems: open sources vs legacy solutions

According to a report[21] published by the Bridge Tank Organization (2020), Greece had the best performance across ten major European countries in terms of flattening the Covid-19 pandemic's curve, followed by Czechia (The Czech Republic) and Romania. Following the World Health Organization (WHO) (2020b) guidelines about health interventions, the Greek Government along with all relevant Ministries and the National Public Health Organization (NPHO) gradually began introducing a plethora of measures (administrative, educational, financial, healthcare and social) to address the impact of this extraordinary crisis. In the context of crisis, digital technology was used for the

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[21] https://www.tandfonline.com/doi/full/10.1080/02615479.2020.1807496

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implementation of a variety of measures to tackle COVID-19 and keep people and society safe and functional.

Among the measures taken to reduce the risk of spreading coronavirus were restrictions on movement and gathering, as well as lockdown of all universities across the country.

On March 11 all universities in the country were closed and all teaching activities had to move onto remote and digital platforms. Moreover, all students' placements including social work placements were suspended after the Ministry of Education announced the temporary closure of practicum placements. Following this announcement, practicum experiences were replaced with online learning experiences and supplemented with additional learning materials. Despite all the challenges for the higher educational system in Greece, it is noteworthy that the transition to online teaching for theoretical lessons in the four social work departments across the country (University of West Attica, Democritus University of Thrace, University of Patras, Hellenic Mediterranean University) started within one to two weeks after the closure order of universities, while online placement learning started a little later. This relatively rapid adaptation to remote learning is undoubtedly due in large to the fact that almost all universities1 in Greece have their own IT infrastructures in place to support remote instruction and other online initiatives (e.g., workshop webinars, teleconferencing.

However, the transition from the face-to-face class to the online course was a totally new experience for students (mainly for undergraduate students) and most of the faculty members. At the moment, 'face to face' teaching remains the basic mode of delivery for undergraduate social work programs in the country, while masters degree programes were already widely using online courses.

Data analysis results clearly showed that digital technology was used to help students stay active, connected and engaged while practicing physical distancing during the lockdown. The vast majority of students looked on the bright side and saw the positive aspects of the crisis situation due to the COVID-19 pandemic and made the most of it; digital technology was used as a medium to support academic online learning and self-education from home, to (re) connect with others, as well as get help and engage in solidarity and volunteer activities concerning people and animals. According to the results obtained, one can say that students who were already immersed in the digital age easily adapted to the new learning reality; not only did they follow their program of studies properly in most cases, but they also learned to e-educate themselves and develop new skills and social capabilities in order to make their own and others' lives more useful and pleasant. Staying at home, students (especially vulnerable students) became much more engaged in their own learning and growth as learners and individuals. The skills created by constant learning and adaptability to new circumstances prove to be important skills needed to prevail through uncertain times. Undoubtedly, such skills are essential to effective social work, as professionals today operate in more uncertain and complex environments than ever before. (Eleni Papouli, 2020).

5. THE DIGITAL TRANSFORMATION OF LEARNING PROCESSES: NEEDS AND REQUIREMENTS Digital skills

Digital skills are crucial to navigating today's technology-dense society and economy. Digital technologies and digital competences are transforming our lives and our society. The broader use of

digital technologies and the acquisition and use of digital skills can boost economic growth, job creation, entrepreneurship and efficient operation of the public sector leading to digital transformation.

However, OECD Survey of Adult Skills (PIAAC) (2012-15)[22] data show that 13% of 16-65 year-olds in many OECD countries lack basic cognitive skills and less than 30% have a cognitive skillset combining high levels of literacy, numeracy and problem-solving skills. Younger generations of workers have a higher level of skills for problem-solving in technology-rich environments, five times more than the older generations of workers. Continuous training and upskilling are necessary to thrive in digital transformation.
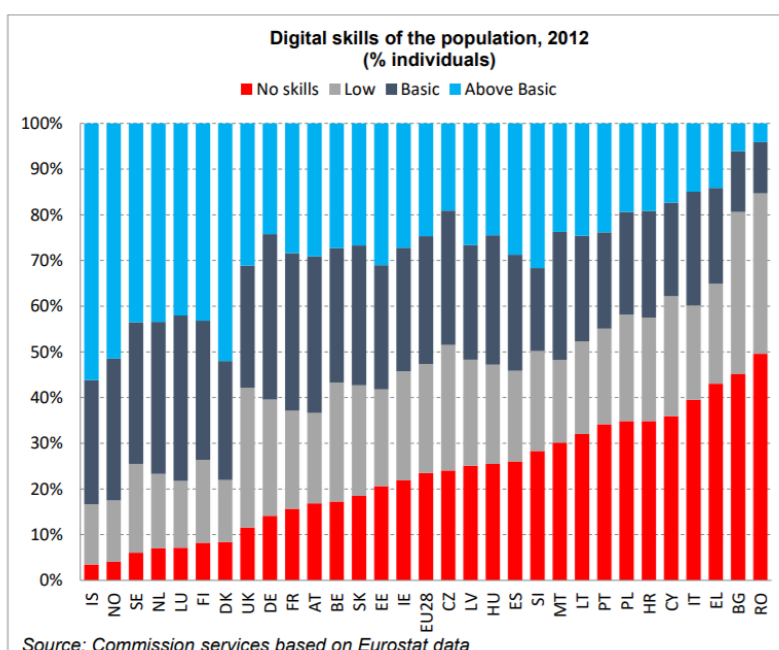
A report by Ferrari, analyzed digital skills from 15 different frameworks. (Ferrari, Digital Competence in Practice: An Analysis of Frameworks, 2012). The report suggests that technical skills constitute a central component of Digital Competence. But digital competences should be understood, in its wider sense, as a multi-faceted concept. The following figure summarizes the competence areas that emerged from the 15 frameworks presented in the above mentioned report. Each component has been taken from more than one framework.

Ferrari proposes that the following 7 areas depicted below should be taken into account when discussing about digital skills and competences.

This list summarises the competence areas that are developed in the selected frameworks, together with the competence areas established in the above definition.

The same report outlines the following areas of Digital skills :

"ICT literacy refers to the ability to use computers and related technologies, from end-users to ICT professionals. It is generally understood as the knowledge and skills needed to effectively use hardware and software components. Computer literacy is defined as "an understanding of computer characteristics, capabilities and applications, as well as an ability to implement this knowledge in the skilful and productive use of computer applications" (Simonson, 1987). The different definitions of ICT literacy developed in the 80's are all along the same lines and have survived unaltered for over twenty years (Oliver, 2000); (Reed, 2005). ICT literacy is still mainly based on the development of operational and technical skills and knowledge. Internet literacy refers to the proficient use of the internet.

Internet literacy refers to the proficient use of the internet. As Deursen, (2010) points out, the expression Internet literacy refers to a specific tool or medium. In this sense, it could be perceived as a subset of ICT literacy. Hofstetter, (1998), Internet literacy relates to connectivity, security, communication and web page development. As it might be noted, Internet literacy is quickly evolving, as nowadays web page development is not as central as would be the competences to understand and manage web 2.0 tools. Furthermore, the Internet is now also accessible via mobile phones and television sets, thus from a variety of tools.

Media literacy is the ability to analyse media messages and the media environment. It involves the consumption and creation of media products coming or retrieved from television, radio, newspapers, films and the internet. Media education is typically concerned with a critical evaluation of what we read, hear and see through the media, with the analyses of audiences and the construction of media messages, and the understanding of the purpose of these messages (Buckingham, 2003). Media literacy involves a set of competences that relate to communication and critical thinking."

In 2001 Marc Prensky in his article (Prensky, 2001) defined as digital natives "the native "speakers" of a digital language related to computers, video games, and the internet" and digital immigrants those who were not born in the digital world, "but, at a later stage of their lives, were fascinated and adopted many or most aspects of technology".

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The perceptions and the needs for each group are quite different. This creates a digital age gap. The way young people use technology is very different from adults. This gap gives rise to different perspectives of what is considered acceptable behavior.

Sharpe al, 2010 clarify that it would be useful "instead of asking students to evaluate how well they can use a digital tool, they could be asked to describe how they use this tool to support their learning." So emphasis should be placed not of knowledge of tools but on functionality for promoting thinking and knowledge.

The World economic forum has proposed the following chart outlining the skills of digital intelligence for children and young people.
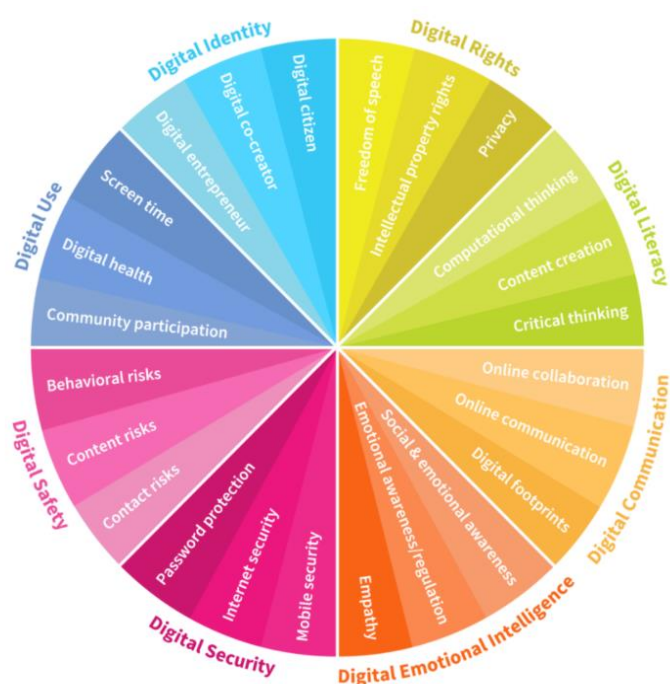
The above are defined as following:

Digital identity: The ability to create and manage one's online identity and reputation. This includes an awareness of one's online persona and management of the short-term and long-term impact of one's online presence.

Digital use: The ability to use digital devices and media, including the mastery of control in order to achieve a healthy balance between life online and offline.

Digital safety: The ability to manage risks online (e.g. cyberbullying, grooming, radicalization) as well as problematic content (e.g. violence and obscenity), and to avoid and limit these risks.

Digital security: The ability to detect cyber threats (e.g. hacking, scams, malware), to understand best practices and to use suitable security tools for data protection.

Digital emotional intelligence: The ability to be empathetic and build good relationships with others online.

Digital communication: The ability to communicate and collaborate with others using digital technologies and media.

Digital literacy: The ability to find, evaluate, utilize, share and create content as well as competency in computational thinking.

Digital rights: The ability to understand and uphold personal and legal rights, including the rights to privacy, intellectual property, freedom of speech and protection from hate speech.

The acquisition of these abilities should be rooted in desirable human values such as respect, empathy and prudence. These values facilitate the wise and responsible use of technology – an attribute which will mark the future leaders of tomorrow. Indeed, cultivating digital intelligence grounded in human values is essential for our kids to become masters of technology instead of being mastered by it.

Following the above, a report by experts (Janssen, 2013) describes the digital competence areas as following:

Digital competence area	Description
General knowledge and functional skills	The digitally competent person knows the basics (terminology, navigation, functionality) of digital devices and can use them for elementary purposes
Use in everyday life	The digitally competent person is able to integrate technologies into the activities of everyday life.
Specialized and advanced competence for work and creative expression	The digitally competent person is able to use ICT to express his/her creativity and to improve his/her professional performance.
Technology mediated communication and collaboration	The digitally competent person is able to connect, share, communicate, and collaborate with others effectively in digital environments
Information processing and management	The digitally competent person uses technology to improve his/her ability to gather, organise, analyse and judge the relevance and purpose of digital information.
Privacy and security	The digitally competent person has the capacity to protect personal data and take appropriate security measures

Legal and ethical aspects	The digitally competent person behaves appropriately and in a socially responsible way in digital environments, demonstrating awareness and knowledge of legal and ethical aspects on the use of ICT and digital content.
Balanced attitude towards technology	The digitally competent person demonstrates an informed, open-minded, and balanced attitude towards Information Society and the use of digital technology. The digitally competent person is curious, aware of opportunities and new developments, and is comfortable to explore and exploit them.
Understanding and awareness of role of ICT in society	The digitally competent person understands the broader context of use and development of information and communication technology.
Learning about and with digital technologies	The digitally competent person actively and constantly explores emerging technologies, integrates them in his/her environment and uses them for lifelong learning
Informed decisions on appropriate digital technologies	The digitally competent person is aware of most relevant or common technologies and is able to decide upon the most appropriate technology according to the purpose or need at hand.
Seamless use demonstrating self-efficacy	The digitally competent person confidently and creatively applies digital technologies to increase personal and professional effectiveness and efficiency

As the authors indicate "Results indicate that experts see digital competence as a conglomerate of knowledge, skills, and attitudes connected to various purposes (communication, creative expression, information management, personal development, etc.), domains (daily life, work, privacy & security, legal aspects), and levels. The above mentioned twelve areas of digital competence identified in this study are highly complementary.

Possessing elementary skills is one thing, applying them in everyday life is something else, as is expanding them to more advanced areas. Digital Competence clearly involves more than knowing how to use devices and applications – which is intricately connected with skills to communicate using ICT as well as information management skills. Besides, sensible and healthy use of ICT requires particular knowledge and attitudes regarding legal and ethical aspects, and privacy and security, as well as an understanding of the role of ICT in society and a balanced attitude towards technology. Needless to say, that various levels of proficiency can be identified for each of these areas. Finally, dictated by the nature of information and communication technologies, i.e. their rapid development, digital competence requires the ability to learn about and with digital technologies, to choose the right technology and to do so in confidence."

The European Commission[23] also developed the Digital Education Action Plan (2021-2027) which focuses on using the COVID-19 pandemic experience as a learning point, when technology is being used at a large scale for education, and being able to adapt the systems used for leaning and training towards the digital age. The framework is divided into two main strategic priorities:

- fostering the development of a high-performing digital education ecosystem
- enhancing digital skills and competences for the digital transformation.

The Digital Education Action Plan (2021-2027) is a renewed European Union (EU) policy initiative to support the sustainable and effective adaptation of the education and training systems of EU Member States to the digital age.

The Digital Education Action Plan:

- offers a long-term strategic vision for high-quality, inclusive and accessible European digital education
- addresses the challenges and opportunities of the COVID-19 pandemic, which has led to the unprecedented use of technology for education and training purposes
- seeks stronger cooperation at the EU level on digital education and underscores the importance of working together across sectors to bring education into the digital age
- presents opportunities, including improved quality and quantity of teaching concerning digital technologies, support for the digitalisation of teaching methods and pedagogies and the provision of infrastructure required for inclusive and resilient remote learning.

Needs and requirements

A research by (Pedro, 2012) showed that some students achieve better results from online learning while others do not achieve better results. Is it difficult to identify just one reason for this phenomenon, but one contributing factor might that online learning programs needs to focus on a different way of delivering knowledge and the learning material.

We also need to consider some basic obstacles in delivering on-line education.

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

High speed internet:

Greece ranks at the bottom in Europe in terms of average internet speed according to a study by the European Data Journalism Network[24] and is still far back in the digital transformation of the economy.

The Greek e-Governance Ministry announced a project to set up 750,000 high-speed internet connections at 100 Mbps, upgradable to 1Gbps, according to the guidelines of the EU's "Connectivity for a European Gigabit Society" plan. The Ministry's digital transformation plan, alongside the Ultra-Fast Broadband (UFBB) services in the country and other projects funded by the EU Recovery Fund, includes the implementation of 5G transmission corridors, and the development of submarine cables, as well as inland infrastructures and microsatellites.

High speed internet will have a huge impact on improving internet access and allowing students and High Education Staff to access a very wide range on available resources (Texts, videos, on-demand material, live lectures, podcasts, etc.)

Devices:

Teachers and students can benefit from high speed internet if they invest in uptodate devices (mobile phones, tablets, laptops, desktops, cameras, microphones, headphones, etc).

Software for personalized learning:

Personalized learning can be defined as prioritizing the needs of individual students when developing curricula and learning materials. Students work at their own pace, often independently of the teacher.

Technology may be used to allow students to access online materials, work through topics, find additional resources and to assess and monitor their progress. Students are encouraged to be active learners and teachers are encouraged to engage with students one to one or in small groups.

The following are important features of effective personalized learning systems:

- Teaching is in line with established college - and career-ready standards as well as developing the social and emotional skills students need to be successful in college and career.
- Students are encouraged to customize their learning experiences to reflect their interests.
- Learning is at the pace of each individual student, this means students can move ahead when they are ready or take a slower pace until they fully grasp the material.
- Teachers have access to data from student assessments and feedback in real-time so they can adapt materials and intervene to help students if necessary so that students remain on track to completion.
- Access to understandable, transferable learning objectives and assessments so students understand expectations in advance.

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[24]   https://www.europeandatajournalism.eu/eng/News/Data-news/Where-do-we-stand-on-the-road-to-a-European-Gigabit-Society

Personalization enables material to be presented in ways which are most meaningful and relevant to the student. A personalized learning program should include different presentation of materials.

Many students prefer to learn in small groups with a chance to contribute to discussions on the topics, unfortunately, traditional delivery of material in large lecture halls fails to retain their attention. For verbal students reading might remain the most attractive option, others who learn aurally might prefer to listen to the material.

While most educators aim to deliver courses in ways which cater to all styles, personalized learning allows the student to pick and choose which delivery methods are most accessible and memorable to them.

The teacher can help the student to identify their most effective way of learning and encourage them to use the most appropriate methods.

Different Personalized Learning Platforms are available for Higher Education Institutions:

Acellus Academy

Achieve 3000 Blendspace

Activate Learning

Adobe Creative Cloud

Chalkable

Class Dojo

Edmodo

Education Elements

Educlimber

Eduguide

Epiphany Learning

Istation

Knewton

Khan Academy

Seesaw

Microsoft OneNote Classroom

Mobymax

Learning management system (LMS):

A learning management system (LMS)[25] is a software application or web-based technology used to plan, implement and assess a specific learning process. It is used for E-Learning practices and, in its most common form, consists of two elements: a server that performs the base functionality and a user interface that is operated by instructors, students and administrators.

Typically, a learning management system provides an instructor with a way to create and deliver content, monitor student participation and assess student performance. A learning management system may also provide students with the ability to use interactive features such as threaded discussions, video conferencing and discussion forums.

Some common features found in a successful LMS include:

Responsive design - Users should be able to access the LMS from whatever type of device they choose, whether it's a desktop, laptop, tablet or smartphone. The LMS should automatically display the version best suited for the user's chosen device. Additionally, the LMS should also allow users to download content so it is accessible while offline.

User-friendly interface - The user interface (UI) should enable learners to easily navigate the LMS platform. The UI should also align with the abilities and goals of both the user and the organization. An unintuitive UI risks confusing or distracting users and will make the LMS ineffective.

Reports and analytics - This includes eLearning assessment tools. Instructors and administrators must be able to view and track their online training initiatives to determine if they are effective or need adjusting. This can be applied to groups of learners and individuals.

Course and catalog management - The LMS holds all the eLearning courses and the related course content. Admins and instructors should be able to create and manage these catalogs and courses in order to deliver a more targeted learning experience.

Content interoperability and integration - Content created and stored in an LMS must be packaged in accordance with interoperable standards, including SCORM and xAPI.

Support services - Different LMS vendors offer varying levels of support. Many provide online discussion boards where users can connect and help each other. Additional support services, such as a dedicated toll-free service number, are available for an extra cost.

Certification and compliance support - This feature is essential to systems used for online compliance training and certifications. Instructors and admins should be able to assess an individual's skill set and identify any gaps in their performance. This feature will also make it possible to use LMS records during an audit.

Social learning capabilities - Many LMSes have started including social media tools within their platform. This allows users to interact with their peers, collaborate and share their learning experiences.

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[25] https://searchcio.techtarget.com/definition/learning-management-system

Gamification - Some LMSes include game mechanics or built-in gamification features that allow instructors and admins to create courses with extra motivation and engagement. This can help students who need additional incentive to complete the course, possibly in the form of leaderboards, points and badges.

Automation - Learning management systems should enable administrators to automate repeated and tedious tasks. Examples include user grouping, new user population, user deactivation and group enrollments.

Localization - It is important for LMSes to include multilingual support features so the learning and training content can remain unaffected by language barriers. Some LMSes integrate geolocation features that allow them to automatically present the appropriate version of the course immediately upon access.

Artificial intelligence (AI) - Finally, artificial intelligence can help an LMS create personalized learning experiences for users by providing course formats suited to their needs, and by suggesting topics the user may find interesting based on the courses they have already completed.
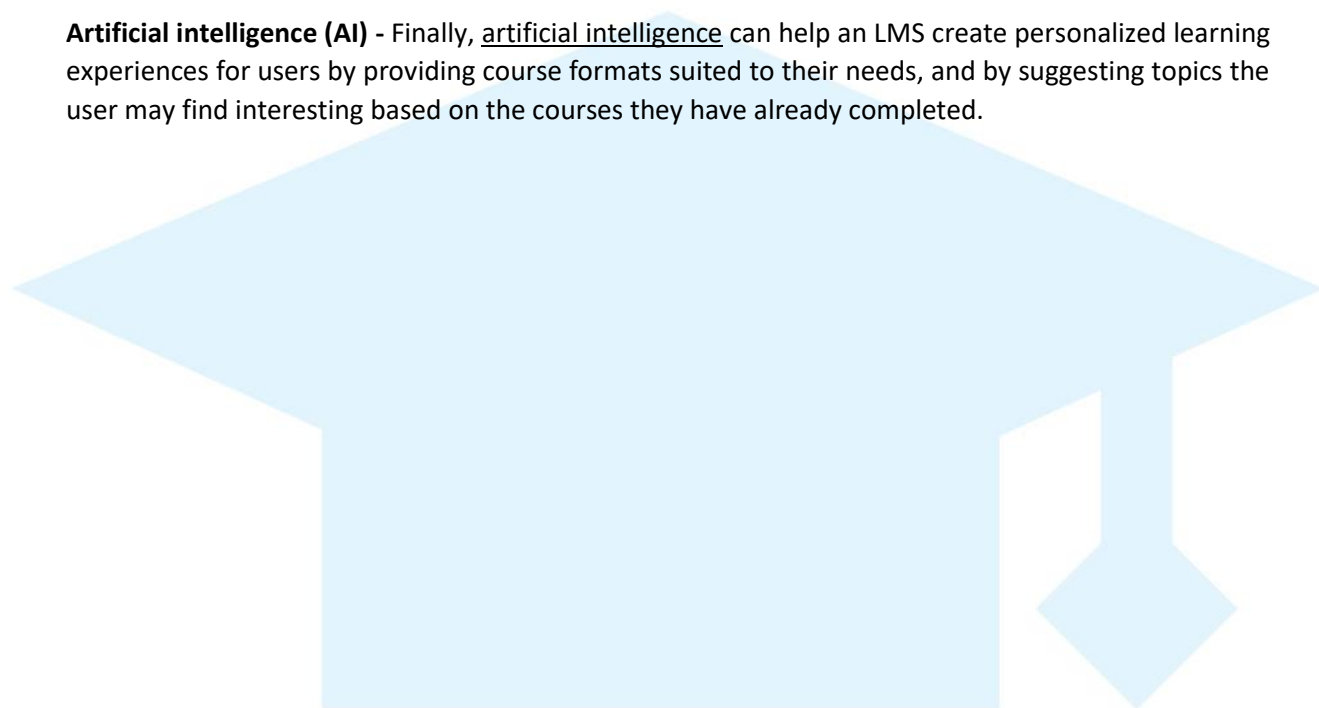
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