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DIGITAL EDUCATION: GOVERNMENTS' STRATEGIES, TEACHING TOOLS IN THE EUROPEAN UNION AND A CASE STUDY OF DIGITAL TRANSFORMATION IN BUDAPEST

Haya Altaleb*, Malak Shatnawi and Zoltán Rajnai

Óbuda University, Doctoral School on Safety and Security Sciences
Budapest, Hungary

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ABSTRACT

This article reviews some governments' strategies in the field of digital education especially during the recent pandemic period in the European Union. It includes some early lessons from the COVID-19 crisis. Besides, the authors cover various essential remote teaching tools for organizing effective virtual courses by evaluating and analyzing e-learning and distance education in terms of threats, challenges, opportunities, strengths, and weaknesses. Finally, this study presents a methodology with two hypotheses using SPSS statistics v26 to perform a survey on the effect of digital transformation. During the COVID-19 pandemic in Budapest, the participants' perceptions of the disease and the efficiency of the enforced restrictions to curb its spread were studied. The study methodology includes statistical data and analytical outcomes.

KEY WORDS

digital education, remote teaching tools, technology in learning, governments strategies in digital education

CLASSIFICATION

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*Corresponding author, η: haya.altaleb@uni-obuda.hu; +36204107793;
H-1081 Budapest, Népszínház street 8, Hungary

INTRODUCTION

Exploring the use of digital technology in the classroom enables educators to create immersive learning environments, which may involve a mix of online and programmable learning opportunities. Virtual learning is a dynamic term. In summary, digital learning will boost learning experiences, save instructors time, allow teachers to better customize learning to individual students, help in participant tracking, provide transparency into the education process for all participants, and much more [1].

Digital education platforms are programmable digital architectures that aim to integrate and coordinate user interactions not only with end-users, but also with corporate entities and government bodies. This is referred to as an online platform. It aims to collect, store, distribute, and systematically monetize user data. It is essential to establish a definition for the term "platform". Since platforms have become so enmeshed in social life in general and in education in particular, it would be a mistake to oversimplify the concept and reserve it exclusively for major ed-tech players such as Microsoft's 365 Education or Google's G Suite. The platform concept is used so widely in educational literature that it risks becoming a catch-all term for all programs and endeavors to make education (broadly defined) "more digital" [2].

Digital games, smartphones, blogs, social media, and learning environments are becoming more prevalent as our world becomes ever more digitalized. The Covid-19 pandemic, as well as the resulting social isolation and school closures worldwide, has accelerated this digitalization, prompting an urgent need for a critical, thorough investigation of how digitalization is affecting the educational environment. This Special Issue focuses specifically on digital education platforms. Such platforms have become more common in recent years, and both multinational and local technology firms have become omnipresent providers of such platforms, in both private and public education: from primary and secondary school programs to platforms designed specifically for higher education, from digital environments designed to support students' learning to environments that monitor their performance, and from digital spaces that combine multiple functions to interfaces with a single purpose [3]. While one of the most positive global impacts of COVID-19 was the acceleration in digital transformation, one of the most significant issues was to meet the challenges that arose. It is a fact that the transformation to online and remote learning and training will become the future trend, but it requires investments in sustainable, innovative platforms with modern tools, which are considered one of the main components of an intelligent education system, combined with adequate applications, AI, cyber and autonomous technologies. To assess the impact of digital transformation, a survey was conducted, and the SPSS statistics v26 was used for analysis. The findings show that many characteristics had a significant impact on digital transformation during the COVID-19 pandemic, the perceived threats of catching the disease and the effectiveness of the applied restrictions to control the spreading were investigated from the participants' point of view. The research methodology will contain statistical information and results from the analysis.

ESSENTIAL REMOTE TEACHING TOOLS

Whether in a conventional class or in a virtual one, students need to be able to communicate clearly and effectively to be successful in their studies. Keeping in touch with not just one, but with a number of students via email is a challenge. From any workstation, participants may join in video conferencing, direct messaging, audio chats, virtual rooms, or any other technical solutions that allow them to communicate with a significant number of people at the same time. The following are amongst the most in-demand tools, like Google Meet and Microsoft Teams [4]. For a good quality teaching experience, the following strategies can be used:

- preparing a schedule for the online class and sharing it with the audience before it begins,
- explaining to students what online etiquette should be followed in class and what is expected from them before the lesson,
- all microphones, except the one used by the speaker, should be muted. This helps students maintain their concentration by cancelling out distracting noises. Anyone who wants to say something should make a gesture to get the speaker's attention without interrupting them.

ONLINE HOMEWORK PLATFORMS

Essays, speeches, tests, and other types of assignments are all examples of assignments. To encourage students to submit their assignments, you can use a combination of the following platforms: Google Docs is a document management system designed specifically for essays and other written assignments. Use Zoom, Skype or any other video conferencing tool for speaking exercises. Videos and presentations are created using YouTube, Prezi, or Google Slides. Google Classroom is used to assign and grade home assignments, as well as to communicate with students via email. Google Classroom is widely regarded as a helpful online teaching/learning tool since it is free, simple to use, and offers all of the essential functions that an online teaching tool should have to meet all potential demands. The following case study demonstrates the successful usage of Google Classroom. Most teachers and students were able to use it in less than two weeks. The online presence was occasionally superior to the face-to-face presence. Both young and older students were able to benefit from the learning tool. Effective communication between the school, represented by school administrators, headteachers, and teachers, and the beneficiaries of the learning process, represented by students and their parents, resulted in an increase in the use of the Google Classroom tool in potentially problematic situations [5].

SOCIAL MEDIA CHANNELS

Education professionals may use social media platforms such as LinkedIn, Facebook, and WhatsApp to create exclusive communities or groups for their students. For e-learning participants, social media apps and websites provide a great platform to communicate with one another and follow up with learning programs. Social media apps and websites can also be used for the following purposes:

- continually communicate and be present after the online class period has ended,
- share and save important lesson-related information, presentations, and resources with colleagues and students,
- hold open forums for questions and answers,
- encourage students to communicate with one another and interact with one another while they are studying or working on their homework assignments,
- plan live events, such as webinars, and keep track of attendance (with Facebook or Instagram Live) [6].

ONLINE VIDEO TOOLS

Zoom and YouTube are both wonderful online video platforms for creating videos with the students. These techniques may be used in many different ways: (1) Recording online lessons or lectures and making them available to students through video so if a student is absent or studying for an exam, the videos can be replayed. (2) Using pre-recorded teaching materials to encourage students to learn independently. When students comprehend an idea independently, they increase their chances of comprehension. (3) Preparing available links to pre-existing internet video services.

DOCUMENT MANAGEMENT TOOLS

Teachers must keep track of documents such as test papers and lesson plans regularly. It is critical to have a place to store, manage, and organize all of these documents to keep track of them effectively, particularly when the teaching is done remotely. The most effective tools to manage the documents, such as OneDrive, GSuite, Dropbox, MS office, and Evernote can streamline the process of preserving documents.

- All documents, files, etc. should be stored in the cloud so that teachers and students can access them from any device, from any location.
- Documents should be neatly organized in relevant folders and subfolders to make them easy to find.
- Exchanging files and documents by a link or as a file. On GSuite, users can change the permission settings to Edit, View, or Suggesting mode.
- Editing and reviewing documents with students, adding suggestions and comments and tracking changes with version history [7].

EUROPEAN UNION GOVERNMENT STRATEGIES IN THE FIELD OF DIGITAL EDUCATION AND E-LEARNING IN EUROPE

To address the effects of the lockdown on distant learning, the report "Resetting education and training for a digital era" was published in 2020. As outlined in the original action plan, the EU can assist individuals, educational institutions, and educational systems in better preparing for work and life in an era of rapid digital transformation by enhancing the use of digital technology in the classroom, and for learning, developing digital capabilities and abilities relevant to digitalization, as well as increasing data analysis and foresight to improve schooling. Additionally, the European Commission countersigned a message on the importance of education and culture in promoting European identity. This communication served as the Commission's response to the Gothenburg summit's leaders' conference on culture and education. The 2018 OECD Program for International Student Assessment (PISA) research reveals that European nations are generally among the top achievers when it comes to student access to the virtual world and teacher and school preparedness [8]. Specific requirements must be met by digital technologies to benefit education, such as having equipment and infrastructure in place, supplying technical and pedagogical support, having a collaborative school vision, establishing leadership using digital technologies, and providing policy frameworks and support. According to the research, if such prerequisites are not met, generic programs on employing digital technology in education will be at risk of not affecting students' performance or, worse yet, having negative effects on their academic results.

Adult online education has grown in prominence significantly as a consequence of the current COVID-19 problem. Previously accessible solely in the classroom, the bulk of preparatory resources are now available online. Individuals are now urged to utilize the time saved by temporary work programs to train online from home in order to learn new skills that will be valuable beyond the health crisis. As a consequence, the crisis presents an excellent chance to assess the potential of online education. The exposure uncovered several significant disadvantages, including the requirement for adequate digital skills, computing equipment, and an internet connection to conduct online training; the complexity of delivering traditional work-based learning online; and the difficulty for teachers accustomed to classroom instruction [9]. During the COVID-19 pandemic, the distribution of formal education in schools switched to e-learning. Lockdown harmed work-based learning and apprenticeships since companies often sought primarily off-the-job components. Public support for online training was crucial for a variety of training providers and end-users, ranging from sharing sites

to free solutions to help instructors and students develop their digital abilities. Throughout the lockdown, states, governmental work programs, and social partners all supported the use of online training. As a consequence of COVID-19, the most productive public employment services promptly shifted jobseekers' training online; others refocused training on high-demand vocations [9]**.**

FUNDING FOR DIGITAL LEARNING RESEARCH AND INNOVATION

The European Union finances various research and innovation initiatives in the field of digital learning via a range of programs, including Horizon 2020, the seventh Framework Program (FP7), and the Competitiveness and Innovation Framework Program (CIP) Additionally, the European Commission is co-financing the creation and demonstration of a pan-European learning and assessment technology system. Furthermore, it co-funds networks that assist Europeans at risk of exclusion with upskilling and reskilling. Horizon 2020 was divided into the following programs[10]:

- an empowering, inclusive next-generation Internet "ICT-2019-30",
- technologies for learning and skills "ICT-22-2016",
- technologies for better human learning and teaching "ICT 20-2015",
- advanced digital gaming/gamification technologies "ICT 21-2014".

GOVERNMENTS' ROLE AND ASSISTANCE IN E-LEARNING

Government support was needed to keep training stable through digital learning, and it was provided in a variety of forms in several countries to ensure training continuity through online learning. The number of people who participated in online training offered by the Public Jobs Service (VDAB) in the Flemish Region of Belgium in the second quarter of March 2020 was 4 times greater than in the same timeframe the previous year. The first Web searches reveal evidence of an increase in the consideration in online training. Furthermore, there were more searches for online learning and e-learning between the end of March and April 2020. Massive Online Open Courses (MOOCs) increased up to fourfold in Canada, France, Italy, the UK, and the US, as restrictive lockdown rules went into effect in the mainstream of OECD nations. They were roughly twice as strong as their long-term trend by the end of April 2020. [11] As an example of the government's strategies, the following sections will overview the case of Hungary and France.

Policy and Strategy of ICT in Hungary

The government launched the Digital Success Programme (DSP) to accelerate the digitalization of the Hungarian society and economy, recognizing that digital change is an inevitable part of the twenty-first century. The Hungarian Digital Education Strategy is a critical strategic component of the program (DES). It established tools and objectives for developing "a system of education and training capable of performing education, instruction, and training tasks per the infrastructure, technology, content, organizational structure, and human resource requirements of the digital society and economy". As a consequence, the DES takes into account all dimensions of education, including instructional strategy, digital readiness and attitude, physical infrastructure, available technology, content, and administration. It says that schools should include digital technology and techniques into their curriculums since they are becoming more integrated into our everyday lives. In accordance with the strategy's goals, Hungary's Digital Education Strategy (DES), which is complementary to the country's Public Education Development Strategy, intends to achieve the following:

- students graduate from public schools with adequate digital competencies and media literacy, as well as the ability to continue developing these skills through lifelong learning,
- digital tools aid in the teaching-learning process by facilitating the fulfillment of public education system expectations (effectiveness, equity, and efficiency) [12].

The Hungarian higher education strategy statement offers a standardized online digital environment that supports personalized learning possibilities. The primary strategic aim is to enhance digital readiness via the implementation of solutions that correspond to internationally recognized standards. According to the statement, one of the essential developmental adjustments that higher education institutions must do is to use the potential of ICT in teaching and learning [13].

Objectives related to the digitalization of higher education:

1. developing learning-intensive higher education,
2. raising the digital and methodological preparedness of academics to an adequate level,
3. garanted access to high-quality learning materials and learning tools,
4. developing e-learning systems and materials; some of the learning and teaching process occurs in online communities,
5. integrating online services and the electronic forms of learning support,
6. the appropriate and sustainable use of digital devices.

Other horizontal goals, in addition to the aforementioned, affect digital higher education as a whole; such as ensuring compliance with information technology security regulations, collecting and processing data on higher education processes as extensively as possible at the institutional and sectoral levels, as well as improving fair access to higher education and involving previously excluded or underserved populations. Moreover, it also means leveraging digital solutions to assist higher education's commercial operations, particularly in the areas of adult education and research, development, and innovation [12].

Policy and Strategy of e-learning in France

In response to an unprecedented health crisis that had a significant impact on higher education in France, the Ministry of Higher Education, Research and Innovation has mandated that all available training courses be delivered online beginning with the first period of containment on March 16, 2020. This pedagogical continuity must ensure the proper continuation of educational activities, the avoidance of student punishment, and the creation of favorable teaching conditions for teachers. Despite several individual initiatives during this period, France developed a digital toolkit based on three fundamental pillars to address the aforementioned difficulties [14, 15]: Primarily, it is focused on two digital platforms: FUN-MOOC and FUN Campus. FUN–MOOC is the French MOOC portal from 2013. It provides the finest of online higher education with courses produced by experts from universities, schools, and other educational institutions. It allows students to practice for free, communicate with others, and grow at their own pace. FUN Campus, designed for HEls, allows instructors to integrate online courses and SPOCs into their syllabi. The second pillar is the Digital University, a French alliance of six thematic digital institutions. Its purpose is to offer peer-reviewed digital scientific and instructional materials to professors and students in Higher Education, as well as their governance. As a rule, these items are openly accessible and free to the public. The notion of a digital university is crucial for higher education administration since it enables them to help students in the future. The third pillar is Connected Campuses, which are private/public places where students may enroll in higher education courses while getting local assistance. They intend to assist young people in pursuing higher education opportunities that they may not have followed otherwise by equipping them with the skills necessary to

overcome geographic, urban, and social hurdles. Today, higher education institutions use several programs, platforms, and instructional tools for synchronous and asynchronous online education. Several classifications encompassing numerous categories have previously been offered in the literature [15].

The Ministry released a list of technological solutions to assist trainers in distance education and training, including web conferencing software, collaborative tools, server links and clouds, and other tools essential for training actors to ensure educational continuity. The Minister of Labor in France, who is also in charge of technical education, established a forum to make tools accessible to professionals in the area, allowing for greater educational continuity (https://travail-emploi.gouv.fr/formation-professionnelle/coronavirus/formation-a-distance) [16]. Today, higher education institutions use several programs, platforms, and instructional tools for synchronous and asynchronous online education. Consider Figure 1 for a suggested technique for remote knowledge gathering and assessment. Several classifications encompassing numerous categories had been previously proposed in the literature [15].

METHODOLOGY

The proposed analysis consists of two parts, the pilot study tests, which shaped the final questionnaire, and the main study, which consists of the hypotheses, survey design, a plan of investigation, statistical analysis procedures, and implementation.

RESEARCH QUESTIONS

The main Hypotheses are summarized as follows:

H_1: There are no statistically significant differences for the sections related to the digital acceleration and the use of e- (study, work, and services) after the end of the pandemic.

H_2: There are no statistically significant differences for the sections related to catching the disease through communication with others, even if enforcement restrictions are applied to control the spread.

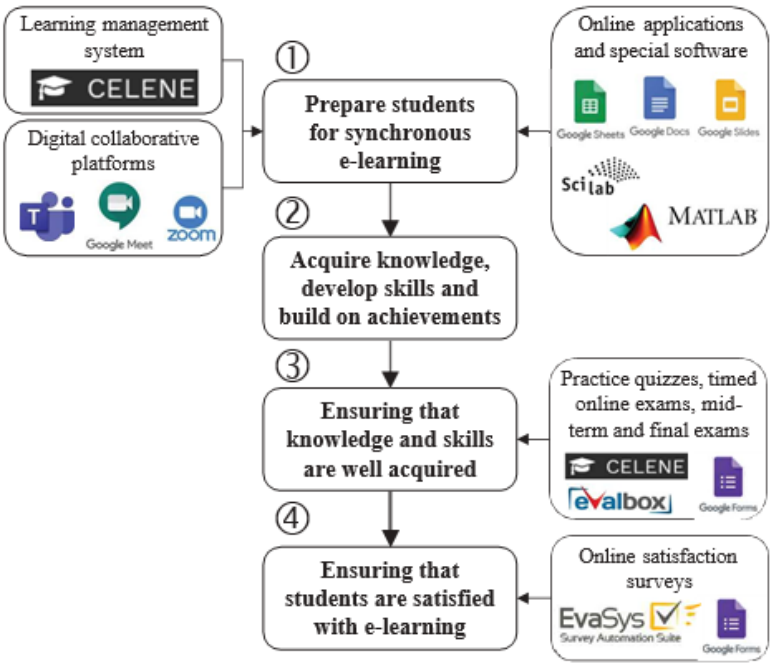

Figure 1. A proposed method for the remote acquisition and evaluation of knowledge.

THE PILOT STUDIES

The Pearson coefficient test for validity and Cronbach's Alpha test for reliability were very helpful and worthy [17-19], while revising and modifying the survey at this stage some questions were changed, merged, edited, or modified.

MAIN STUDY AND RESEARCH, METHODOLOGY AND PLAN OF IMPLEMENTATION

The survey used the Likert scale and underwent several tests through SPSS analysis [20-22] to check variables significances and research models. The check for normality and homogeneity should be carefully handled for all assumptions as seen below [23]. Initially, for reliability and validity, Cronbach alpha and Pearson coefficient were calculated at a significant level ($\alpha = 0,05$), and the mean, standard deviance, variance, skewness, and kurtosis [24] were generated to make the necessary comparison. Finally, the verification of the parametric and non-parametric characteristics to get confidence intervals for post-hoc analysis was achieved by Levene's and ANOVA tests [25] and through Kruskal-Wallis [26] and Friedman test [27] as non-parametric tests.

Test of Normality

Normality for each hypothesis was checked through Kolmogorov-Smirnov test [28] at the level of significance ($\alpha \geq 0,05$), as well the kurtosis and skew values were checked to ensure that they fall within the acceptable ranges (–10, +10) and (–3, +3) respectively [29, 30], the hypotheses H1and H2 for the gender, educational level, age, employment status, and income found statistically significant since most of the statistical significance values were below the level of significance ($\alpha = 0,05$). This indicates that the distribution is not normal.

Hypothesis $\mathbf{H_1}$, Table 1, confirms that values of kurtosis and skew are acceptable, and the distribution values of the Kolmogorov-Smirnov test is statistically significant where most of the statistical significance values were below the level of significance ($\alpha = 0,05$). This indicates that the distribution is not normal for the gender, educational level, age, employment status, and income.

Hypothesis $\mathbf{H_2}$, Table 2, confirms that values of kurtosis and skew are acceptable, and the distribution of the Kolmogorov-Smirnov test is statistically significant, the statistical significance values for the variable (age) were below the level of significance ($\alpha = 0,05$). This indicates that the distribution is not normal, while most of the statistical significance values for (educational level, employment status, and income) more than the level of significance ($\alpha = 0,05$). This indicates that the distribution is normal for this variable.

Test of Homogeneity of Variances

Homogeneity of variance [30] assessed using F-test [31] for equality of variances, the values should be more than the level of significance ($\alpha = 0,05$), a Scheffé statistical test which is a post-hoc test was used to study the main and simple effects for all possible paired multiple comparisons.

Test of Multicollinearity

Multicollinearity means that there should be no interaction between the variables [32, 33], the variance inflation factor (VIF) values should be less than three. The following Table (3) shows the result of the Test for Multicollinearity for both hypotheses.

The exploratory factor analysis (EFA) and Confirmatory Factor Analysis (CFA); EFA aims at creating factors from the dataset by using the Kaiser-Meyer-Olkin KMO [34] and Bartlett's test of sphericity. It is a technique to discover underlying variables or factors while using AMOS for CFA [35] to confirm the fitness of the model and relations between latent variables and their observed indicator.

RESEARCH RESULT

Statistical Analysis for the Hypotheses $\mathbf{H_1}$ and $\mathbf{H_2}$ state that there are no statistically significant differences at the level of significance ($\alpha \leq 0{,}05$) in the average respondents' answers to the items related to the applied procedures and restrictions to limit coronavirus spread during mobility through different modes of transportation, and the items related to the digital transformation and the use of e-services, e-work, and e-study even after the end of the pandemic. The means and standard deviations of the respondents' answers were computed to verify the hypothesis, according to the independent variables (gender and educational level) and examining the Nonparametric Kruskal-Wallis test to reveal the statistical significance of

Table 1. Hypothesis $\mathbf{H_1}$ Test of Normality for Gender, Age, Education, Occupation, and Income.

Tests of Normality							
Budapest		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Gender	Male	0.109	172	0.000	0.941	172	0.000
	Female	0.154	167	0.000	0.907	167	0.000
Education	High School or Less	0.117	22	.200*	0.977	22	0.861
	Bachelor's Degree	0.137	115	0.000	0.913	115	0.000
	Master's Degree	0.118	106	0.001	0.968	106	0.012
	Ph.D.	0.125	60	0.020	0.927	60	0.001
	Other	0.154	36	0.030	0.941	36	0.053
Age	less than 18	0.157	11	.200*	0.910	11	0.245
	18 - 28	0.162	81	0.000	0.943	81	0.001
	29-39	0.165	129	0.000	0.876	129	0.000
	40-49	0.131	65	0.008	0.967	65	0.078
	50-59	0.201	43	0.000	0.890	43	0.001
	60-69	0.204	10	.200*	0.909	10	0.272
Occupation	Student	0.108	100	0.006	0.966	100	0.012
	Working	0.114	139	0.000	0.931	139	0.000
	Studying and Working together	0.131	61	0.011	0.953	61	0.019
	Unemployed	0.139	38	0.063	0.915	38	0.007
Income	< 500	0.143	47	0.018	0.932	47	0.009
	501 - 1000	0.131	112	0.000	0.921	112	0.000
	1001 - 1500	0.140	47	0.022	0.960	47	0.111
	1501 - 2000	0.190	45	0.000	0.925	45	0.006
	2001-2500	0.120	31	.200*	0.952	31	0.180
	>2500	0.156	57	0.001	0.917	57	0.001

*a lower bound of the true significance. a. Lilliefors Significance Correction

Table 2. Hypothesis **H2** Test of Normality for Gender, Age, Education, Occupation, and Income.

Tests of Normality							
Budapest		Kolmogorov-Smirnov*			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Gender	Male	0.118	172	0.000	0.960	172	0.000
	Female	0.068	167	0.059	0.991	167	0.368
Age	less than 18	0.212	11	0.178	0.874	11	0.088
	18 - 28	0.126	81	0.003	0.964	81	0.022
	29-39	0.174	129	0.000	0.940	129	0.000
	40-49	0.148	65	0.001	0.911	65	0.000
	50-59	0.138	43	0.038	0.921	43	0.006
	60-69	0.152	10	.200*	0.908	10	0.268
Education	High School or Less	0.172	22	0.088	0.878	22	0.011
	Bachelor's Degree	0.133	115	0.000	0.956	115	0.001
	Master's Degree	0.064	106	.200*	0.985	106	0.264
	Ph.D.	0.096	60	.200*	0.951	60	0.018
	Other	0.140	36	0.070	0.899	36	0.003
Occupation	Student	0.088	100	0.052	0.959	100	0.004
	Working	0.112	139	0.000	0.975	139	0.011
	Studying and Working together	0.123	61	0.023	0.976	61	0.283
	Unemployed	0.136	38	0.074	0.950	38	0.092
Income	< 500	0.145	47	0.014	0.929	47	0.007
	501 - 1000	0.102	112	0.006	0.964	112	0.004
	1001 - 1500	0.119	47	0.095	0.926	47	0.006
	1501 - 2000	0.159	45	0.006	0.963	45	0.156
	2001- 2500	0.156	31	0.052	0.972	31	0.582
	>2500	0.201	57	0.000	0.892	57	0.000

*a lower bound of the true significance. a. Lilliefors Significance Correction

Table 3. Hypothesis Test for Multicollinearity.

Variable	Collinearity Statistics	
	Tolerance	VIF
Gender	0.938	1.066
Education level	0.93	1.075
Age	0.966	1.036
Occupation	0.898	1.113
Income	0.95	1.053

the differences, and reviewed χ^2 test which allows making inferences from the sample regarding the hypothesis relationship, when there are statistically significant differences between the respondents' answers and to figure the direction of these differences in favour of which level, the Mann Whitney test used.

CONCLUSION

In summary, this study presented a methodology with two hypotheses using SPSS statistics v26 to perform a survey on the effect of digital transformation. During the COVID-19 pandemic in Budapest, participants' perceptions of the disease and the efficiency of the enforced restrictions to curb its spread were studied. The study methodology included statistical data and analytical outcomes. Earlier the authors reviewed some Governments' Strategies in the EU in the field of digital education in Europe, especially in France and Hungary. In addition, the most effective tools in e-learning today were also discussed as well as the ways they can be used for a better teaching and learning experience.

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