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**Perspectives of Online Education in the Context
of the COVID-19 Pandemic Crisis**

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Abstract

The COVID-19 pandemic forced the digitalization of many sectors, especially of the educational sector starting with March 2020. Along with the fight for health security and the government measures such as self-quarantine and social distancing, destined to reduce the number of COVID-19 infections, the educational sector was forced to adapt in a matter of days to full online teaching worldwide. This has brought numerous challenges in terms of digital skills for the educational facilities personnel and learners, as well as of adapting to new ways of teaching, respectively learning. The present paper intends to analyse if the measure of closing educational facilities in the European Union at different dates in March 2020 could be a factor for reducing the numbers of COVID-19 cases in May 2020. Secondly, we tested if there is a relationship between the digital skills of individuals in percentage and share of persons taking at least one online course in 2019.

The results of the study indicated a contribution of the closure of educational facilities in reducing the number of COVID-19 cases, as well as a relationship between the digital skills of the population and the share of persons taking at least one online course in 2019 before the pandemics started. The study is one of the first regarding the measures for COVID-19 and the educational field, offering a basis for future research in the field as more measures are expected to be applied in the upcoming year.

Keywords: Online education, face-to-face learning, COVID-19, correlation, digitalization.

JEL Classification: I25, O3

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1. Introduction

The online education sector has known a continuous increase in the past decade with technology development, more competition in the business field and the need for IT skills and competences of the population. Furthermore, the COVID-19 pandemic which started in 2019 (World Health Organization, 2020), imposed new strategies for living, education, work stimulating jobs from home, online education, online purchasing and online activities in general where possible (European Commission, 2020). The year 2019, as well as the beginning of the current year were defined by security measures for population's health and strict measures of social distancing and of avoiding physical contact where possible, especially by staying home, working from home, educating from home, purchasing from home, online medical consults and other online activities.

The trend of developing online education started already in the '80s when the modern Internet was created, although other forms of remote education, such as through correspondence were available long before this period (TheBestSchools, 2019) ever since more educational institutions, including the ones offering tertiary education, started to offer online courses. According to Statista (2020a) 49% of the global students followed an online course in 2015 comparing to 46% in 2013. The evolution of the e-learning market encountered also a major development between 2013-2016, especially in the field of packaged content with a market size of 33063 million US Dollars in 2016, followed by platforms with a market size of 7121 million US Dollars (Statista, 2020b). Other e-learning services include learning management systems. The Europe 2020 strategy's target is that at least 40% of 30-34-year-old people in the 27 Member States of the European Union (EU) have graduated from tertiary education by 2020, this target being exceeded in 2019 with a level of 40.3% in the European Union (Eurostat, 2020a). The e-learning market also brought a significant income globally, namely 40.67 billion US Dollars in 2019, however being in a decreasing trend (Statista, 2020c). Globally, the USA represents the region with the highest degree of online education, with 6 million students in 2011 following at least one online course, while the next positions are occupied by India, China and South Korea (ICEF Monitor, 2012).

In 2019-2020 two phenomena in the educational systems have been observed, namely the closure of many educational facilities in March 2020 in the European Union in the context of the COVID-19 pandemic and the fact that online education has started to occupy an important percentage in terms of the people attending at least one online course in 2019. The COVID-19 pandemic has changed more elements of learning and has affected also the phenomena of educational tourism, where individuals travelled across borders to gain knowledge or learn (Harazneh et al., 2018). However, the pandemic has favoured the organizational learning (Bratianu et al., 2020) in terms of adapting individuals to the environmental conditions.

The objective of the present paper was to analyse if the closure of the educational facilities in the European Union in the context of the pandemic was indeed an efficient method influencing the increase in the number of infections

per million persons and the online education trend in 2019. Secondly, the digitalization of learning, namely the share of persons attending at least one online course in 2019 before the pandemics and the digital skills of the population were correlated. This was intended in order to reveal that the online learning development began along with the digitalization and was only expanded by the measures of educational facilities closure and social distancing of COVID-19.

2. Literature review

2.1. Evolution of online education

Online education practically started in the 80's when the modern Internet was created. The first higher education institution that offered an online study programme was Western Behavioural Sciences Institute, School of Management and Strategic Studies in 1981 and in 1985 the first accredited online higher education programme was offered by Nova Southeastern University (TheBestSchools.org, 2019). The 90's represented the Era of Information and Internet Boom. This implied the possibility of expanding online higher education programmes and the development of learning management systems. Given the economic context of that time, companies started to use the Internet for research, promotion and innovation.

This technological boom was marked by inflation and an Internet bubble. In 1991 the World Wide Web was presented and offered to the public. This offered to the public the possibility of online learning in the version that is known nowadays. In 1992 the Electronic University Network presented an offer of a PhD programme through America online and in 1994 Calcampus offered the first online courses in a higher education programme with real-time teaching and participation, respectively synchronized learning. Jones International University was the first accredited higher education institution in 1996 that offered only online learning and in 1998 the creation of Google further expanded the possibilities of online learning. The 2000's until present were considered the Era of Information-Global Community. In this period distanced households and communities were linked through Internet, while legislations were updated to support the dynamics of knowledge and information through the usage of Internet. Online formats are introduced in the business field, and having a website and a digital profile on social media, online certifications for learning and other such online activities became usual. In 2009 more than 5.5 million students were registered globally for at least one online course of higher education. Regarding some of the countries with the highest degree of online education US occupied the first place, as in 2011 6 million students in America attended at least one online course (ICEF Monitor, 2012). India, China, South Korea held the next positions and in the European Union the UK developed the online learning system with investments of over 100 million British Pounds in 2011.

Currently there is also a Digital Education Action Plan that was introduced by the European Commission in order to offer measures supporting digitalization of educational systems and help European Union states meet challenges and opportunities in the era of digitalization. The Digital Education Action Plan focuses

on eleven fields of measures used to support digital education, namely the first three actions are dedicated to making better use of digital technology for teaching and learning, the next four actions for developing digital competences and skills and the last three actions for improving education through better data analysis and foresight:

Action 1 - Connectivity in Schools

Action 2 - SELFIE self-reflection tool & mentoring scheme for schools

Action 3 - Digitally Signed Qualifications

Action 4 - Higher Education Hub

Action 5 - Open Science Skills

Action 6 - EU Code Week in schools

Action 7 – Cyber-security in education

Action 8 - Training in digital and entrepreneurial skills for girls

Action 9 - Studies on ICT in education

Action 10 - Artificial Intelligence and analytics

Action 11 - Strategic foresight (EC, 2020).

Since 2019 and until present nowadays, given the globalization phenomena, technology development and especially the COVID-19 pandemic of the last year online education has become a necessity at least in terms of combining it with face-to-face education, if not exclusively offering online courses. Blended learning platforms that were complementary to the face-to-face classes were developed or improved within higher education institutions through the availability of digital study materials and tools, as well as educational tools for evaluating students. They also fully digitalized even some subjects from numerous Universities and departments. The COVID-19 crisis has emphasized the importance of online education used in order to ensure continuity for teaching students, pupils, adults and other categories of participants under health safety conditions.

2.2. Policies of countries for closing educational facilities in the context of the COVID-19 pandemic

The COVID-19 pandemic represented a challenge for higher-education institutions, as well as other types of educational facilities that were required to delay face-to-face classes by March 2020 until the end of the semester or until further notice (Volpe and Crosier, 2020). The institutions had to find a rapid solution to continue the teaching for the students and to ensure the activities of their employees and this was possible through the implementation of online learning as the main alternative to face-to-face education, as well as through online activities of other types for non-educational staff. In March 2020 all countries of the European Union closed their educational facilities due to health risks under circumstances of the COVID-19 expansion in order to limit the pandemic and deaths resulting from it (COVID-19 Healthdata, 2020). Another issue besides that one was represented by the recommendations of the European Union to keep educational facilities closed at least by the end of May 2020 if not until September 2020 or until further notice. This could have jeopardized the continuity of learning for students and the activity

of the personnel of educational institutions. Online learning ensured the continuity of both perspectives in the current context of necessity for social distancing due to the COVID-19 pandemic. However, many learners suffered a form of digital inequality whereby they lack the connections and devices to learn remotely (EPALE, 2020). Figure 1 illustrates the cases of COVID-19 infections in the European Union starting with the 1st of March 2020, when educational facilities started to close until June 2020.

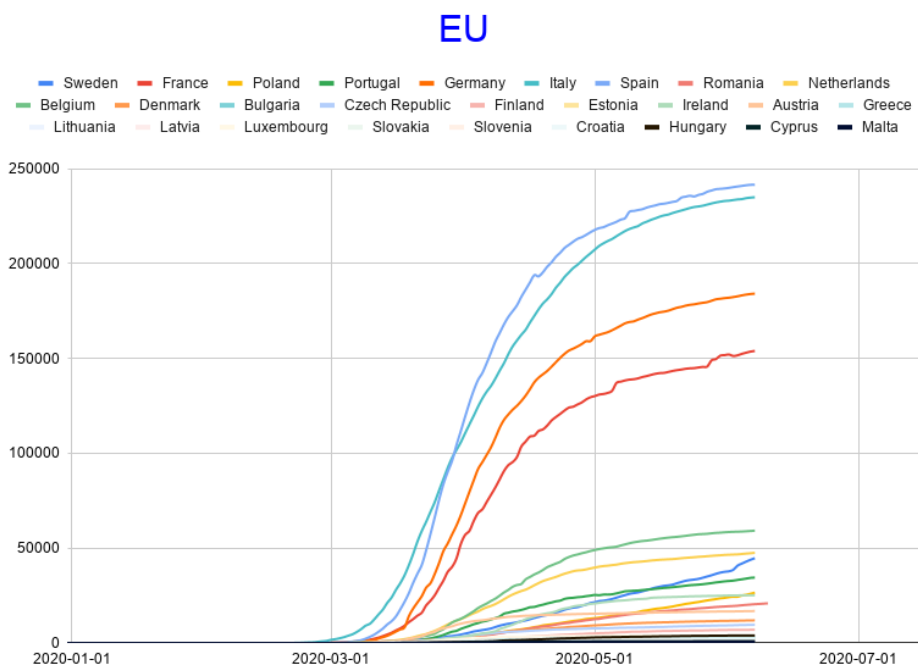


Figure 1. Cases of COVID-19 in the European Union from March 2020-June 2020
 Source: Worldometers.info (2020) and COVID-19 Healthdata (2020)

According to the paper of ETUCE (2020) the Eurydice research network mentioned the periods until some countries of the European Union have to keep the educational facilities closed, namely:

Germany and Switzerland: Terms are different in school closures across the country.

Luxembourg: upper secondary schools (ISCED 3) will open on May 4th for students in their final year.

Austria: upper secondary schools will open on May 4th 2020 for students in the last school year who need to take the national exam (Matura).

Czechia: Tertiary education institutions may operate from 20 April 2020 only for individual consultations and examinations.

Norway: Higher education institutions are opening from April 27, 2020 for students that are at the end of their degree studies, and who are dependent upon using equipment at the university.

The closure of educational facilities starting with March 2020, as well as the closure of numerous other face-to-face activities from different sectors led to the increase of stock price of online platform companies, especially for Zoom Video Communications which skyrocketed in early 2020, amounting to over 150 U.S. dollars on March 23rd (Statista, 2020d). As the need for social distancing was imposed in order to protect citizens' health from the COVID-19 pandemic, the demand for remote solutions like Zoom also increased in several fields and especially in the educational sector in order to ensure continuity of the activity. This contributed to the strong performance of Zoom's shares. Numerous companies and educational facilities used Zoom as a main platform to communicate and perform several activities online during the COVID-19 pandemic.

SWOT analysis online education vs. face-to-face education

The COVID-19 pandemic has also brought to attention advantages and disadvantages of both forms of learning, online and face-to-face, which had to be faced by educational facilities. These were tested also before the pandemic, as online education programmes expanded in many educational facilities, but in 2020, along with the exponential increase of online learning, they have been confirmed by more studies, as shown in the tables below. Both types of education, respectively face-to-face education and online education have their own positive and negative parts and can offer high-quality learning for the students, however, aspects such as schedule flexibility, feedback, socializing possibilities, costs and other such factors make a difference in terms of opting for one form or the other. The COVID-19 crisis forced the majority of educational institutions globally to offer further courses, but only online in order to prevent the pandemic. This e-learning phenomenon has also shown the necessity of improving online learning platforms, the technical and social issues that can arise in the e-learning process and further solutions for improvement.

Face-to-face education offers the advantages of direct socializing and the possibility of creating networks by working directly with different members and stakeholders of the educational institution, as well as the possibility of direct consultancy for students and more learning and support through this during classes, as shown in Table 1. However, there are other less positive parts, such as: it is more time consuming, which can decrease the number of participants, especially in the case of students working. This can impact also negatively the income of educational institutions if they charge taxes from students or if they receive financing based on the number of students they teach.

Table 1. SWOT analysis of face-to-face education

<p>Strengths</p> <p>Students, parents, educational institution employees can interact directly for problem solving.</p> <p>Teachers/professors can better supervise students at evaluations/exams and also adapt the teaching process during classes to focus students' interest on the topic.</p> <p>Rapid consultancy for students' questions directly.</p> <p>Efficient socializing and communication of students, teachers/professors and other parties</p> <p>Feeling of belonging to a community</p> <p>Networking</p> <p>Teaching hours are done strictly in classrooms and this can stimulate the "necessity" of students to participate physically to a certain number of classes with their classmates</p> <p>Students can compare written information</p>	<p>Weaknesses</p> <p>Courses/seminars/classes materials are usually not available on an online platform where all students have access to</p> <p>Increased stress for some participants due to being in a room full of people.</p> <p>For students with jobs or family issues, etc. not attending more classes can be demotivating for participating in further classes in the future for this subject/for further participating in general.</p> <p>Teachers/professors cannot answer all students' questions in some cases.</p> <p>Time consuming, such as with the transport to the educational institution, which can affect negatively the number of participants (especially students working, etc.) and income of the educational institution.</p> <p>Face-to-face education costs are higher, such as transport costs to the education institutions.</p>
<p>Opportunities</p> <p>Partnerships on a national and international level with other universities, educational institutions, etc.</p> <p>Increased demand for employment on certain fields, especially in the financial, sales/procurement, IT, engineering, which offers the basis for creating courses.</p> <p>Expansion of subvention programmes for Universities.</p> <p>Expansion and accessing European and international financing for research projects, equipment of classrooms, Universities' or educational institutions' expansion, renovating the institutions' building, etc.</p> <p>Development of technologies.</p>	<p>Risks</p> <p>Competition from other educational institutions.</p> <p>Hostilities.</p> <p>Terrorism.</p> <p>Pandemics, such as COVID-19.</p> <p>Increased demand for online courses</p> <p>Political instability and political decisions affecting the educational field.</p>

Source: Hande, 2014, Guma et al., 2019, Volpe and Crosier, 2020, Authors' own research (2020)

On the other hand, online education offers materials online, allowing accessibility to these education sources everywhere with the condition of Wi-Fi access and more comfort in terms of participants being in any space they want or need to, which can reduce this type of stress, as shown in Table 2. However, the access to online education can be restricted or limited based on financial reasons in more regions, where there is poverty or no or limited subventions for purchasing computers, laptops or devices for participating in e-learning.

Table 2. SWOT analysis of online education

Strengths	Weaknesses
<p>Accessibility of students to online materials and innovative teaching methods.</p> <p>Teaching a high number of students in a short time is possible.</p> <p>Interaction possibility between students and teachers/professors online and also physically in classrooms if a combination of face-to-face and online education methods are offered.</p> <p>Learning IT skills for teachers/professors and students.</p> <p>Independent learning for students is possible.</p> <p>Possibility of a quick feedback online.</p> <p>Accessibility in any region and work from home is possible as long as there is Wi-Fi/Internet.</p> <p>Support from external specialists for administrating and maintaining the online platform.</p> <p>Participants in online learning can be in a comfortable space, which reduced this type of stress.</p>	<p>Technical issues due to lack of Internet connection/poor connection.</p> <p>Lack/reduced possibility of supervising the real activity of students online during classes (regarding their real-time focus on the discussed topics).</p> <p>Distractions for participants, especially for students (such as games on Internet, eating, etc.) instead of focusing on the discussed topic.</p> <p>Lack of funds for many institutions for purchasing computers, laptops for some educational institutions and/or students.</p> <p>Increased stress for students when assignments with a limited time are given.</p> <p>Resistance change from institutions and students (in some regions, etc.).</p> <p>Limited skills in using online platforms for some participants (teachers/professors/instructors, students, etc.).</p> <p>Costs for the training of personnel of the educational institutions in order to use online learning platforms (depending on the necessities).</p> <p>Incompatibility of the online software with hardware and software parts.</p> <p>Lack of a stable and complete regulation regarding online learning policies (for some institutions).</p> <p>Tendency to socialize less in some cases (for students, teachers, professors and other participants).</p> <p>Integrity issues with online testing.</p> <p>A feeling of isolation for participants sometimes.</p>

Opportunities	Risks
Development in the technological field, new innovations for online learning solutions Increased demand for online learning and online learning platform services National and international partnerships with other educational institutions Development of user-friendly, online platforms COVID-19 pandemic imposed online learning for many educational institutions stimulating this field.	Increased costs of new technologies, that need to be updated for online learning. Competition with other educational institutions. War.

Source: Hande, 2014, Guma et al., 2019, Volpe and Crosier, 2020, Authors' own research (2020)

3. Aims of the research and research methods

As the data for online education in the context of the COVID-19 pandemic is still under development, we focused on the information available for the European Union States between March 2020 and May 2020. In March 2020 the educational facilities in the European Union states were closed at different times when there was already a certain number of COVID-19 pandemic cases, which imposed a rapid response in this field in order to ensure the health safety of their members whether personnel or students.

Firstly, we used the Pearson coefficient to analyse if there was a correlation between the number of cases of COVID-19 infections per million persons when educational facilities closed in March 2020 and the number of COVID-19 infections per million persons currently, namely on the 23rd of May 2020. Then we calculated a correlation between the digital skills of individuals and the number of persons taking at least one online course in 2019. The formula for the Pearson coefficient is:

$$\text{Pearson coefficient} = \frac{E[(X-E(X))(Y-E(Y))]}{\sqrt{\text{VAR}(X)\text{VAR}(Y)}} \quad (\text{Meissner, 2014}).$$

The value of the coefficient of correlation always lies between +1 and -1, respectively:

$r=+1$, perfect positive correlation

$r=-1$, perfect negative correlation

$r=0$, no correlation.

Depending on the value of the Pearson coefficient the strength of the correlation can be interpreted as follows (Evans, 1996):

0.00-0.19 “no correlation-0 to very weak”, 0.20-0.39 “weak”, 0.40-0.59 “moderate”, 0.60-0.79 “strong”, 0.80-1.0 “very strong”.

4. Findings

4.1 Educational facilities closure in the context of the COVID-19 pandemic

Firstly, we tested if there is a correlation between the number of cases of COVID-19 infections per million persons when educational facilities closed in March 2020 and the number of COVID-19 infections per million persons currently, namely on the 23rd of May 2020. We correlated the numbers of days since the educational facilities were already closed on the 23rd of May and the growth multiplier of the number of cases of Covid-19 infections per million users during the period in which the educational facilities were closed. We found a non-significant (p-value of 0.1974) correlation of 0.25. The R-squared, which is the proportion of variance in one variable explained by the other variable is low (0.0656) as well. Another approach would be to correlate between the number of cases of COVID-19 infections per million persons when educational facilities closed in March 2020 and the number of COVID-19 infections per million persons currently, namely on the 23rd of May 2020. For this correlation we found a higher value of 0.41, still significant (p-value of 0.0336 for the t-test) which implies that the higher the infections degree with COVID-19 at the moment of closure of educational facilities the higher the degree also on the 23rd May 2020. The R-Squared value is 0.16 and this correlation is basically the same correlation as the first one, but in this case we do not include directly the time component. Table 3 presents the number of COVID-19 infections per million persons on the date of closure of educational facilities and the number of infections per million persons currently (23rd of May 2020).

Table 3. Number of COVID-19 infections per million persons at the date of closure of educational facilities and the number of infections per million persons currently (23rd of May 2020)

Country	Closing date of educational facilities	Number of days closed until 23-May-2020	Covid-19 infected persons/million persons at closing date of educational facilities	Total/million of Covid-19 infected persons on 23-May-2020	Growth Multiplier of Covid-19 infected persons during this period
Italy	04/03/2020	81	51.08	3792.36	74.2
Romania	11/03/2020	74	2.42	930.96	384.5
Greece	11/03/2020	74	9.49	275.79	29.1
Slovakia	12/03/2020	73	3.85	276.41	71.9
Norway	12/03/2020	73	147.69	1540.76	10.4

Country	Closing date of educational facilities	Number of days closed until 23-May-2020	Covid-19 infected persons/million persons at closing date of educational facilities	Total/million of Covid-19 infected persons on 23-May-2020	Growth Multiplier of Covid-19 infected persons during this period
Latvia	12/03/2020	73	8.47	554.50	65.4
Ireland	12/03/2020	73	14.19	4984.28	351.2
Malta	13/03/2020	72	27.18	1381.89	50.8
France	13/03/2020	72	56.10	2796.08	49.8
Cyprus	13/03/2020	72	11.97	792.31	66.2
Bulgaria	13/03/2020	72	4.46	349.03	78.3
Spain	14/03/2020	71	136.70	6039.62	44.2
Belgium	14/03/2020	71	59.48	4928.34	82.9
Netherlands	15/03/2020	70	66.25	2630.55	39.7
Slovenia	16/03/2020	69	121.70	706.14	5.8
Portugal	16/03/2020	69	32.20	2964.11	92.1
Poland	16/03/2020	69	4.68	561.05	120.0
Luxembourg	16/03/2020	69	129.63	6385.40	49.3
Lithuania	16/03/2020	69	6.60	1463.77	221.7
Hungary	16/03/2020	69	4.04	387.16	95.9
Estonia	16/03/2020	69	154.55	1374.35	8.9
Denmark	16/03/2020	69	157.86	1949.70	12.4
Croatia	16/03/2020	69	13.88	546.04	39.4
Austria	16/03/2020	69	113.10	1833.45	16.2
Germany	18/03/2020	67	147.18	2148.92	14.6
Finland	18/03/2020	67	27.98	1187.58	42.4
United Kingdom	23/03/2020	62	99.77	3858.27	38.7

Source: Author's own calculations based on data from Worldometers.info (2020) and COVID-19 Healthdata (2020)

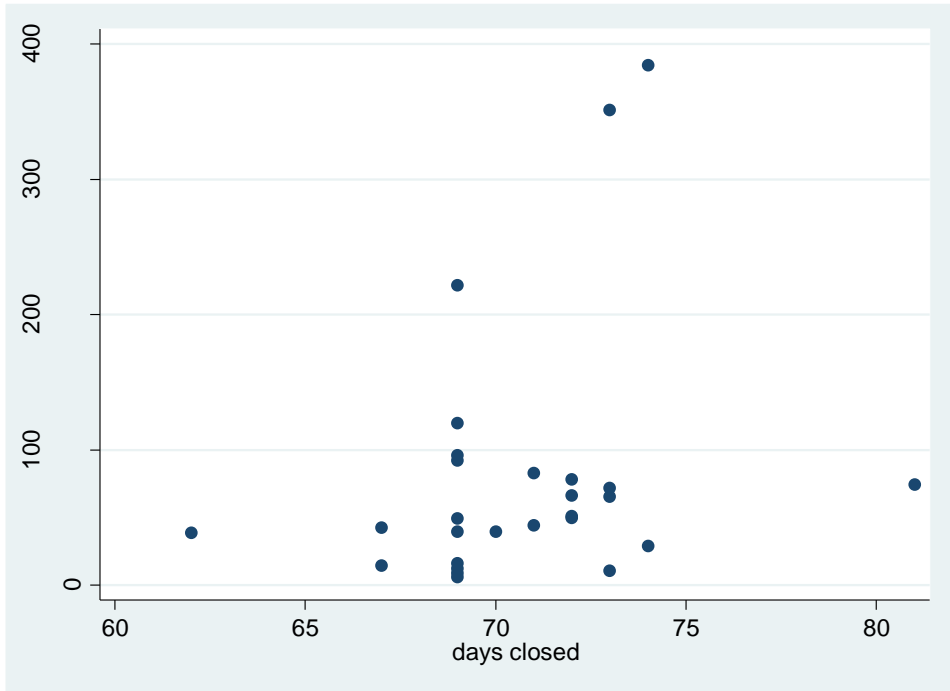


Figure 2. Number of days of closure of education facilities since closure of the educational institutions and the growth multiplier of COVID-19 until May 23rd 2020 (Scatter plot of data points)

4.2. E-Learning in 2019

Secondly, we focused on discovering whether there is a correlation between the digital skills of individuals in terms of the percentage and share of persons attending at least one online course in 2019. We found a significant correlation coefficient of 0.75, which indicates a strong connection. This implies that populations of countries with high percentages of individuals with basic or above basic overall digital skills tended to take at least one online course comparing to countries with lower percentage of individuals having basic or above basic overall digital skills. The correlation is significant as the significance level is 0. Furthermore, we performed the Shapiro – Wilk test to test for a normal distribution, one of the necessary assumptions of the Pearson correlation (Appendix A). Figure 3 presents two percentages, namely the percentage of the population having individual digital skills as well as the percentage of the population taking at least one online course. Table 4 presents the correlation results and a scatterplot to display the data points, as well as a fitted line (under OLS assumptions). Figure 4 presents a scatterplot of the two variables (including a fitted line under OLS assumptions).

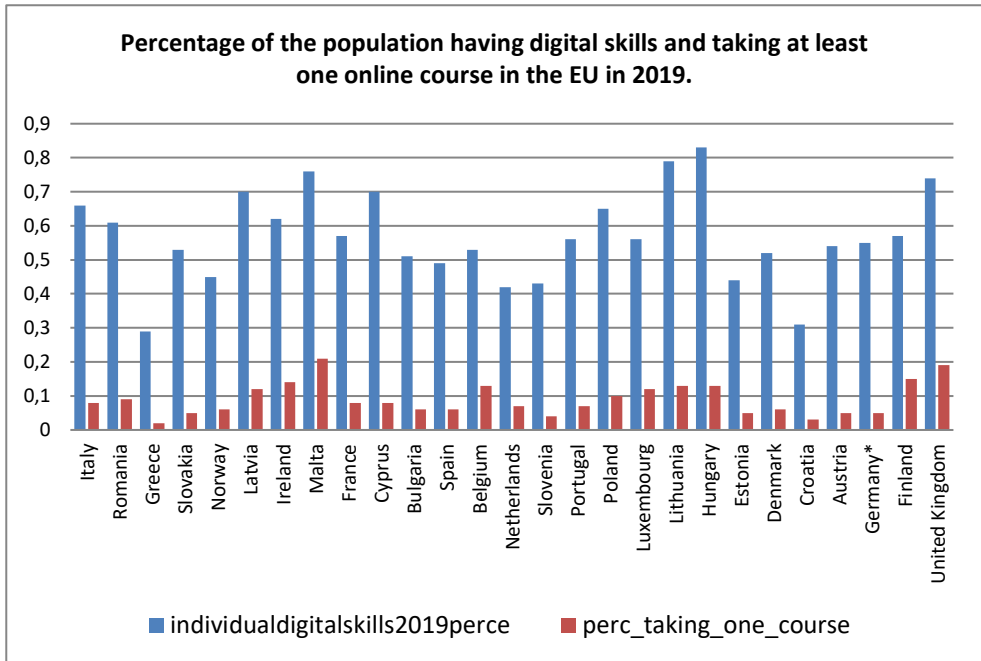


Figure 3. Individuals attending at least one online course and individual digital skills in 2019

Source: Statista (2020d), Authors’ own calculations based on Eurostat (2020b)

Table 4. Correlation between percentage of individuals attending at least one online course (perc_t~e) and individual digital skills (indivi~e) in 2019

	perc_t~e	indivi~e
perc_takin~e	1.0000	
indiviual~e	0.7523	1.0000
	0.0000	

Source: Statista (2020d), Authors’ own calculations based on Eurostat (2020b)

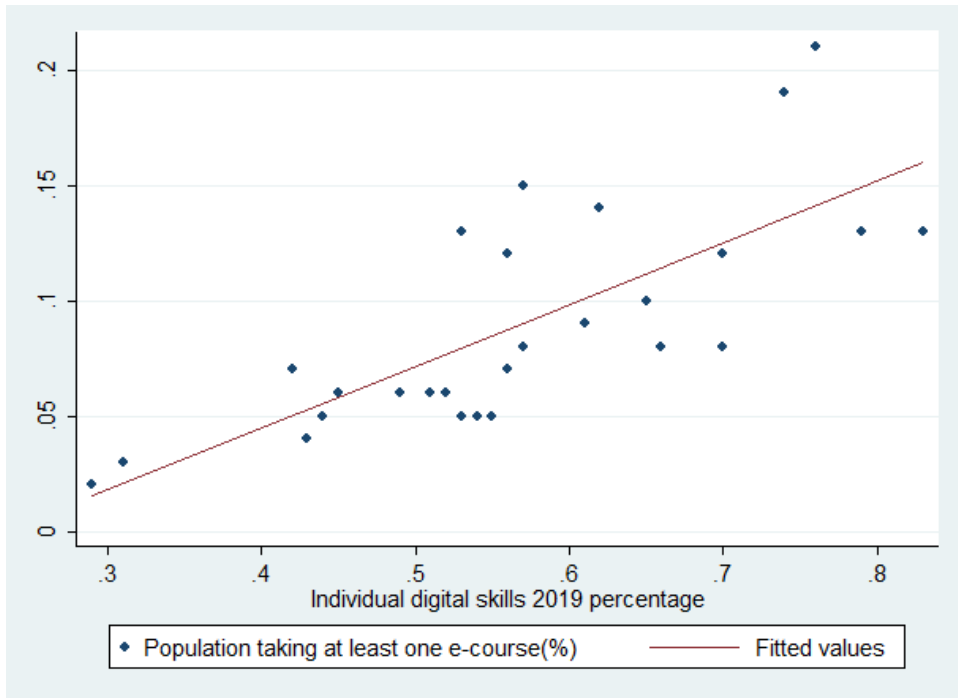


Figure 4. Pierson- results including significance level and a scatterplot of the data points (with an OLS regression line)

Source: Statista (2020d), Authors' own calculations based on Eurostat (2020b)

Limitations of the study refer to the restrictive available data on online learning development during 2020 and to other connected variables.

5. Conclusions

The e-learning market has encountered a significant development in recent years, cumulating 49% of the individuals attending at least one online course in 2015 and bringing a high income from the e-learning market of about 41 billion US Dollars in 2019. The COVID-19 was only an accelerator for the development of online learning and its more dynamic introduction throughout educational systems all over the world. While the digitalization of societies was already in progress in the recent period, the COVID-19 pandemic changed the perspectives of education imposing online learning as a main solution for teaching, as regulations for social distancing for health security imposed this. While it can bring advantages such as the possibility of teaching in real time to numerous students and the possibility of access from any region with connectivity to Internet, online learning also brought challenges in terms of reorganizing the personnel of educational facilities in order to be able to perform online teaching and the costs associated with it, it decreased socialization among participants and other security and supervision issues for the teaching personnel. The new online learning system throughout the world

also imposed quick new regulations to educational facilities in order to support a transparent and efficient teaching process, that can avoid legal issues or complains of any sort from all participants. Thus, although online learning itself is an advantage for most participants, it still brought challenges in legal, social and economic terms for educational facilities, their personnel, students and other stakeholders. Higher educational facilities have been some of the most affected, as they are responsible for ensuring education for more mature learners, but also to contribute to community development through knowledge, innovation and skills for jobs (Paunescu et al., 2018).

This paper explores whether there is a positive relationship between the closure of the educational facilities and the declining numbers of COVID-19 infections from March to May 2020. We do not find a negative relationship and more research will have to be done, for example by comparing multipliers over different periods.

Secondly, regarding the online learning in 2019 we found a significant correlation, implying that populations of countries with high percentages of individuals with basic or above basic overall digital skills tended to attend at least one online course comparing to countries with lower percentage of individuals having basic or above basic overall digital skills. Thus, digitalization of the society in terms of added digital skills and the current context of the COVID-19 pandemic are factors of influence for online education, that are also expected to continue and develop in the next years.

The COVID-19 pandemic context has accelerated the introduction of online learning worldwide through learning platforms, the educational institutions' websites or other e-learning solutions and thus, the restructuring of the concept of learning. However, this phenomenon is also possible and encouraged due to basic and above basic digital skills of the populations from earlier ages, which contributed to a rapid implementation of the online learning.

As the educational facilities are forced due to the current pandemic context to keep the closure of their institutions until September 2020 earliest, if not until further notice, the online learning is already a solution considered for a mid-to long term teaching and learning. Benefits of the online learning are already being noticed, especially in terms of accessibility in any region and work from home for educational personnel and students, rapid feedbacks, more comfort in terms of the personal location of the online platforms' users, such as at home in a familiar environment. However, the online learning also brings some challenges in terms of social distancing and less personal communication through self-isolation, less possibility of supervision of students and financing issues in terms of providing the software or hardware necessary for online learning and/or trainings for personnel and other participants in the process.

A future research objective would be to analyse the effect of the COVID-19 pandemic on online learning platforms demand during March 2020 and until the reopening of educational facilities, as well as the changes in the teaching process after this period worldwide, and whether educational facilities will continue only online, face-to-face or with a mixed structure of services, namely online and

face-to-face. We could find further negative correlations regarding educational facilities closures and COVID-19 and this can be explained by more factors, such as lock-down of business, local or national restriction measures different from one country to another and other factors. The massive open online courses (MOOC) are also an interesting topic for future research in correlation with the COVID-19 pandemic development as more educational facilities will be focused on online.

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Appendix A

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
perc_takin~e	27	0.93144	2.016	1.440	0.07495
individual~e	27	0.98039	0.576	-1.132	0.87116