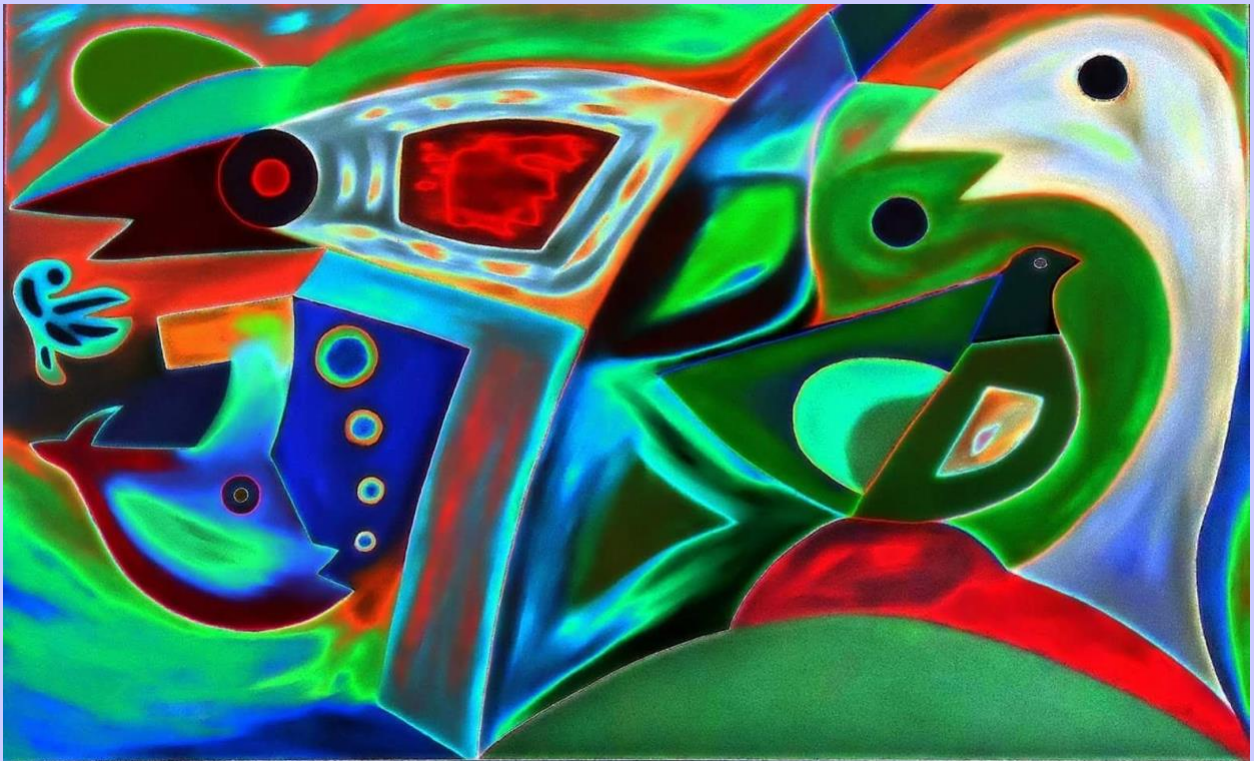


# **Journal of Digital Art & Humanities**



**ISSN 2712-8148**

**Vol.3 Iss.2**

**December 2022**

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# The Current Landscape of Digital Transformation. An Overview, and Prospects in Romania

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[https://doi.org/10.33847/2712-8148.3.2\\_1](https://doi.org/10.33847/2712-8148.3.2_1)

Received 28.10.2022/ Revised 10.11.2022/Accepted 11.12.2022/Published 27.12.2022

**Abstract.** Many scientific papers, articles, and books related to digitization, digitalization, and digital transformation have been published, and many issues are defined, researched, and discussed for two decades already worldwide, yet with timid application in real life. However, the digital transformation process in many countries has been significantly accelerated by the Covid-19 difficult situations due to social distance restrictions, and especially the lockdowns imposed by governments. The paper summarizes the roadmap to digital transformation in 193 countries according to EGD (United Nations E-Government Development Index), the EU's main areas for multi-projects, and Romania's e-Government and e-Business current situation. There are also presented a number of examples of successful e-Government and e-Business projects in Romania.

**Keywords:** public sectors, digitalisation, e-business, e-government, digitization, digital transformation.

## 1. About Digital Transformation

### 1.1. Digitization, digitalization and digital transformation

The digitization is the process of transforming information from a physical format (analogue data, such as images, video, text) to a digital version, while the digitalization is the practice of utilizing technology to enhance one organization processes [1] Therefore, digitization relates to information, whereas digitalization relates to the internal optimization of processes, such as work automation with the aim to improve business and the general well-being of people [2]. Tilson et al. define digitalisation as "*the socio-technical process of applying digitizing techniques to broader social and institutional contexts that render digital technologies infrastructural*" [3].

The main goal of digitization is to make information more easily accessible, storable, maintained, and transferred. Organizations can only increase their business operations efficiency and automate their day-to-day activities through digitalization [4]. These two conceptual meanings of digitization (digitization) and digitalization (digitalisation) are closely linked and often used interchangeably across a wide range of literature.

Although discussions regarding digitalisation (directions, areas to be developed, benefits and drawbacks as well as its consequences for labor markets and working conditions) has been debated for many years in media, the politics and research last for more than two decades, the literature has been intensified in recent years.

At the same time, the literature addressed many aspects of the digitalisation process in many countries, including the way that digitalisation accelerates now job loss and change of work procedures [5-8].

Consequently, the number of papers, articles and books published have addressed many aspects of the digitization and digitalisation process, therefore the increasing interest for the subject is obvious, according to the results in Google

Scholar [9], Web of Science Core Collection [10], Scopus [11] and IEEE Xplore [12] presented in Table 1.

Table 1. The number of papers, articles and books published in Online Databases

Online Database	Google Scholar		SCOPUS		Web of Science Core Collection		IEEE Xplore	
	Anytime	2022	1950-2022	2022	1975-2022	2022	1967-2022	2022
Digitization	1340000	20200	28260	3225	20538	3088	4597	419
Digitisation	309000	14000	28260	3225	17524	2084	4597	419
Digitalization	758000	39200	28736	6072	18933	4379	3139	583
Digitalisation	154000	12500	28736	6072	3174	842	3139	583

The term “digital transformation” refers to a modern perspective over the organisational activity, model, and competencies in order to make use of newly accessible technology. Digital transformation demands a much wider use of digital technologies as well as a better understanding of the new paradigm of cultural, social, political and economical shift, worldwide.

While people must be more important than technology, when it comes to digital change, a customer-centric organizational reforms must be applied by leaders, driven by radical organisational culture challenges, and the use of technology that empowers and enables people [13]. According to Brennen and Kreiss [14] the process of digital transformation is how many domains of life are restructured around digital communication and infrastructure. Digital transformation brings new freedoms and rights, and give citizens the opportunity to reach out various services beyond physical communities, geographical locations, and social positions. Many areas, such as public services [15,16], healthcare [17-20], education [21-26], justice [27], environmental protection [28], e-business [29-32], industry (manufacturing) [33,34], economy [35, 36], culture [37] and so on, can only benefit from the many advantages of digital transformation.

However, there are still many challenges in front of a secure and citizens-centered digital transformation that need to be addressed during the digital era that has already began. There must be better defined the strategic autonomy in technology and development, and novel rules must be imposed (regarding cybersecurity, online platforms and media freedom) in order to protect citizens from cybertheft, counterfeit products, and disinformation [38]. The pandemic period because of COVID-19 (that came as a black swan event [39]) forced most of the world population to change their daily habits dramatically and slow down (if not even cancel) most of their daily activities.

However, there is a saying in Romania: “Any event that brings a bad situation comes along with a good one”. Although the pandemic period has been problematic from many points of view, the limited physical access to public institutions, forced Romanian authorities to rush the digitalisation process, authorizing remote access to information allowing procedures that have been considered at least unacceptable, if not forbidden, previously to the 2020 year. At the same time, the companies’ owners realized how important is to invest in the IT technologies, not only to increase their business but to keep making business in the new economic era because of the paradigm change during and after Covid-19.

### **1.2. Benefits and Drawback**

There are two main directions enhanced by digitalization. First, the automatization of work that changes job functions and in some cases erases jobs that become useless and second, the creation of work without jobs via digital platforms.

The main focus is on services, which is under the highest pressure from automatization and the trend of work without jobs [40].

These main concepts related to digital transformation must be first and foremost human-centered to enhance the human digital welfare. The digital welfare state concept refers to a state in which public authorities deploy technologies to perform a broad range of public services (easy access to public services as social protection and assistance systems, public education, and healthcare, and so on) [41], while they maintain fair policies with a broad vision to create advanced digital society that empowers both citizens and businesses.

However, there are many concerns regarding digitalisation, one of them being is on how the government's use of data about its citizens. All the changes that digitalisation brings, reconfigure human rights and increase the governs' power and how data about people impact the citizens' digital welfare state [42]. There are arguments that the logic of data analytics and predictions go well in hand with digitalisation policies focused on public sector efficiency but risk to undermine individual rights [43].

Some major drawback of digital transformation for citizens consists of the spread of disinformation, addiction to social media, compromised personal privacy, increase in the crime rate, breaches in data security, loss of traditional lifestyle and values, development of more deadly weapons of war, loss of jobs and information overload.

## **2. Digital Transformation Landscape**

### ***2.1. The United Nations' Survey***

Significant information regarding evolution and current status of digitalisation across all 193 states member of the United Nations (UN) have been concluded in 28 September 2022. The 12th edition survey about the UN' assessment of the digital government landscape has been presented in November 2022 at the UN e-Government Event [44].

The survey contains more than two decades of research with relevant data, based on a ranking of countries, according to UN EGDI (E-Government Development Index).

The EGDI integrates features, such as the infrastructure and educational levels, reflecting the way a country is using information technologies to allow access and inclusion of its people. The EGDI is a composite measure of three important dimensions of e-government, namely: provision of online services, telecommunication connectivity and human capacity [44].

The EGDI is based on a two decades of United Nations experience resulted in comprehensive Survey of the online presence of all 193 United Nations Member States. It evaluates national websites and how e-government strategies and policies are implemented in general and in specific areas for delivery of vital services. The evaluation aims to rate the e-government performance of countries relative to one another. The results are tabulated and combined with a set of indicators.

Even though the initial model has been kept, the specific connotation of these values differs from one edition of the Survey to the next one, according to changes and novel technologies on the market.

Mathematically, the EGDI is a weighted average of three normalized indices as the most important dimensions of e-government:

- scope and quality of online services - OSI (Online Service Index);
- inherent human capital – HCI (Human Capital Index);

- development status of telecommunication infrastructure - TII (Telecommunication Infrastructure Index).

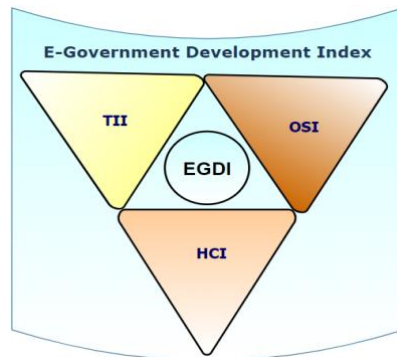


Fig. 1. The tree components of EGDI

Each of these indices is a complex indicator that can be analyzed distinct from the other two.

$$EGDI = \frac{OSInorm + HCI_{norm} + TII_{norm}}{3} \tag{1}$$

Prior to the normalization of the three component indicators, the Z-score standardization procedure is implemented for each component indicator to ensure that the overall EGDI is equally decided by the three component indexes, i.e., each component index presents comparable variance subsequent to the Z-score standardization.

In the absence of the Z-score standardization treatment, the EGDI would mainly depend on the component index with the greatest dispersion.

After the Z-score standardization, the arithmetic average sum becomes a good statistical indicator, where "equal weights" depicts "equal importance."

For standard Z-score calculation of each component indicator:

$$x_{new} = \frac{x - \mu}{\sigma} \tag{2}$$

X - is a raw score to be standardized;

μ - is the mean of the population;

σ - is the standard deviation of the population.

Within 0 to 1 range of EGDI values the countries are then grouped into four levels as presented in Table 2.

Table 1. Range of EGDI values

No.	EGDI classification	Quartiles (descending order)	EGDI values from... to inclusive
1	VERY HIGH	VH, V3, V2 and V1	0.75 ÷ 1.0000
2	HIGH	HV, H3, H2 and H1	0.50 ÷ 0.7499
3	MIDDLE	MH, M3, M2 and M1	0.25 ÷ 0.4999
4	LOW	LM, L3, L2 and L1	0.00 ÷ 0.2499

In all references to these ranges in text and graphic elements, the respective values are rounded for clarity and are expressed as follows: 0.75 to 1.00, 0.50 to 0.75, 0.25 to 0.50, and 0.00 to 0.25.

In order to have better view of the situation, in case of subgroups of countries with similar levels of performance, each EGDI group is further divided into four equally defined intervals, named quartiles as seen in Fig. 2.

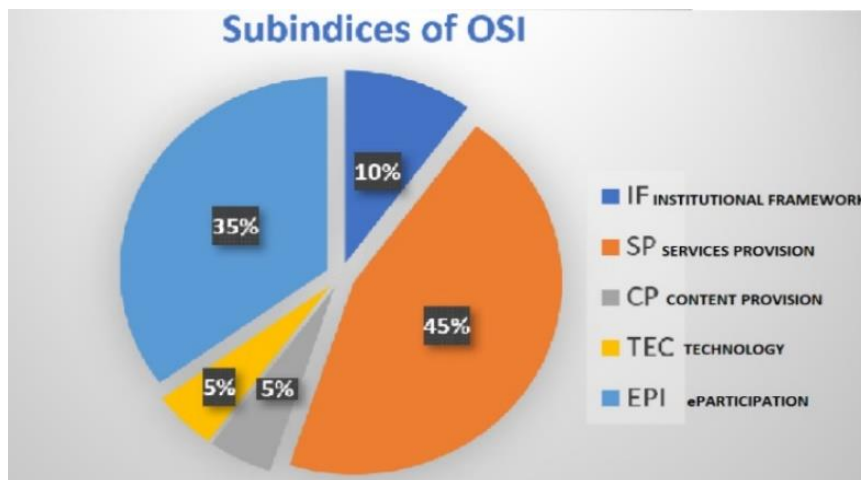


Fig. 1. The five subindices of OSI.

The evaluation criteria have evolved continuously since 2003, being kept up-to-date according to novel technologies, new concepts and paradigms, therefore, in 2022, the UN Survey comes as a refined formula for generating the Online Service Index.

This new approach presents a standardization and normalization division to further align the OSI with LOSI (Local Online Service Index) by splitting the assessment questions into five discrete particular areas forming five subindices: Institutional Framework (IF), Services Provision (SP), Content Provision (CP), Technology (TEC) e-Participation (EPI) with the OSI as a whole calculated based on the normalized values for each subindex as presented in Fig. 2.

Each of the five subindices of OSI are assigned a weight based on the relative proportion of questions that fit in to the associated category in the OSI evaluation feedback form.

This 2022 edition includes data analysis in both global and regional contexts, and a study of local e-government development based on the UN LOSI (United Nations Local Online Service Index). It also contains consideration of inclusion in the hybrid digital society, and a concluding chapter that outlines the trends and developments related to the future of digital government. As all previous editions, it provides data acquired during study, the methodology used and related pilot study initiatives [44]. In this study, Denmark, Finland, and South Korea are at the top of the 2022 UN e-government ranking. Although Romania is one of the countries with a very high EGDI level that largely derives from high or very high HCI and TII, more attention should be directed towards transforming services for citizens and shifting them online, as well as providing support for humans to acquire more advanced digital skills.

## 2.2. European Union Digital Transformation' Perspectives

As part of the EU (European Union) effort to shape the Europe's digital future, the Digital Decade policy program is based on the "digital compass" that sets out digital perspective for the next decade. It consists of clear, concrete targets based on four general main areas - skills, infrastructure, business and public services, presented in Fig. 3 [45].

The first target refers to digitally skilled population and highly skilled digital professionals with over 20 million ICT specialists and gender convergence covering at least 80% of European population with digital skills.

As for infrastructure, the perspective is to develop a secure and sustainable digital one with Gigabit for everyone and 5G connectivity everywhere, double EU share in global production for cutting-edge semiconductors, 10,000 climate neutral highly secure edge nodes, and the first computer with quantum accelerator.

The third area refers to digital transformation of businesses of EU companies, particularly SMEs - Small and medium-sized enterprises that should reach at least basic level of digital intensity (at least 90% of them), use novel concepts and technologies as AI (Artificial Intelligence), big data and cloud computing to increase their revenues (about 75% of them), and to support and increase innovation and innovators managing start-ups.

Last, but not least, digitalisation of public services targets all the public services, medical records (to be digitalized and become available remote), as well as, digital IDs for all EU citizens. As part of the digital market strategy, the European Commission has launched a number of digital programs [46].

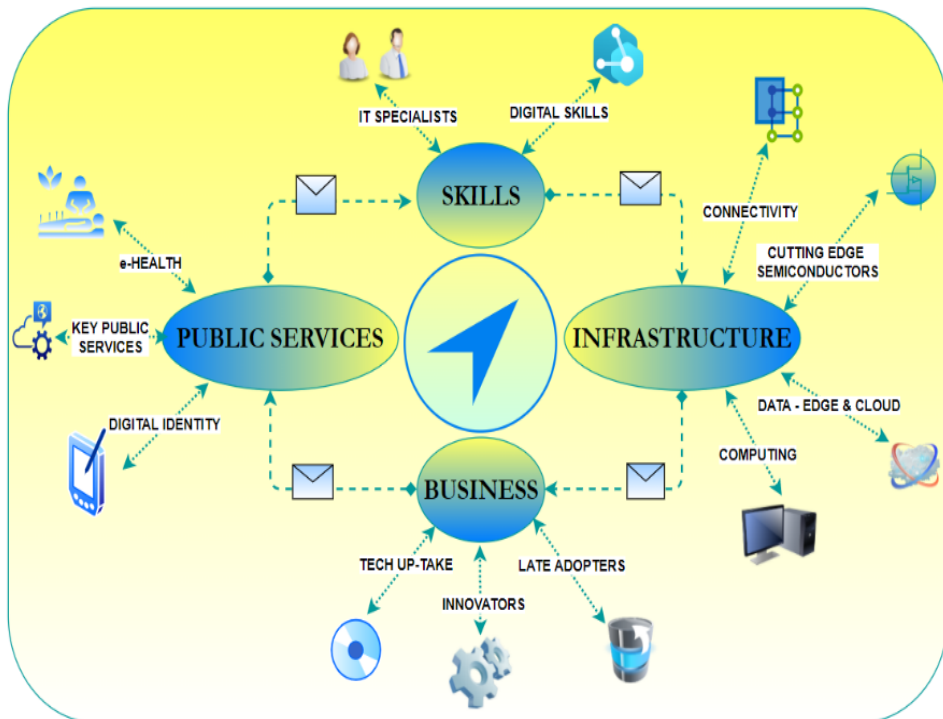


Fig. 2. Digitalization areas and targets for next decade in EU countries



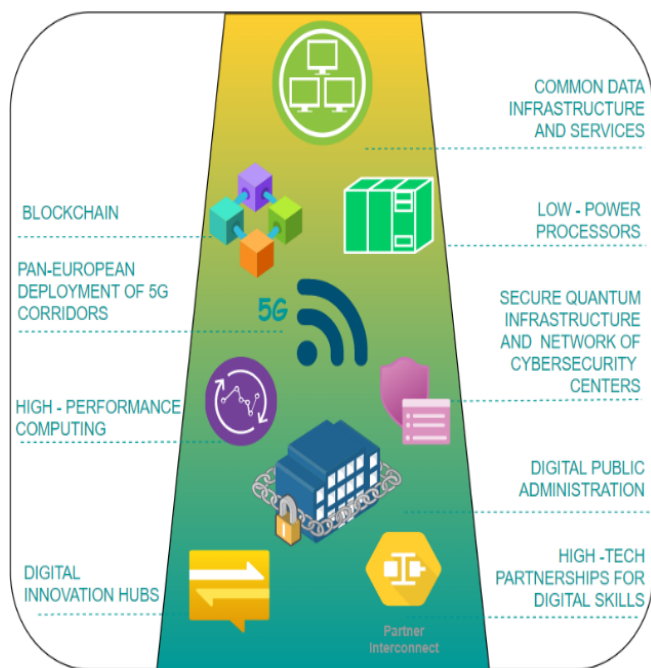


Fig. 3. Areas for EU multi-country digitalisation projects

Although the list is not final, being under process of improvement, the EU Commission identified some major areas for the multi-country digitalisation projects as seen in Fig. 4.

### 3. Digital Transformation in Romania. Efforts and Results

The Authority for the Digitization of Romania (ADR) is a structure with legal personality within the Ministry of Research, Innovation and Digitization that has the role of realizing and coordinating the implementation of strategies and public policies in the field of digital transformation and the information society [47].

Global e-government policies, strategies and project applied in practice aim to improve the quality, efficiency and control of interactions between public administration, on the one hand, and citizens and private organizations, on the other hand in order to provide as many as possible services online.

E-government refers to digital interactions between citizens and administration (G2C – Government to Citizen), between administration and others government agencies (G2G – Government to Government), as well as to those between the administration and the private economic environment (G2B – Government to Business).

One of the working concepts that drive the development of these projects is that of the life event. An event of life covers public services that are related to a certain situation that the citizen (or the company) encounter in the lifetime. According to EU policy, there is a set of 20 life events (12 for citizens and 8 for companies) aiming to increase the quality of the services provided, increasing the number of users and the degree of coverage for different categories. The evaluation method of these

life events is conducted according to five degrees of digital transformation services that take into consideration how advanced is the digital interaction between citizens/companies and public administration (as presented in Fig. 5).

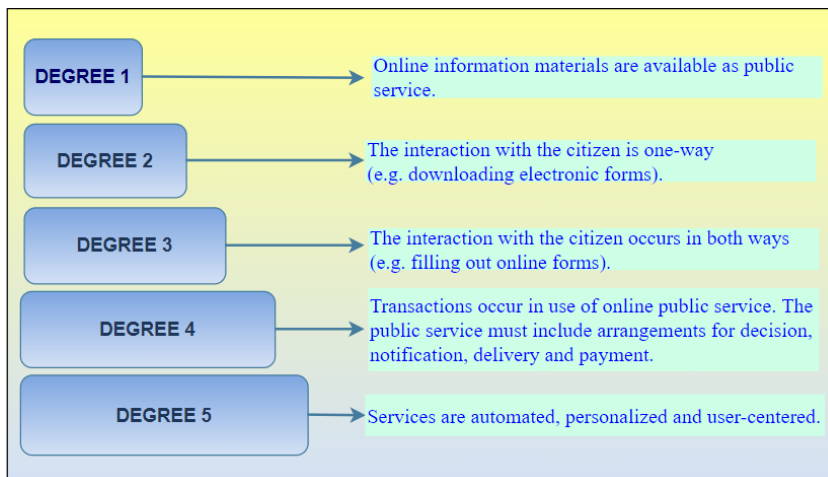


Fig. 4. Degrees of availability in digital transformation services to citizens

With the aim to objectively measure the evolution of different countries in the field of e-government, one of the most relevant indices is given by EGDI, evaluated by the United Nations Organization.

The EU Member States are above the global average, and the European countries are more developed than all other geographical areas of the world, from the perspective of e-participation measured by:

- the availability of information about public services without being requested;
- citizens' online participation in the public policy debate;
- citizen participation through online forms in the development of public policies or the design of certain service components public.

Another relevant measurement of progress in the field of e-government is given by DESI (The Digital Economy and Society Index) base on about 30 indicators relevant to the EU's digital performance. DESI consists of indicators on Europe's digital performance and evaluate the progress of EU countries.

The National Strategy regarding the Digital Agenda for Romania 2020 (NSDAR 2020), adopted by Government Decision no. 245/2015 SNADR 2020 was prepared in order to align Romania with the strategic directions established in the framework of the Europe 2020 Digital Agenda.

Since investments in information technology and communication (ITC) have a direct influence on progress of the Romanian economy, NSDAR 2020 deals with four key areas (including the one dedicated to e-government), as in Fig. 6.

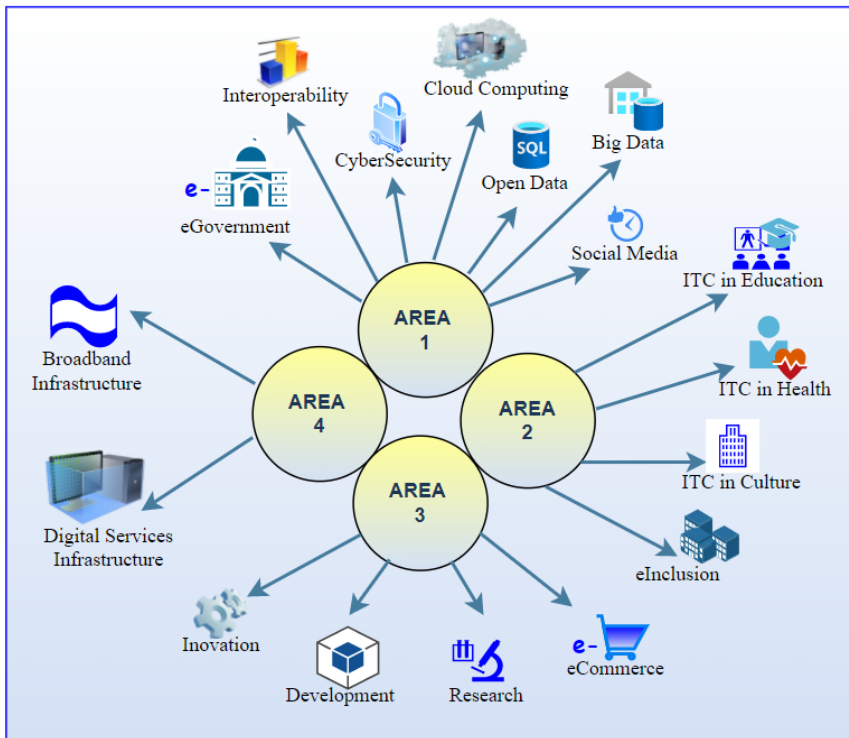


Fig. 5. Development ITC areas

In the field of e-government, NSDAR targets services that provide at least life events of the 4th degree of performance/sophistication (see Fig. 5).

For example, for the life event "scheduling a medical consultation" (as part of the Area 2, sub-field ITC in Health), aims, to create a platform integrated for all services with easy access or e-accessibility as part of a medical system patient-centered, as well as the efficient management of information generated by the IT system that can be better used in order to manage the resources of the medical system.

For life events related to enrollment in various forms of education and the library, national aptitude/baccalaureate exams, the ICT in Education sub-field aims to provide relevant equipment and infrastructure in schools, as well as ongoing training ITC specialist skills of public administration staff.

The main objectives with the regard of Area 1 are:

- increase the transparency of public administration acts through computerization of public services;
- develop and improve security networks and systems cybernetics;
- increase access to digitized public services;
- make more efficient the public administrations and reduce the public administration's costs;
- improve the business environment;
- improve governance at the time of implementation of computerized public services.

All the objectives above, to be fulfilled, must be supported by a legal framework in Romania, therefore, the relevant legislation to the field of e-government consists of two regulatory levels, namely legislation with a rather horizontal character (which covers large topics of e-government) and legislation specific to various fields of activities with the aim to support the development of electronic public services, such as: Law no. 119/1996 regarding civil status documents, Law no. 455/2001 on electronic signature, Government Decision no. 922/2010 regarding the organization and operation of the Contact Point unique electronic, Government Decision no. 908/2017 for the approval of the National Framework of Interoperability or Government Decision no. 89/2020 on organization and operation Authority for Digitization of Romania.



Fig. 6. EGDI Romanian rank and value in 2022

As the result of the effort made in all directions to implement digital transformation in Romania, the UN Survey made public this November (2022) show that Romania is classified on the place 57<sup>th</sup> (among all 193 countries evaluated), according to EGDI index (Fig. 7).

The evolution of Romania (since 2003 to date) regarding EGDI, according to UN Organization Survey (Nov. 2022) is presented in Fig. 8.

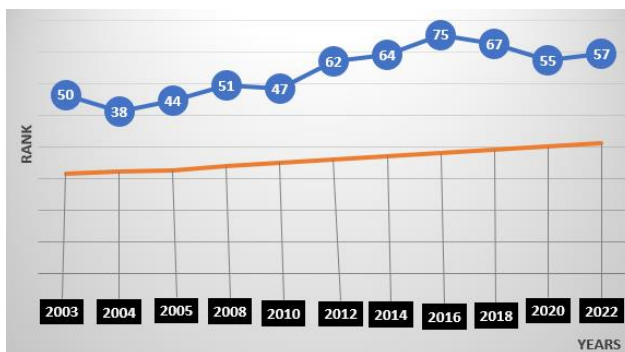


Fig. 7. EGDI Romanian rank evolution from 2003 to 2022

The EGDI index for Romania in 2022, according to the UN Survey is shown in Table 3.

Table 2. EGDI index for Romania in 2022

Country	Region	Sub-region	EGDI Group	Rating Class	Rank	EGDI 2022	OSI 2022	TII 2022	HCI 2022	"Level of Income"
Romania	Europe	Eastern Europe	Very High EGDI	V1	57	0.7619	0.6814	0.7954	0.809	UMC

Romania profile for 2016 is shown in Table 4.

Table 3. EGDI - Romania profile for 2016

Rank	Country	Region	Sub-Region	EGDI 2016	OSI	TII	HCI	Level of Income
75	Romania	Europe	Eastern Europe	0.5611	0.4565	0.4533	0.7736	Upper Middle Income

Romania is among countries in Europe with the highest EGDI value as seen in Table 5. Also, EGDI in 2020 is compared with the one in 2022.

Table 4. EGDI value for Romania

Country	Rating class	EGDI rank	Subregion	EU	OSI value	HCI value	TII value	EGDI (2022)	EGDI (2020)
Romania	V1	57	Eastern Europe	Yes	0.6814	0.8090	0.7954	0.7619	0.7605

According to TII and HCI subcomponent convergence and divergence for the high OSI group, 2022 Romania is classified as with Very high TII + Very high HCI.

The human capital index (HCI) (in 2011, 2012 and 2015) for Romania and its components are presented in Table 6.

Table 5. 2011, 2012, 2015 HCI for Romania

Country	HCI	Adult Literacy (%)		Gross enrolment ratio (%)			Expected years of schooling			Mean years of schooling			
		Index value	Year	Source	Index value	Year	Source	Index value	Year	Source	Index value	Year	Source
Romania	0.7736	98.77	2015	UNESCO	80.56	2011	UNESCO	14.21	2011	UNESCO	10.78	2012	UNESCO

The Romanian e-Participation Index and its utilization by stages is shown in Table 7.

Table 6. Romanian e-Participation Index

Rank	Country	EPI	Total %	Stage 1 %	Stage 2 %	Stage 3 %
60	Romania	0.6271	63.3%	70.6%	57.9%	42.9%

The Telecommunication infrastructure index (TII) in Romania and its components are presented in Table 8.

Table 7. TII in Romania

Country	TII	Percentage of Individuals using the Internet	Fixed-telephone subscriptions per 100 inhabitants	Mobile-cellular telephone subscriptions per 100 inhabitants	Fixed (wired)-broadband subscriptions per 100 inhabitants	Wireless broadband subscriptions per 100 inhabitants
Romania	0.4533	54.08	21.26	105.91	18.52	37.70

One of the OSI subindex, the e-participation index (EPI) for Romania in 2022 is 0,625 as can be seen in Table 9.

Table 8. The e-participation index (EPI) for Romania

Country	EPI Group	EPI 2022	Rank	E-information	E-consultation	E-decisionmaking
Romania	High EPI	0.625	54	0.8	0.5	0.2

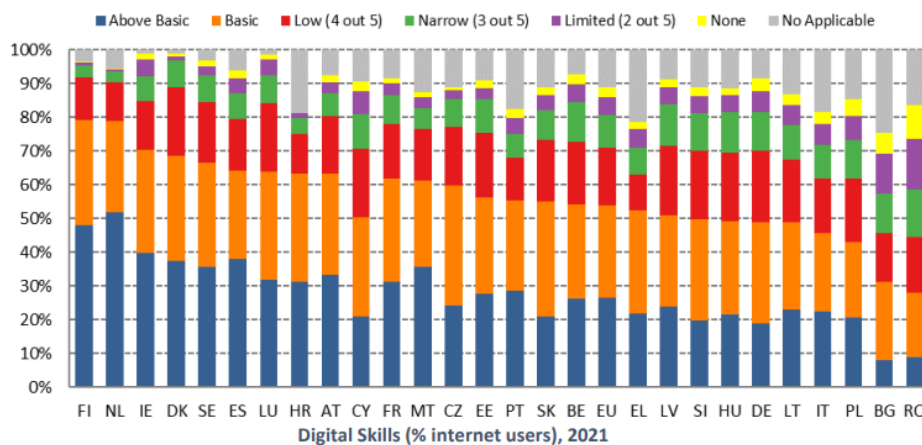
Regarding the European Commission's, Digital Economy and Society Index (DESI) measurement, Romania is in 27th place out of 27 EU member states. Although the digital communication infrastructure in Romania has a high rate, the lowest ratings are received for the use of internet services and digital public services.

In the field of integration of digital technology by businesses, Romania has the lowest rates of SME digitalization. As for the Digital Economy and Society Index, Romania, Bulgaria, and Greece have the lowest DESI scores.

However, Romania is far ahead better at the connectivity criteria; the Country Report for Romania regarding the Index economy and digital society, for the year 2020, remarks the strong competition based on registered infrastructure in Romania, especially in urban areas, which is reflected in the indicators in which the country performs very well, namely very high network coverage fixed capacity and the use of broadband services of at least 100 Mbps (over 75% and, respectively, 55%).

More than 60% of homes in Romania are subscribed to services of very high-speed broadband (fourth fastest in the EU), and in terms of graduates in the field of ITC, Romania is well placed in the ranking, being the fifth. Optical Fiber to the Premises (FTTP) coverage doubled in the last 5 years and reached 50% in the mid-2021 in the EU. Romania, among other countries, is leading with 85% FTTP coverage and the lowest broadband prices among Lithuania, Poland, and Bulgaria.

On the other hand, regarding the human capital – digital skills, Romania is at the end of the list with less than 30% of people (aged 16-74) having at least basic digital skills (less than 10% are above basic). Here, the Finland and Netherlands are the frontrunners in the EU.



Source: Eurostat, Community survey on ICT usage in Households and by Individuals

Fig. 8. EU countries – internet users / digital skills (2021 survey) [45]

Romania is at the end of the list regarding the smallest investment in digital technologies in the business sector (less than 10%).

Regarding the Cloud computing services of sophisticated or intermediate level, Romania is situated at the lowest level with less than 10%. As for AI and Big Data adoption (collecting, storing, and analyzing data) the evaluation shows that only 5-6% of enterprises in Romania use it.

Regarding the DESI 2022, referring to Digital public services, unfortunately, Romania is at the end of the table with the lowest score (20 for citizens and 42 for business) while Estonia and Finland are the top performers with scores above 85.

Two members states that do not have an eID scheme in place are Cyprus and Romania. The eID (Electronic Identification) refers to the process of using person

identification data in an electronic form uniquely representing either a natural or legal person or a natural person representing a legal person. While Cyprus is planning to start issuing an eID as a pilot in the third quarter of 2022, Romania is expected to deliver 8.5 million eIDs by June 2026.

The top performers in the integration of digital technologies are Finland, Denmark, and Sweden. Romania, along with Bulgaria and Hungary show the weakest performance.

Although Romania registers delays in many areas reflected in many DESI dimensions, some of them quite substantial, is on an upward tendency in line with the general trend at the level of the European Union.

#### 4. Examples of good practice at the national level regarding the use of e-government tools

A number of calls for projects have been launched lately by the national authorities with the aim to improve the digital transformation process and speeding up the implementation procedures of digitalization in Romania [48].

The funding is directed to:

- ITC hardware purchases;
- procurement of equipment for automation and robotics intended for technological flows, integrated with digital solutions;
- development and/or adaptation of software applications/licenses, including RPA software automation solutions, respectively Robotic Process Automation;
- procurement of blockchain technologies;
- purchases of artificial intelligence systems, machine learning, augmented reality, virtual reality;
- purchase of presentation website;
- procurement of cloud and IoT services;
- training the staff who will use ICT equipment;
- consultancy/analysis to identify technical solutions needed by SMEs, etc.

At the national level, there are some successful projects available for citizens and businesses.

##### 4.1. G2C – Government to Citizen

One of the most useful and used platform as public service is the platform “[ghiseul.ro](https://ghiseul.ro)”. This is a project developed by the Authority for the Digitization of Romania and supported by the Romanian Electronic Payments Association, which offers taxpayers the opportunity to view existing payment obligations and/or to pay online by card, (partially or fully), the local taxes, local services, traffic fines, and fees for a number of documents (passport, ID, car registration, driving license, and so on) [49].

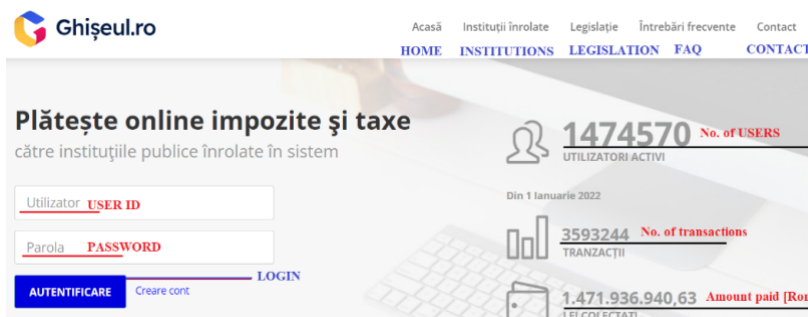


Fig. 9. Ghiseul.ro, the LOGIN page

Citizens have the possibility to enroll on the National Tax Administration Agency platform (ANAF) (which is clear and well structured) and get (online) from the authority, a Personal Virtual Space (SPV).

Through SPV, the citizen has remote access to its dedicated platform space to send documents and declarations, buy shares emitted by the state, and so forth.

The answer from authority comes back quickly, in a professional manner, and the citizen personal archive is easy to reach [50].

The National Road Infrastructure Administration Company (CNAIR) [51] has also a professional platform allows to check the validity of the Vignette and also buy a new one online or by SMS.

On the General Direction of Driving Licenses and Auto-Registrations platform, there is detailed information regarding procedures and documents necessary to get (extend) a driving license and obtain certificates for new (or newly bought) vehicles, and also fill forms for online programming at institutional headquarters, as well as an online simulation for examination in order to get a driving license [52].

The National Cadaster and Real Estate Advertising Agency has, also, a professional platform, (the 4th grade of digital transformation - figure 5) that allows citizens and organizations to fill out forms, pay online by card, and receive (by e-mail) information about Romanian real estate properties and owners [53].

The InfoCert online service (developed by the National Trade Register Office) provides certificates, allows registration for new organizations, and sends information to citizens in an automatic flow manner [54].

On the portal of the Ministry of Justice/courts in Romania, it is possible to quickly view pending cases or those that are being resolved in court. The search options are multiple with many filters to reach out quickly to the desired information [55].

Local Authorities/Halls have various online services (as part of digital transformation) classified from class 1 to class 4. It is notable, however, that in the last two years, in Romania, more and more integrated platforms have begun to be developed to make available to citizens local and regional services, online.

A good example is the CityManager platform [56], (part of the B2G Business to Government model) which is developed with the intention to be used by urban/rural Halls in the service of the communities (G2C model) The platform has been launched in 2017 and already implemented in several Transylvanian localities situated in Alba, Sibiu, Mureș, Brașov, and Hunedoara counties and makes available to citizens a number of specialized online services such as:

- allows the visualization of concentrated information about a citizen related to Taxes and Fees, Agricultural Register, Urbanism, Social Assistance, and Electronic Registry, in one place;
- allows submitting documents/applications online and receiving their solution automatically;
- allows citizens to report any community problems online 24/7, even from their mobile phone (abandoned cars, potholes in the asphalt, disturbing public order, obstacles on the road, garbage thrown in unauthorized places, lighting system malfunctions, stray dogs, etc.);
- paying taxes, fees, and fines online on the institution's website;
- online verification of the status of the documents submitted to the institution;
- real-time information on the status of submitted documents;
- quick access to information of public interest, automatically published on the website;
- citizens can automatically issue their Certificates from the Agricultural Register and Tax Certificates;



- citizens can consult their land, buildings, declared cars, taxes, fines and other charges directly on the institution's website.

CityManager is an integrated software solution (Fig. 11) for digitizing the interaction between public administration and citizens through online public services, reducing bureaucracy and simplifying the work of civil servants.



Fig. 10. City Manager Platform.

#### 4.2. G2B – Government to Business

Business organizations have a number of services online (including RO e-Factura or RO e-Transport) on the National Tax Administration Agency (ANAF) platform that is developed so far to the 3rd degree of digital transformation, according to figure 5 [57].

SEAP, the Electronic Public Procurement System (available in both Romanian and English languages) is probably the first online public service for business companies. It allows an organization to publish, sell, and bid services for governmental institutions. (Fig. 12.) [58].

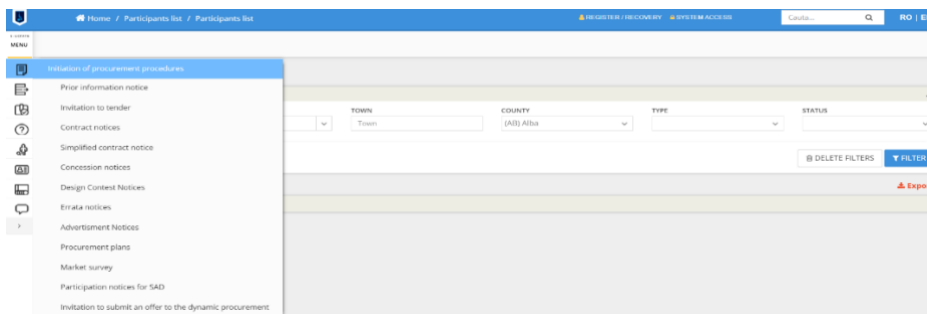


Fig. 11. The e-licitatie.ro platform.

There is a huge gap between public institutions and private ones in the medical domain. Although some public hospitals (as part of G2C model) allow online programming for clinical consultation, most of these online services are not working in real situations. Private medical institutions, on the other hand, have far more advanced online services, that are developed most of them up to the 4th grade and 5th grade of complexity. A good example is the Regina Maria Company, one successful Romanian business in the medical area [59]. Besides its platform that is developed up to the 5th grade of complexity (figure 13), there is also available an application for mobile devices that incorporates lots of medical information (about medical staff, future and former visits to doctors, hospitalizations, medical investigations' results,

the patient’s medical history, virtual clinical service, virtual medical assistant, offers, and medical subscriptions, invoices, online payment by card, and so on) and allow real-time interaction with medical personnel and doctors.

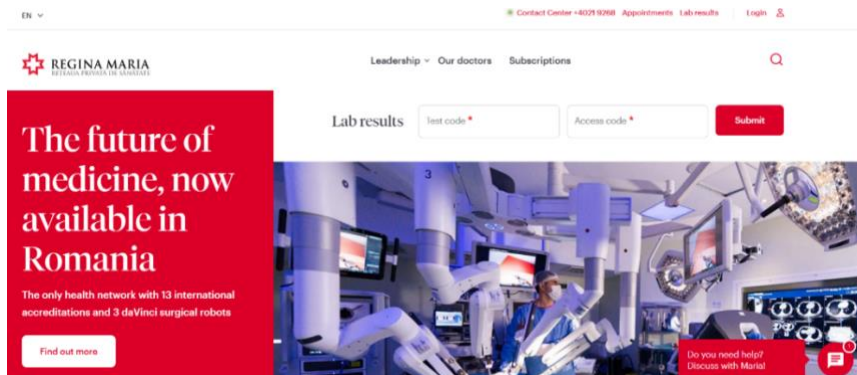


Fig. 12. Regina Maria – Private Medical Network.

Education is another area where digital transformation is in progress in Romania. However, the differences between public and private institutions regarding digital transformation are less distinguishable here, than in medical system.

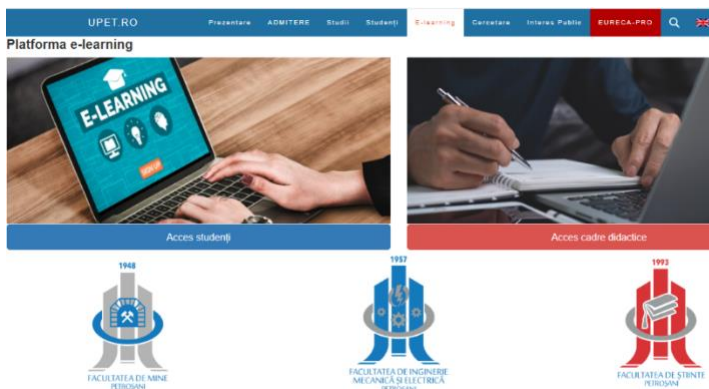


Fig. 13. University of Petrosani e-learning platform [60].

Most schools allow parents to check online (on the institutions' platforms) their children's scholar situation and be up-to-date regarding the current curricular and extra-curricular activities organized by teachers.

Universities have today more advanced digital transformation instruments as part of their own web platforms, because of the pandemic situation that forced professors, for two years, to teach and evaluate students online.

E-learning platforms, with advanced tools incorporated, allow efficient teaching, online interaction in real-time, and tools for a fair evaluation (figure 14). Students can read online, information relevant to them, pay their taxes, and can also check their own grades [60].

### 4.3. B2C and B2B – Business to Customers and Business to Business

Private telephone services (fixed and mobile), media (television, internet), electricity, gas, running water, heating, household water, meteoric water, and garbage collection have advanced platforms with varying degrees of sophistication, but no less than level 3. Besides lots of information available online, their platforms allow to make new contracts, choose different services, see their own consumptions, own invoices, pay online, and compare consumptions (quantity and financial) in previous years with the current one. Most of these companies have applications for mobile phones, that make it easy to access information online, allow one to send own meter readings (some by taking photos of meter index), and pay invoices online by card.

When comes to digital transformation, of all the online services, the banking ones have the highest dynamics. One of the most famous banks, Banca Transilvania, another successful Romanian business, is often in first place in terms of digital transformation and the variety of services included in the online platform and mobile phone applications [61]. The BTPay mobile phone application (figure 15) is a good example of an online banking service, complex, easy to access, and used even by users who are less trained or they feel less comfortable with mobile applications.

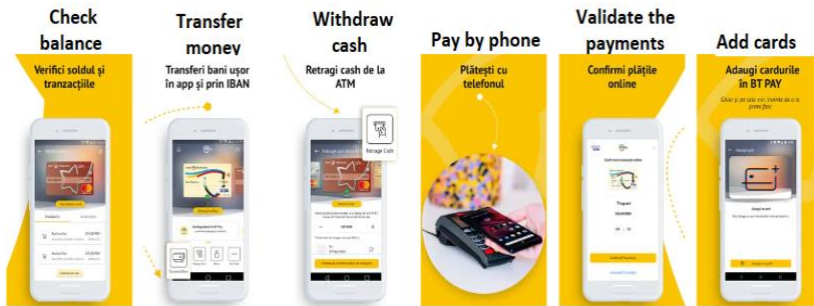


Fig. 14. BTPay app

Courier companies, during the pandemic time, grew in number and services "like mushrooms after the rain". A relevant example is Fan Courier (Fig. 15).

It is a successful Romanian courier business company that offers several online services such as AWB tracking, self AWB and cost estimate [62].



Fig. 15. Fan Courier Services online

BeeFast is a super-fast courier system based on a locally developed IT platform and its integration with e-commerce solutions. It is a service for fast delivery in an average time of 55 minutes in the Romanian capital, Bucharest and Ilfov county [63]. BeeFast is based on an IT platform that has several features: orders are received by both businesses and individuals, either by integrating with business e-commerce solutions or by placing the order directly. Couriers are assigned automatically based on proximity. If the client business does not already have an online shop, BeeFast builds such a shop for free within 24 hours and integrates it with the delivery solution. In this way, businesses can be online in 24 hours. For the next period, BeeFast aims to continue the development direction of the digital infrastructure, pursuing the implementation of new applications, both in the B2B area for the integration of more complex businesses in terms of the products and services offered, as well as for couriers and final requests [64].

And the number of examples, covering many other areas of business in Romania, is much more, and keeps growing.

## 5. Conclusions

Most e-business and e-government models in Romania, as part of digital transformation processes, are under development, though some of them are rather at the beginning of the development process and the steps made are few and reluctant, and others are quite advanced, even up to the 4th of 5th grade of sophistication. Unfortunately, in Romania, the lack of a general vision of the political actors regarding digital transformation and its benefits, obstructs its implementation and possibility of growth in public institutions, especially in infrastructure, skills, and public services, therefore delaying the deployment of new projects.

Although this has been the case in the past, we can notice many positive changes during the past three years and the dynamic of development and implementation of digital transformation projects keep growing in Romania.

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# Social Computing for Collaborative Learning in Higher Education

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[https://doi.org/10.33847/2712-8148.3.2\\_2](https://doi.org/10.33847/2712-8148.3.2_2)

Received 25.10.2022/ Revised 20.11.2022/Accepted 23.12.2022/Published 27.12.2022

**Abstract.** This study aims to investigate the use of the specific social computing tool (Wiki) for collaborative learning, and study students' perceptions in higher education. The participants of the study were a higher education student cohort in Bahrain. The data was collected through questionnaire and interviews. To demonstrate the intricacy of the investigation topic, a mixed methods data collection method was employed. Wiki as a social computing tool significantly enhances student collaboration, according to the preliminary questionnaire results and interviews with selected respondents. As a social computing tool, a Wiki has the potential to play a significant role in the future of learning settings, according to the study's findings.

**Keywords:** Social computing, Wiki, collaboration, social media.

## 1. Introduction

The interactive and social components of internet activities are defined as social computing. Using a computer for social purposes is known as social computing. The Web 2.0 notion refers to the technological architecture for applications that support its practices, which is closely related to the concept of social computing. [1–4]. A broad category of online technologies (platforms and applications) that encourage user interaction, communication, collaboration, and data sharing are collectively referred to as social computing. [1], [4].

Web services that are simple for users to use that allow for the reading, creation, sharing, and recommendation of content are included in social computing. [2]. Social computing suggests the freedom to access all types of information and transform the user from reader to content creator. Social media such as wikis, Blogs, microblogging, RSS, and instant messaging, are just a few examples of social computing [1].

Wiki advances and facilitates online collaboration and provides more possibilities for engagement between students, knowledge generation, and cooperation [5], [6]. It can be argued that using a Wiki in education is important; however, the appropriate pedagogy should be taken into account, together with careful planning and consideration. [6], [7].

Likewise, studies on the potential on students' perceptions on the use of a Wiki for collaborative learning in education were explored [8]–[12]. However, there is a need for further research on students' perceptions on the use Wiki as a collaborative social computing learning in higher education [7], [13]. This study aims to investigate the use of the specific social tool (Wiki) for collaborative learning, and study students' perceptions in higher education institution in Bahrain.

What follow is the section two where the literature review of the study is presented. Section three represents the data and methodology of the research including the qualitative and quantitative methods. In section four the results of the



study are presented and in the last section a brief discussion of the results, and recommendations, future work and concluding of the study are highlighted.

## **2. Literature Review**

The academic world has been introduced the importance of social computing tools in education. The rapid growth of social computing use in our daily lives, has resulted in higher education institutions' warm reception of social computing [1]–[4].

Social computing is beneficial for different cooperative or collaborative purposes, such as planning work and enabling real-time learners' interactions [1], [2]. Social computing such as Wikis, is another example of social media commonly used in education for collaborative learning [1]. Leuf and Cunningham first launched the Wiki in 1995. It was developed as a collaborative Internet tool [14].

A wiki is a website where users can simply and collaboratively create and amend pages [6], [13]. A well-known example of a Wikis is Wikipedia [15]. Wikis are useful tools for collaborative learning, writing, knowledge generation, and management, especially in higher education contexts, according to studies. [6], [10], [13], [16]–[19]. The responsibilities and actions of users and, concurrently, the distribution of work among group members form a pattern that develops through time and with repeated use of Wiki [5], [10].

On the other hand, the literature, which emphasized that students do not always learn more efficiently when using the Wiki alone and without appropriate direction, corroborated this claim. Instead, there should be a balance between face-to-face events and using a Wiki [5], [10], [19]. A significant difference was observed in the perception and reception of the Wiki among the students, even though it was assumed that using Wiki would promote critical thinking among students. [5], [19], [20].

## **3. Data and Methodology**

To demonstrate the intricacy of the investigation topic, a mixed methods data collection method was employed. [21]. The students' perceptions on using Wiki for collaborative learning was gathered through a questionnaire and interviews.

Dokuwiki was chosen because it offered a wide range of features, such as integrating and utilizing other social computing tools, user authentication, tracking contributions, and version control [22]. Fig. 1 shows the default Dokuwiki interface.

A Dokuwiki is an open-source Wiki that simplifies independent Wikis' construction and subsequent development and the hosting of the Wiki was done on a personal server. In the study, students were offered brief introduction on how to use Wiki and work collaboratively in their projects, included basic exercises related to the course content, for example, writing, editing, proofreading content, raising questions, and replying in the form of discussion.

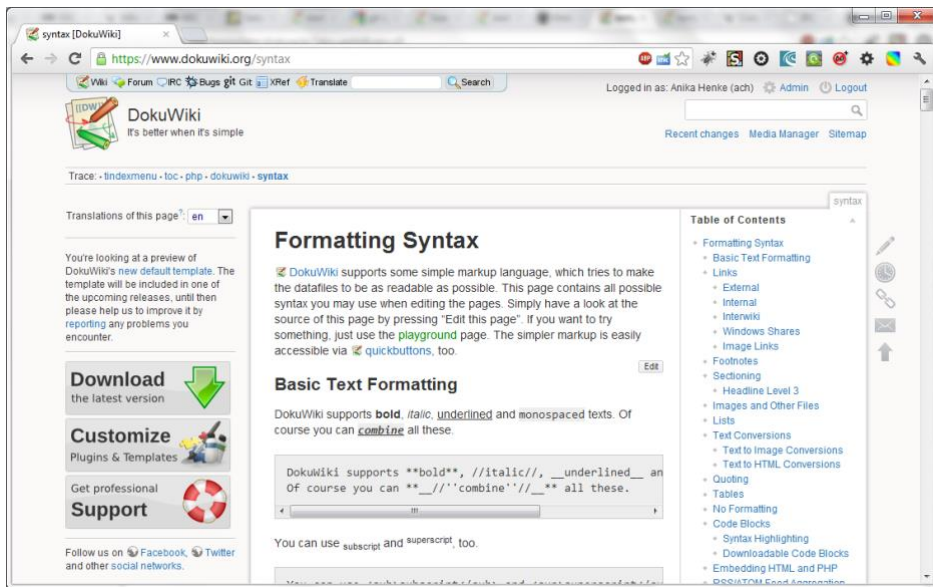


Fig. 1. The default Dokuwiki interface (adapted from Dokuwiki [22]).

It is worth mentioning that only registered users could edit the Wiki course; this way, the aim was to prevent vandalism and track the use of the Wiki. Fig. 2 shows the course Dokuwiki collaborative project website.

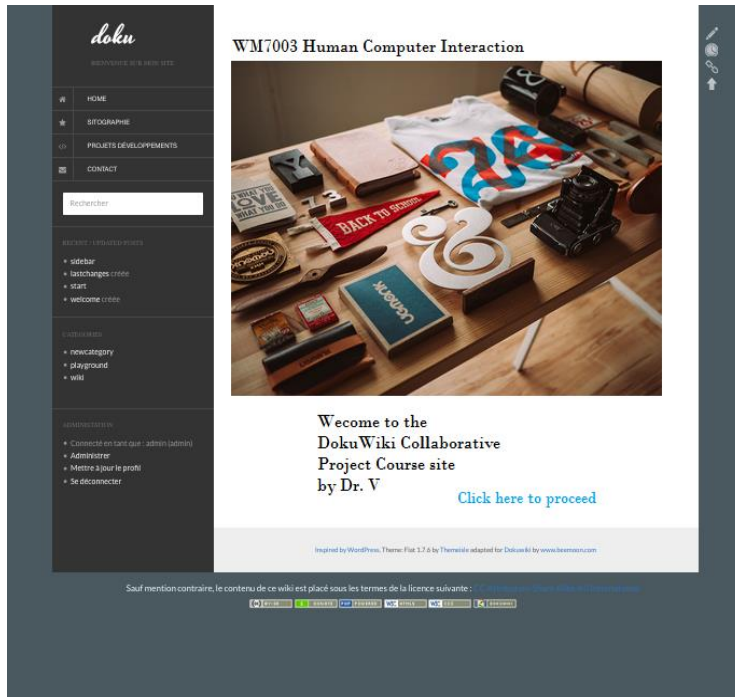


Fig.2. The course Dokuwiki collaborative project website.

Moreover, students were assigned to work in small groups to research and share information on the assigned topic. This promoted student collaboration using the Wiki as a learning environment, where the students used the Wiki to support a mutual understanding of the subject. The Wiki provided a learning environment for students to collaboratively store, organize, display, post, revise, edit content and respond to each other's questions.

The dataset n= 40, 34 females (85%) and 6 males (15%) consisted of undergraduate students studying in a higher education institution in Bahrain.

Students' perceptions of utilizing Wiki for collaborative learning were obtained using a questionnaire and interviews with the chosen participants at the end of the study in line with the prior experiment by Alexakis et al.[5]. The questionnaire was assessed using Likert scale [21] and aimed to gather the students' perceptions on using Wiki for collaborative learning as represented in Table 1.

Table 1. Students' perceptions of using Wiki for collaborative learning

<b>Questionnaire (adapted from Alexakis et al. [5])</b>	
Q1	I feel comfortable writing comments on other students' pages.
Q2	I am worried that other students might dislike my comments on their work.
Q3	I feel encouraged to interact with other learners on the Wiki.
Q4	I can get to know my fellow students through the Wiki.
Q5	I feel that there is too much course information on the Wiki.
Q6	I often participate in discussions on the Wiki.
Q7	I have received valuable comments from tutors.
Q8	Other students' comments on my wiki pages have helped me improve my work.
Q9	I find it more efficient to interact with each other via the Wiki than face-to-face.
Q10	I have learned more about my research project from fellow students via the Wiki than via face-to-face collaboration.
Q11	I am now confident in giving and receiving feedback to/from other students.
Q12	Overall, the Wiki has helped promote my initiative to learn independently.

A quantitative survey followed by qualitative interviews. To better grasp the subject under examination, a link between the two methodologies was conducted [21]. The interviewees were chosen at random among the students to participate in the interviews. During the interview, students were free to express their opinions and give explanations of the key elements in the themes. Two stages of data analysis for the interviews were completed. Transcript analysis demands for a scientific mind and thorough familiarity with the text [23]. Stage one involved creating transcripts, identifying themes, concepts, and events, and then coding them to extract information on particular subjects [24]. In order to code the themes, the researcher had to interact with the data and comprehend all of its implications and insights. The context was described in the second phase using the data, and its relationship to the study topics was explained [24], [25].

The interviews were conducted towards the conclusion of the course to allow the researchers to get information about the study subjects without being restricted by the questions. The interviews provide insight into how the participants felt about utilizing the course Wiki.

The nature of the research was clearly explained at the outset of the interview. The assurance that all information will be maintained confidentially was made to the participants before asking for their official consent to proceed ahead. The process of classifying, contrasting, weighing, and combining interview data involves extracting meaning and consequences, seeing patterns, or combining event details to form coherent narratives [25]. In order to cross-reference important identity development and imprint topics, each informant's interview was audio recorded and then transcribed.

#### 4. Results

The questionnaire used a set of questions as listed in Table 1, with the findings shown in Figures 3, 4, 5 and 6. Each point on the x-axis of the figure corresponds to a question in the table.

More specifically, students felt comfortable writing comments on other students' pages (Q1) with a higher frequency of "agree" with 48% followed by "not sure" with 22%. They were not worried about other students disliking their work (Q2) with higher frequency "not sure" 37% followed by "agree" with 26%. They felt encouraged to interact with each other using the Wiki (Q3), with most of the answers stating "agree" and "strongly agree" with the higher frequency 43% and 28% respectively, as shown in Fig. 3.

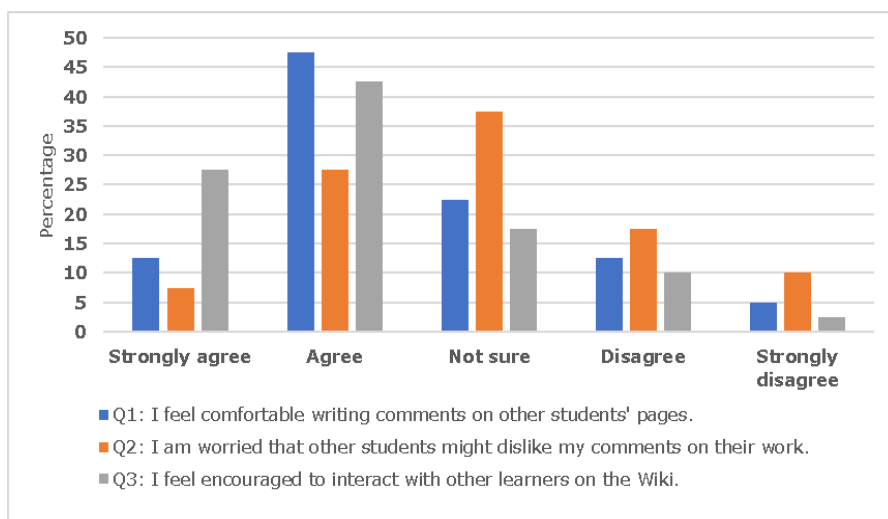


Fig. 3. Students' responses on Q1, Q2 and Q3.

As shown in Fig. 4, students mentioned that they were able to get to know fellow students through the Wiki (Q4), with most of the responses mentioning "not sure" with 37%, followed with "agree" and "strongly agree" with 30% and 17% respectively. Moreover, from the responses, students "agree" that there is too much course information on the Wiki (Q5) with the highest frequency 45% and "strongly agree" 30%. For the (Q6) I often participate in the discussion on the Wiki, student

replied with the higher frequency "agree" with 45% following by "strongly agree" 22%.

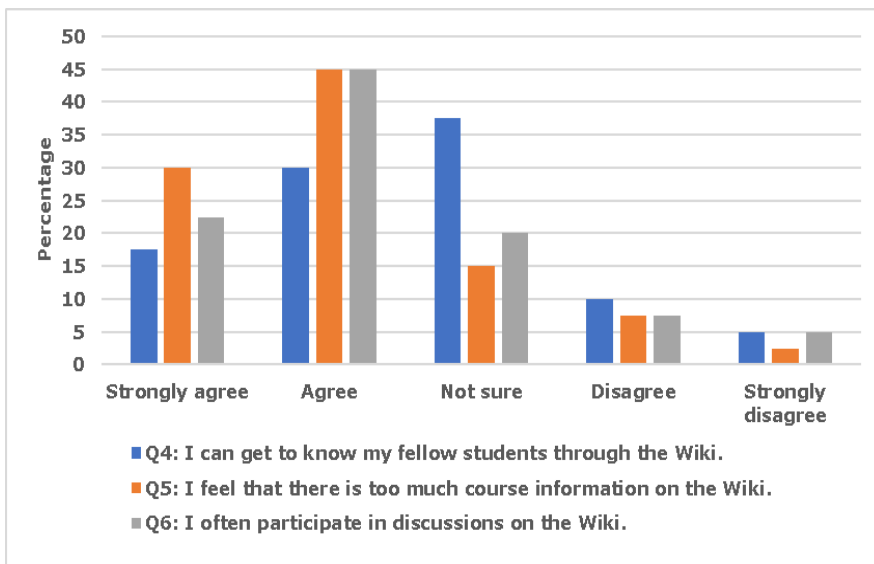


Fig. 4. Students' responses on Q4, Q5 and Q6.

Furthermore, students mentioned that they had received valuable comments from tutors (Q7) "agree" 55% with the higher frequency and 30% "completely agree". Students "agree" with 52% and "strongly agree" that other students' comments on the Wiki have helped them improve their work (Q8). Student replied on (Q9) that they found more efficient to interact with each other via the Wiki than face-to-face, with the higher frequency 51% "agree" and 20% "completely agree", as shown in Figure 5.

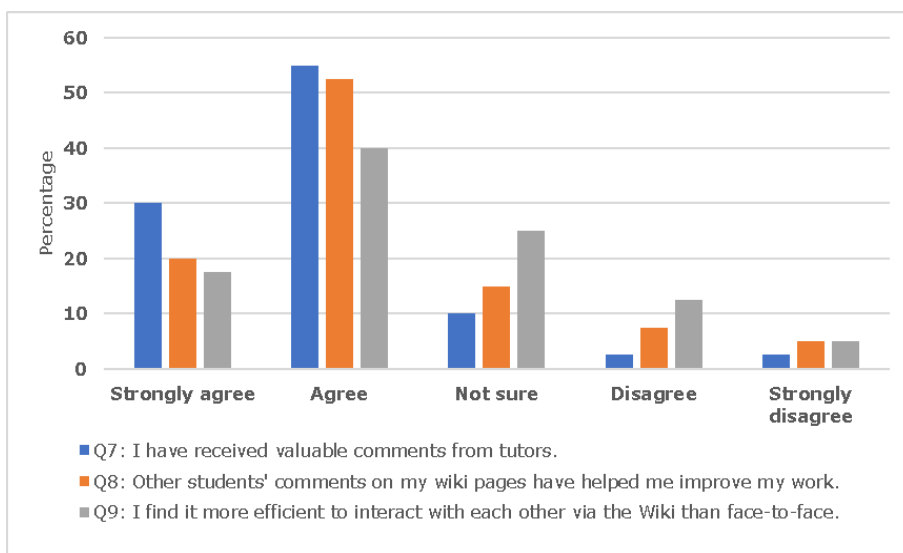


Fig. 5. Students' responses on Q7, Q8 and Q9.

As shown in Fig. 6, students "agree" with 37% the highest frequency, followed by "not sure" with 28% that they learned more about the research project from fellow students via the Wiki rather than face-to-face collaboration (Q10). The student felt confident in giving and receiving feedback to/from other students (Q11) with "agree" to be the highest frequency 40% and 38% to be "strongly agree". Overall, the students stated that the Wiki had helped them to learn independently (Q12), with "agree" and "strongly agree" having the higher frequency, 40% and 35% respectively.

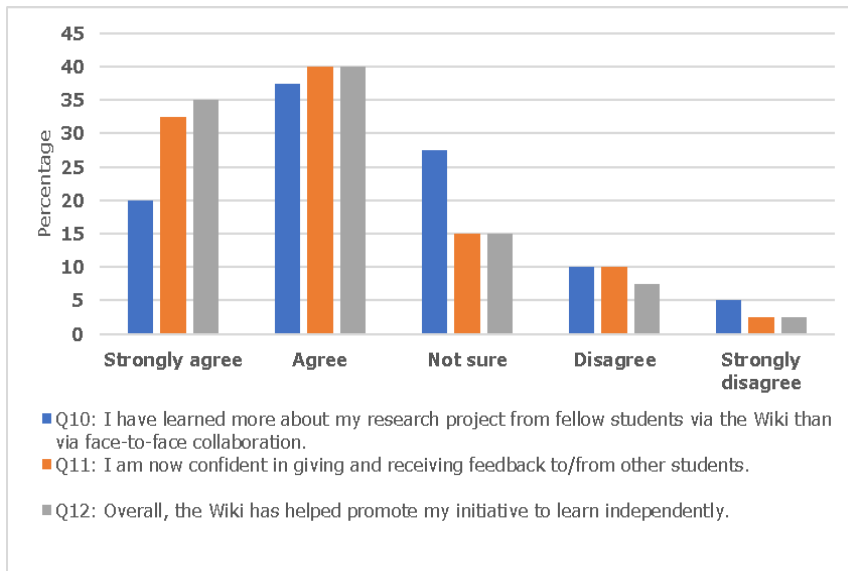


Fig. 6. Students' responses on Q10, Q11 and Q12.

As mentioned earlier, interviews with selected participants were carried out at the end of the course. Following are the topics and key insights related to the research that emerged from the interviews and were subsequently probed and questioned by the researcher.

#### 4.1. Collaboration and feedback

In many cases students faced several problems using the Wiki. A typical reflection of that was mentioned by students "Wiki might be a bit complicated, maybe it would encourage us students more if it was a bit easier to use." and "Perhaps an easier interface to work with... seeing as I found it difficult to try and structure our Wiki page or perhaps customize it the way we wanted". The above comments suggested that probably the study could use a social computing tool with simple interface maybe a blog, however considering the fact that the emphasis of the experiment was on collaborative authoring the choice of the Wiki concept seemed more logical. Working collaboratively on the same task is always difficult for students even in traditional settings, students found really difficult to collaboratively work on the Wiki and this was mentioned in their feedback "I didn't like the Wiki, even though I know the purpose of using it this semester however, it didn't help us that much as a group". It can be argued that using a new tool added a certain difficulty to the teamwork process.

Some students stated that they received useful feedback from peers in Wiki and stated, "I have learnt more on my research project from other students". Students also expressed that one while using the Wikis was a positive experience, not

all of the students were able to adjust to the tool stating: "I believe it is useful, however the students don't use it effectively which limit its good features". It is worth mentioning that most of the students stated that using the Wiki added to the difficulty of the course, mainly because in the beginning even for simple task in the Wiki they had to spend some time to figure out how to proceed.

#### **4.2. Motivation**

The majority of students stated that the Wiki help them and contributed to the teamwork projects. Some of the student found motivation in from the simple fact that they were introduced to a new tool that could possible improve their performance and thus stated "To me learning a new tool to improve my learning proceed seems fantastic", "becoming familiar with Wiki form the course, now I know how to contribute to Wikipedia, this is great". A big cohort of students stated that "I wish we had more time to practice suing the Wiki" that seems to be representative for the learning curve of the Wiki.

#### **4.3. Privacy and technical issues**

A significant concern for the students was privacy, raised during the interviews by some students. They stated: "Wiki has less privacy.", "I do not feel confident with the privacy setting in the Wiki." From the discussion, it was observed that this was mainly related to the fact that students were embarrassed or afraid of making mistakes. The issue was rectified using Wiki's anonymity feature, using usernames.

Many technical problems, frequently encountered with many online tools, were reported by students using the Wiki software platform. Some of the problems were focused on the functionality of the Wiki, stating, "It is not user friendly," "not interactive design, a bad design.", "hard to navigate." It can be argued that these mentioned problems are expected to be solved as part of the evolution of Wiki hosting sites.

#### **4.4. Positive and Negative Reception**

As part of the negative reception points, students mentioned that: "Using Wiki is collaborative work, and without team synchronization, it is tough to get things done properly". Some students also did not use the Wiki, stating, "I did not use it", and "I do not think the Wiki is useful". On the other hand, as part of the positive reception part, students mentioned that they appreciate the purpose of using the Wiki, stating, "Having the slides in the Wiki, being able to view my team's progress, receive comments, have learning resources. All these will help me in my learning experience", "It helped me to view the work that my team did and how far we reached with our group work as well as sharing my work on the Wiki for others to view".

### **5. Conclusions**

This study investigated the use of the specific social tool (Wiki) for collaborative learning, and study students' perceptions in higher education institution in Bahrain. To demonstrate the intricacy of the investigation topic, a mixed methods data collection method was employed. [21]. The students' perceptions on using Wiki was gathered through questionnaire and interviews. Wiki as a social computing tool significantly enhances student collaboration, according to the preliminary questionnaire results and interviews with selected respondents.

According to studies, Wiki cannot be successfully used without the necessary prior training, thought and consideration, and planning along with the appropriate

pedagogy. [5], [7], [26]. In particular, this was the experience running the experiment; despite the fact that the students were supposed to get prior guidance and ongoing support during the semester, the quality of their work was frequently compromised by their insufficient skill set.

The literature, which emphasized that students do not always learn more efficiently when using the Wiki alone and without appropriate direction, corroborated this claim. Instead, there should be a balance between face-to-face events and using a Wiki [5], [10], [19].

A significant difference was observed in the perception and reception of the Wiki among the students, even though it was assumed that using Wiki would promote critical thinking among students. [5], [19], [20]. Some students were less keen to use the Wiki, while indications of technophobia were noticed, which explain the elements of unfavorable reception reported.

Cross-sectional research was used in this study to gather data at a specified time, and the decision to use this method was justifiable given the length of time required to conduct the investigation, which was the duration of the course. Future longitudinal studies focusing on various target populations and exploring how students perceive the use of social computing for collaborative learning in various contexts and nations can also widen the area of future research.

The study's findings clearly reveal that Wiki, in particular, can facilitate collaborative learning with social computing. According to the study's findings, Wikis have the potential to be effective social computing tools in the development of learning environments.

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# The relationship of students' psychological security level in the digital educational environment

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[https://doi.org/10.33847/2712-8148.3.2\\_3](https://doi.org/10.33847/2712-8148.3.2_3)

Received 27.09.2022/ Revised 17.11.2022/Accepted 23.12.2022/Published 27.12.2022

**Abstract.** Currently some studies that demonstrate the correlation between students' level of psychological security and their academic performance and engagement have been published. Many studies have examined the importance of the level of psychological safety among students, some of which have proposed a methodology for assessing this indicator. To assess students' level of psychological security in studying, there were conducted online surveys. The sample included 351 students between the ages of 19 and 21 ( $M = 19.57$ ,  $SD = 0.59$ ), predominantly female (57%). As a result of the survey, it was found that women showed a higher level of psychological safety. The same trend was found in levels of academic engagement and academic performance. Using linear regression analysis, psychological safety was found to positively affect academic performance and attainment, especially in an online educational environment.

**Keywords:** Psychological Security, Behavioral Engagement, Cognitive Engagement, Emotional Engagement, Academic Performance.

## 1. Introduction

Due to COVID-19 and its consequences, almost all universities in the world were transferred to distance learning, including Peter the Great St. Petersburg Polytechnic University (SPbPU). Before COVID-19 only 4% of all university courses were online, 14% were partly online and 82% were full-time, so changes had to be made urgently [1, 2]. The full transition to learning in a digital environment has caused many difficulties in various fields of education. According to Buzzetto-More and Koohang [3], affected areas are the psychological state of students and teachers, students' engagement, and an equally important point is academic performance. Many researchers have studied various indicators that may directly and indirectly influence students' attitude towards educational process, their academic involvement and performance [4]. The main task of the university in the transition to distance learning was to create a secure and comfortable digital environment for students, so that students feel psychologically safe. It was also important to keep the students' interest and desire to continue their studies and actively participate in the learning process. Many researchers studied the importance of psychological security level among students, some of them proposed the methodology of assessing the indicator [5]. Nevertheless, there are few studies that demonstrate the relationship between psychological security level of students and their academic engagement and performance.

This study addresses a valuable contribution to the Russian literature by comprehensively assessing psychological security level of students and their academic engagement and performance, investigating whether psychological security mediates the relationships between academic engagement and performance, considering the university students perceptions. The following research questions are presented in order to address the need to generate actions to set an effective educational environment:

1. How do students' varying degree of psychological security relate to their behavioral, emotional, and cognitive engagement?

2. How do students' varying degree of psychological security relate to their academic performance?

2. To what extent does the level of psychological security predict students' academic performance and engagement?

Therefore, this study pursues as main goals to: a) determine the relationships between the levels of psychological security and the sex of a sample of university students; b) establish the associations between psychological security level, academic engagement and performance.

## **1.1 Theoretical Background**

E-learning, which is considered a new approach of learning, covers all the ways of learning and teaching supported by technology [6], and includes all definitions related to increased accessibility of sources, flexibility towards the learner, and extension of abilities [7]. In addition, it is considered the fastest and least costly way, making it affordable for everyone to participate in the learning process. L. G. Nazarova [8] argues that Dynamic eLearning covers innovative information accessible to all learners. The concept of e-learning offers educational organizations using this technology a number of benefits, incorporating short and efficient learning curve, flexibility and modularity. Weaknesses of e-learning are high dropout rates, high design and maintenance costs [9].

Several studies have been conducted on student and user perception of e-learning. Buzzetto-More & Koohang [3] conducted a study of student perceptions of various components of e-learning. They discovered that e-learning can improve students' understanding of the course content they are taking, and this will have an influence on higher education. Selim [10] showed that students perceive teacher characteristics as the most important factor in the success of e-learning. Mohd Alwi [11], who studied the perception of e-learning specialists, uncovered that their respondents agree that there are security risks in e-learning, and good safety supervision in e-learning is significant to ensure a secure e-learning environment.

It should be noted that modern educational institutions strive to use e-learning in order to be skilled to satisfy all requests, among which psychological safety is of paramount importance.

Psychological security. Security is acquiring the newest strategic and socio-economic role, including to guarantee the consistent functioning of any organization that aims to protect the environment and sustainable progress in existing conditions. Security is a major part of human needs; therefore, it is important to recognize its important role in education and training. [12].

Students are the largest users of e-learning. Students are disturbed about their privacy and safety when using the e-learning system. They are concerned that sensitive information, such as their ratings and what they do, might be disclosed to others. They also need a reliable system so they don't get frustrated when using a system that could affect their academic performance. It is important to consider the needs and opinions of students as the largest users of the e-learning system in order to ensure the successful implementation of the system in any educational institution. One of the reasons people reject the online system has to do with computer security concerns. Availability, integrity and confidentiality are the building blocks of computer security [3].

Psychological safety as a mental feeling of acceptance, love, receiving help and as an emotionally oriented system has been considered by some authors as something that contributes to the satisfaction of emotional requirements, satisfaction and a sense of belonging. [13] (pp. 5-12). This leads to harmony with society, detection

and recognition of realities and adaptation to them, the disclosure of inner talents and, finally, the promotion of a healthy lifestyle among societies [14] (pp. 71-81).

Online users using the system fear that they will lose their privacy, the privacy of their personal information, and the availability of the system when they need it. In an e-learning system, users will feel more confident in interacting and collaborating with others when mechanisms are in place to ensure confidentiality, trust, and a secure environment. Students' perception of the service quality of the e-learning system is important as students can offer insights into the conditions that reduce the quality of service in e-learning and they experience the institution's service delivery system day after day [15].

Students' engagement. A significant assessment for teaching students in a digital environment is engagement. Fredricks and McColsky [16] noted that while some researchers explain it in terms of views and principles about the significance of learning, others define it as an effort beyond the bare minimum.

Based on an analysis of digital learning publications Halverson et al. [17] discovered that about half of their publications mention the term "engagement". Their outcomes also presented that, despite the common usage of the term, in very exceptional cases, research is directly linked to involvement in digital learning.

Several scientists have proposed a multidimensional interaction model [18-20]. According to this theoretical model, engagement is multidimensional, which can embrace behavioral, emotional and cognitive aspects [21, 22]. According to Fredicks et al. [19], behavioral engagement underlines involvement, stubbornness, and participation in academic activities. Emotional engagement centers on positive and negative reactions to peers, professors, and institutes, as well as evaluating learning results. In terms of cognitive collaboration, it comprises the student's involvement to the understanding of the topic. "Cognitive engagement draws on the idea of investment; it incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills" [19] (p. 73).

Academic engagement expects numerous long-standing positive effects such as pursuit of higher education, steadiness in learning modes, enhanced job prospects, positive self-perception and welfare, and less depressive indications [23-27]. Thus, participation can have positive and wide-ranging results even outside the educational environment. In addition, academic participation was discovered to be strongly associated with academic inspiration and performance: students rate their studies, score higher, and report lower levels of academic abstinence and effort avoidance [28].

Log records from electronic learning management systems can keep independent and related data, such as how many times a student has logged in. Although scholars have concentrated on log files for various points, they infrequently used these log archives for analysis interactions. It is only lately that Gobert, Baker, and Wixon [29] have established procedures to notice engagement in the online study environment for examining scientific questions. Hence, other methodologies, such as interviews, have their benefits. Scientists can use interview techniques to get comprehensive material about why students partake or do not partake in certain events, why students vary in communication performance and contextual aspects that can lead to student engagement or disengagement [30]. Taking into account the point that each method to dimension has its pros and cons, a number of academics recommend using numerous techniques to measure engagement [31-33].

Thus, it seems possible for us to analyze the mutual influence of student engagement on their academic performance. However, during the pandemic, given the fact that education is completely digitalized, a new dimension emerges that affects both student engagement and academic performance. Unfortunately, no relevant studies on this topic have been found. In the current study we would like to share the experience and to fill the existing research gap using a mixed methods approach to

take into account all factors: students' psychological security level, students' engagement and learning outcomes in a digital environment.

## **2 Materials and Methods**

### **2.1 Participants and Procedures**

The study involved university undergraduate students (2nd year of study) of Peter the Great Saint-Petersburg Polytechnic university aged from 19 to 21 years ( $M = 19.57$ ,  $SD = 0.59$ ), 57% females. The total number of participants in the sample was 351. A survey of students was conducted online using the Moodle platform. Consent was obtained by all participants in this study. The results were collected at the end of the spring semester 2020 after 4 months of distant learning due to COVID19 situation. Analyses were carried out on the depersonalized data.

### **2.2 Measures**

For the assessment of students' psychological security in online educational environment, the Trustworthiness Factors survey was used [1]. It includes 10 statements that explore interpersonal trust in work groups identifying trust-building behaviors ranked in order of importance, and it is divided into two categories: Trustworthiness Building Factors (TBF) (e.g., "I communicate honestly, without distorting any information") and Trustworthiness Reducing Factors (TRF) (e.g. "I make excuses or blame others when things do not work out").

The Trustworthiness Factors survey was previously validated in a sample of 16–18 years old students ( $N = 102$ ). The validation study showed that coefficients of internal consistency of items for each scale ranged from 0.51 to 0.75, indicating an overall reasonable homogeneity of the items in each scale. Each statement is rated on a 5-point Likert scale.

The present study measured students' Academic Engagement Scale using the three most common dimensions identified by researchers, which included behavioral, emotional, and cognitive engagement. We measured behavioral engagement through students' attendance records of online lectures in MS Teams and records of online logins to the Moodle platform (results are presented in 10-points scale). To identify emotional involvement, we used Motivation Questionnaire. Special statements were created to identify the students' perceptions about teaching and learning offered, defining five indicators: desire of learning after university, anxiety, positive attitude to learning, self-esteem, and self-demand. For each of the questions, the participants marked one of the five Likert-scale responses. The questionnaire included two questions for each motivation factor. To investigate students' cognitive engagement we conducted a survey consisted of three items defining cognitive criteria, which index the extent to which students are attending to and expending mental effort in the learning tasks encountered ("I put a lot of effort into preparing for classes on Moodle"; "I was engaged with the topics at hand in lectures"; "I invest much time in implementing homework tasks"). The Cronbach's internal reliability coefficient obtained in our study for the Academic Engagement Scale was 0.84.

We used the students' semester grades in professional disciplines as measures of academic performance. Russian universities assess students' performance using a 4-point system, with grade 5 indicating excellent performance, 4—good performance, 3—satisfactory performance, 2—not satisfactory (fail).

We analyzed data using IBM SPSS Statistics, version 21: ANOVA, correlation and regression analyses.

### 3 Results

#### 3.1 Descriptive Statistics and Gender Differences

The descriptive statistics for all variables are presented in Table 1.

Table 9. Means, standard deviations and ANOVA results by gender

Measures		ALL (N=351)		Females (N=200)		Males (N=151)		ANOVA effects
		M	SD	M	SD	M	SD	
		Trustworthiness Building Factors	3,83	0,71	3,87	0,74	3,78	
Trustworthiness Reducing Factors (R*)	3,24	0,68	3,11	0,68	3,35	0,66	0,23	
Academic Engagement Scale	Behavioral engagement	8,3	0,91	8,71	0,87	7,62	1,12	0,005
	Emotional engagement	4,17	0,76	4,31	0,72	4,02	0,97	0,38
	Cognitive engagement	3,93	0,81	4,01	0,77	3,69	1,14	0,03
Academic Performance	Students' average semester grade on professional disciplines	3,86	0,68	4,09	0,71	3,67	0,66	0,01

\*Reversed results

The obtained results reflect that girls have significantly higher indicators of the Academic Engagement Scale compared to boys. This fact is consistent with earlier data, for instance, Guay, Vallerand, Blanchard [34] y Ayub [35]. There were no significant gender differences in Trustworthiness Factors, however, boys show higher rates of Trustworthiness Building Factors, while the indicator of Trustworthiness Reducing Factors was lower by boys.

#### 3.2 Correlation analysis

Also, we conducted a Pearson correlation analysis to identify whether TFS scores impact the academic engagement scores of the students. The results are shown in Table 2.

Table 10. Pearson's correlation results for the variables under study (N = 351).

	1	2	3	4	5	6
1.Trustworthiness Building Factors	1					
2.Trustworthiness Reducing Factors (Reversed)	0.61***	1				
3.Behavioral engagement	0.31**	0.19	1			
4.Emotional engagement	0.25*	0.22*	0.34**	1		
5.Cognitive engagement	0.28**	0.24*	0.17	0.13	1	
6.Academic Performance	0.17	0.15	0.21*	0.19	0.25*	1

Note: \* p<0,05; \*\* p<0,01; \*\*\*p<0,001

When Table 2 is examined, it is seen that the TFS scores and the academic engagement scores of the students have a significant and positive correlation. At the same time the Trustworthiness Building Factors and Trustworthiness Reducing Factors both had a quite weak influence on students' academic performance ( $R=0.17$ ;  $R=0.15$ ).

### 3.3 Regression analysis

The results of the linear regression analyses conducted to analyze whether the psychological security level of the university students predicted the academic engagement are presented in Table 3.

Table 11. Trustworthiness Factors Scale scores as a predictor of academic engagement

	B	SEB	$\beta$	t	F	R2	Adjusted R2
Constant	2.71	.10	.35	7.89**	48.29**	0.14	0.16
TFS	.01	.00		6.87**			

Dependent variable: Academic engagement, \*\* $p < 0.001$

According to Table 3 the TFS scores predict the academic achievement levels of the students significantly in a positive way ( $\beta = 0.35$ ,  $t = 6.87$ ,  $p < 0.001$ ). 4% of the total variance of the academic engagement scores can be explained by the SDI scores ( $R^2 = 0.144$ , adjusted  $R^2 = 0.141$ ).

The results of the linear regression analyses conducted to analyze whether the psychological security level of the university students predicted the academic engagement are presented in Table 4.

Table 12. Trustworthiness Factors Scale scores as a predictor of academic performance

	B	SEB	$\beta$	t	F	R2	Adjusted R2
Constant	2.09	.09	.15	2.78*	7.73*	0.023	0.027
TFS	.01	.00		3.14*			

Dependent variable: Academic performance, \* $p < 0.01$

In Table 4 it is shown that the TFS scores predict the academic achievement levels of the students less significantly than academic engagement scores but also in a positive way ( $\beta = 0.15$ ,  $t = 2.78$ ,  $p < 0.01$ ).

These findings show that feeling of the psychological security is an enhancing effect on the academic engagement and academic performance levels of the students.

## 4 Discussion

The rapid transition of the educational process to the digital environment has caused excitement among both teachers and students. Students' anxiety stems not only from novelty, but also from a disturbed sense of security. In our study, we examined the impact of psychological safety of students on academic performance and student engagement in the educational process.

For the analysis we used the Trustworthiness Factors survey, students' attendance records of online lectures in MS Teams and records of online logins to the Moodle platform, Motivation Questionnaire and cognitive criteria survey. Also, we analyzed students' semester grades in professional disciplines as measures of academic performance.

In contrast to earlier studies [3, 10, 14], we consider student safety not only as an aspect of personal data security, but more as a psychological one. We confirm that the psychological security of students affects the behavior of students during the educational process, namely, the activity of their participation in the classroom, enthusiasm for the process, the feeling of comfort and the effectiveness of learning in a digital environment. The direction of our research is similar to the works of Rafie, Ramid and Hashini [13] and Miguel Moneo et al. [4].

Researches [30-33] on students' engagement assessment allowed us to choose the best methods for analyzing this factor. However, unlike all previous studies, our study focuses on the relationship between the psychological safety of students and their willingness to take an active part in the educational process.

The present study allowed us to highlight the important role that the psychological security plays in the online learning, considering the perceptions of the studied university students. The focus on the relationship between trustworthiness factors that are reflected the level of psychological security, academic performance and engagement constitutes an added value of this paper, since most of the international research has focused mainly on the methodology of assessing the psychological security and defining the borders of its definition. It was possible to conclude that the influence of psychological security on students' engagement and academic performance is particularly visible in the online educational environment. This is an important result that should be consequently considered extremely valuable, influencing the design of online learning and technologies to improve the students' perceptions of psychological security in the Russian university context.

#### **4.1 Limitations of the Present Study and Suggestions for Future Research**

It should be noted that our study has limitations. Only students from Russia were analyzed, therefore, these students had a similar mentality, which can differ from representatives of other countries and affect the psychological security state. Also, the study was conducted on a short time frame basis since distance learning was introduced in March 2019, which is a short period. Furthermore, the transition to the distance format was made very abruptly, literally in a week the educational process completely switched to a digital environment. Such drastic changes could negatively affect the psychological state of students and affect the results. Thus, with a smoother transition with advance preparation of students, the results may differ.

We hope that our research will be useful for future scientific work. This direction is promising, since distance education continues at the present time. It is important to study separately the adaptability of students to the digital environment over time, the selection of educational technologies specifically for the digital environment, in order to improve the academic performance of students and their sense of security. In addition, it seems important to study aspects of the psychological health of teachers, as participants in the educational process.

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# Education for Colombian Civil Engineers under Problem-Based E-Learning Modalities

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[https://doi.org/10.33847/2712-8148.3.2\\_4](https://doi.org/10.33847/2712-8148.3.2_4)

Received 26.10.2022/ Revised 01.11.2022/Accepted 23.12.2022/Published 27.12.2022

**Abstract.** It is well known that material resistance is a core course for any civil engineer, since construction work requires the use of materials that are subject to constant exposure to internal and external factors. The University of Medellín has implemented a new strategy in its materials resistance course that includes elements of virtual education and elements of active learning focused on PBL (Problem-Based Learning). This article describes the use of the new educational methodology and its advantages. According to the results of this study, it can be concluded that only lectures do not contribute to the active involvement of students in the learning process and do not allow students to acquire the practical skills necessary to apply the studied courses in their future work. Active involvement in solving practical problems has not only a great impact on student motivation, but also improves academic engagement and performance.

**Key words:** Problem-based learning, Virtual education, Materials resistance.

## 1. Introduction

There are many cases that question the efficiency in the design and execution of construction work in the country. Some studies from Los Andes University (Universidad de los Andes in Colombia) revealed that the 2013 collapse of Stage 6 of the Space Building (Antioquia) was due to the lack of structural capacity of the columns to support normal loads. Finally, on February 27, 2014, Stage 5 of the building was demolished and the National Professional Council of Engineering (COPNIA for its acronym in Spanish) of Colombia pointed out that the engineers who designed and executed the construction of the building were responsible for this catastrophe.

The above data is only used to emphasize that engineering training is critical, and not doing it well leads to disasters such as these. The construction of any engineering work (for example, a bridge, a building, a tunnel, etc.) requires the use of materials that will be subjected throughout their useful life to the action of internal and external forces, which will produce stresses and deformations in its structure. The material stress and deformation values must be calculated appropriately according to its mechanical properties, in order to avoid possible specific failures of the structure and to minimize the probability of collapse throughout its useful life. In this regard, the Materials Resistance Course becomes the cornerstone of any civil engineer. Historically, this course has reported worrying loss rates of up to 85% per academic semester at the University of Medellín-Colombia.

These failure rates have led subject-area teachers to seek, together with colleagues from other areas of engineering and education, new options to improve student performance. Another goal is to generate greater student retention of covered subject-related topics, thus ensuring adequate preparation to handle real-life situations that impact many lives. During the first semester of 2020, an experiment linked to a research project was carried out, in which the selected population were the Materials Resistance Course students at UdeM (University of Medellín). This academic strategy incorporates elements of virtual education and

active learning, specifically PBL (Problem Based Learning). This course is currently taught under the traditional method of master lecture and a set of individual written evaluations. A course improvement related to the student evaluation process is expected to take place based on a radical change in the teaching methodology and assessment-of-learning process, which includes the implementation of a constructivist approach geared to having students collaboratively solve work-related problems and are linked to the materials resistance area.

The above-mentioned initiative is also a good option to promote creativity and innovation, by implementing training processes that stem from the analysis and solution of contextualized problems. This article shows the design of the experiment, including the applied method, reporting details of each phase with the goal of providing information that allows replicating exercises of this type in other knowledge and application contexts. Partial results of the pilot study are also provided. This proposal seeks to reduce the loss and dropout percentages and, at the same time, strengthen the competencies of the students who take the above-described subject. The initiative is part of the project entitled "Adaptive Problem-Based-Learning Management Tool to Promote Collaborative Work in Virtual Courses at University Level", research co-financed by Colciencias (call 804-2018).

After the introduction, this article continues with a theoretical and conceptual framework in which some elements are specified, and the problem is explained. The method used to implement the PBL strategy is then explained in detail. The confirmation of the experiment is presented thereupon. Finally, some partial results are shown, as well as recommendations and the main conclusions drawn from the experiment.

## **2. Theoretical and Conceptual Framework**

This section addresses the concepts underlying this research and offers the reader elements for its understanding. New methodologies are currently being implemented for teaching hard sciences (engineering falls into this classification). Constructivism is one of the most used approaches. It refers to the student's active role in meaningful learning, the importance of social interaction in their training, and the solution of problems in authentic or real contexts [1].

The Materials Resistance Course is an integral part of any academic program in Civil Engineering. The topics offered in this course are cross-curricular to all civil engineering areas of knowledge and its main objective is to teach the fundamental concepts and theories on the structural performance and mechanical behavior of the main materials used in the construction of infrastructure works and buildings at the service of society. The course development includes the main physical-mathematical laws developed to date that explain the mechanical performance of the main materials used by the civil engineer, and at the same time students are taught to be able to interpret all those numerical values obtained from the different mathematical calculations derived from the laws that govern the mechanical performance of materials, and to develop greater sensitivity on the different types of failure of a deformable solid material.

Traditionally the materials resistance course is taught under master lectures where the teacher explains the properties of materials and demonstrates the formulas that guide their behavior in different scenarios. Students find the subject much more difficult to understand as they cannot find clear connections to their professional practice. It is in this respect where it makes sense to use active methodologies and the concept of constructivism, which materializes in Problem-Based Learning (PBL).

PBL is an active teaching and learning methodology, the process of which revolves around relevant and meaningful problems for students. These problems are explored in small working groups that are to arrive at a solution proposal [2]. This

teaching approach integrates theory and practice, while facilitating the student's development of skills to solve real problems typically found in their daily professional practice. In PBL, the student must assume an active position in society through significant contributions to the solution of needs [3]. As an alternative to PBL is project-based learning (the acronym of which is the same as PBL). It can be said that this is a modality of PBL, but a fundamental difference must be emphasized: PBL (problems) has its fundamental purpose in learning, a method to solve the problem and in the assimilation of the explored concepts. On the other hand, when the basis is the development of a project, the emphasis is on the conditions of the final product and the effectiveness of the intervention. In both cases, the connection that students have with reality and motivational aspects that lead them to undertake creative processes aimed at seeking solutions are common requirements. Taking into account that one of the proposals to intervene in the materials resistance course is based on the use of virtuality, a brief definition of this modality is made below. Virtuality is a different mode of education in which non-face-to-face interaction is privileged.

The teaching-learning process is mediated by ICT (Information and Communication Technologies), and more specifically by a technological platform [4]. Virtuality is based on the philosophy of asynchronism and non-concurrency, that is, it is not necessary for the individuals linked to the process to coincide either in time or space. In this type of training, a software generically called virtual education platform LMS (Learning Management System). is used as a means of interaction. LMS have a graphical and intuitive interface. Some of their features include: academic management and administration, course organization, calendar, organization of digital materials, activity management, student monitoring, assessment of learning, among others. Sakai, Moodle, Chamilo, Olat, Kuepa are examples of virtual learning platforms [5]. Seeking to offer customization options on LMS-type platforms, it is necessary to incorporate the concept of learning style, associated with the way students prefer or find it easier to learn. Learning styles according to the Kolb model are classified into four areas, according to experimental processes and knowledge classification, as follows [6]:

Converger: learning style related to people who have preferences for theoretical aspects and active experimental processes.

Assimilator: people in this field prefer learning based on the theoretical knowledge component with reflective experimentation.

Accommodator: learning style related to people who have a preference for practical knowledge and active experimentation, and Diverger is the style assigned to people who have a preference for reflective experimental learning combined with pragmatic knowledge. As it was mentioned in the introduction, the materials resistance course (civil engineering) currently has a worrying dropout and mortality rate at the University of Medellín. It is necessary to tackle these situations, by analyzing options to improve the rates, and also, develop greater motivation in students, who are currently aware of the importance of the subject in their professional training, but given the historical losses, they enroll with a high level of caution, and perhaps this negatively affects the results obtained. Another situation to tackle is the level of involvement of the students who are in front of the screens accessing the courses. It is necessary to identify their needs and preferences and design strategies so that they can achieve an active and leading role in their process.

### **3. Method**

The teaching method adopted for this experiment was PBL. Under this methodology, students go from the original statement of the problem to its solution, working collaboratively in small groups, sharing through this learning experience the

possibility of practicing and developing skills of analysis, writing, synthesis, observation, reflection, a sense of responsibility, and in general, appropriation of attitudes and values, great contributions in their training process [2].

The proposal to carry out the experiment entails having the students go through the following stages shown in Fig. 1. The teaching method adopted for this experiment was PBL. Under this methodology, students go from the original statement of the problem to its solution, working collaboratively in small groups, sharing through this learning experience the possibility of practicing and developing skills of analysis, writing, synthesis, observation, reflection, a sense of responsibility, and in general, appropriation of attitudes and values, great contributions in their training process [2]. The proposal to carry out the experiment entails having the students go through the following stages shown in Fig. 1.

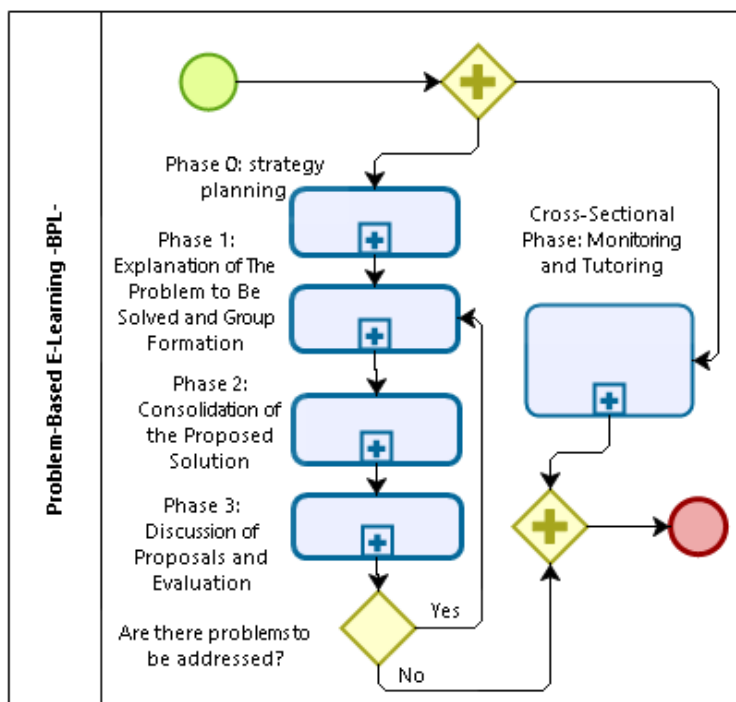


Fig. 1. Phases of the PBL method

The rest of the section explains the approach to each phase in more detail. During the phase 0, the implementation of ICT mediated Problem-Based Learning was done. For this purpose, the coordinator of the structures area (to which the materials resistance course belongs) had to establish the conditions at management level (Dean, Program Head) of this initiative, including a general endorsement to develop it, and a percentage of assessment admitted of all the work that the students would do in order to solve the problems that would unfold sequentially throughout the semester. The coordinator also drew up a first version of the schedule that was agreed upon with those in charge of the support technology platform, seeking to ensure that needs were met from the technology point of view, but also ensuring that problems would be released on a timely basis so that the students could have sufficient conceptual elements to be able to develop it. Once the work schedule had been defined and socialized, each teacher of the intervened course proceeded to design their course plan according to the new changes requested and the incorporation of

problems into the teaching process. All the teachers and the coordinator built a set of tools and rubrics to be able to evaluate the work. They also defined the number of problems that could be included based on the allotted time and the complexity of each topic.

It should be noted that when generating problems for each learning style (a variant included with the aim of offering personalization according to the needs of the students), the tutor also had to disaggregate tasks, maintaining coherence with the type of problem that each team was working on. Another interesting exercise consisted in analyzing the roles that the different team members should assume to facilitate group work, and equitably distribute all responsibilities. Along with the design of problems and challenges, a set of group and individual deliverables was also defined. The elements defined by the teachers were arranged in the virtual platform visible to the students. One problem was unfolded at a time, with a 2-week-time period for it to be solved. Below are the tools and rubrics developed to facilitate the assessment of the students' learning process.

Table 1. Solution Strategy Assessment Rubric

Criterion	Good (4)	Fair (3)	Poor (2)	Not presented (1)
<b>Relevance</b>	The proposed solutions take into account the required scientific parameters and the physical and social characteristics of both the population and the physical space and fully meet the needs demanded.	The proposed solutions take into account some of the physical and social characteristics of the population and space.	The proposed solutions are not physically or socially relevant or do not take into account the characteristics of the population to benefit.	No solution or solution strategy is presented.
<b>Viability</b>	The proposed solutions show enough elements to be considered not only viable but also possible to implement with the resources that have been proposed.	The proposed solutions show some elements that demonstrate their viability	The proposed solutions are not physically, scientifically or economically viable or do not demonstrate criteria that demonstrate their viability.	There are no proposed solutions or none of them show criteria that account for their viability.
<b>Solution algorithm</b>	The solution is well described and adequately represented with a detailed explanation where each step is less complex than the requested problem.	The solution is described with minor inaccuracies and represented with an explanation where each step is less complex than the problem.	The solution does not describe the functionality of the product or has inconsistencies that fail to address the problem.	It does not present a general solution algorithm
<b>Completeness</b>	It describes an explicit and clearly defined strategy for solving the problem. It involves analysis and synthesis from a wide spectrum of perspectives.	It generally describes a strategy for solving the problem. It does not involve analysis and synthesis from a wide spectrum of perspectives.	It does not adequately describe a strategy for solving the problem. It does not involve analysis and synthesis from a wide spectrum of perspectives.	It does not present a problem solution strategy. It does not involve analysis and synthesis from a wide spectrum of perspectives.

After, in the phase 1 the tutor raised a need that the students of the course should solve. Previously, a rigorous structuring of the problem was carried out according to the competencies that the students needed to develop, and each problem was broken down into a set of challenges that would be easily understood by the groups. The number of problems was prepared as defined in Phase 0. These statements would be displayed sequentially. Once the first problem is solved, the second will become visible, and so on until 6 problems are completed (this according to the course content and grouping topics in a coherent way). For each problem, 4 variants were prepared, one for each learning style. At the same time, the students had to register on the virtual support platform (KUEPA) and fill out the Kolb test to determine their individual learning styles. This would be the first input to feed the neural network that would determine team formation, since students with the same learning styles would be grouped together. It is important to note that team formation was randomly done only for the solution to the first problem. In the next 5, the virtual platform was in charge of setting up the groups, through the Artificial Intelligence engine. After this, each member chose their role within the team, seeking to enhance

skills, knowledge, assuming a role they were comfortable with and could contribute in a better way. The roles that each student assumed in their team were developed with the support of pedagogical experts and they are not part of the scope of this article. It is also worth mentioning that when the tutors structured the problem, they had to think of variants according to the students' learning styles. For this exercise it was decided to use the Kolb test, which proposes 4 types of learning (as was previously explained). Once these activities were sorted out, each team proceeded to plan the work during the time set up for each challenge, and thus the phase ends.

During the phase 2, as mentioned above, PBL must be implemented as group work. This is how all the students organized themselves into small work teams and began to exercise the role they assumed in the group, seeking to contribute to the solution of the problem from their strengths. For example, the brain made a general outline to guide all team members about their roles, implementation times, and the best way to address challenges. Meanwhile, the resource researcher searched for the essential concepts and themes in order to help all his classmates solve the assigned problem. It was also the task of this role to consult prices for the budget. Each role left evidence of compliance with their responsibilities on the platform. Each group, at this stage, must worry about organizing to be able to find the solution of the problems in the established time and with the established work schedule. This is how the workings of each deliverable began, each task according to the active roles, all aligned to achieve the common goal. In the regular follow-up meetings, the team evaluated the progress of each task, to determine improvement actions in case of delays due to group work-related dynamics. When the deadline date arrived, the tutor entered the platform to verify and review each deliverable provided by the teams and thus determine if the problem was solved. Fig. 4 shows the detail of the phase as already explained.

The phase 3 allowed to close the initiative. At the end of the period established for the problem to be solved, the teams deliver an artifact that includes the solution. The artifact delivered depended on the learning style detected. For some it was a pitch-type presentation, for others it was a pre-recorded video, for others, it was a poster. Additionally, each team had to submit a report of maximum 5 pages with a summary of the entire experienced process. With this information, the tutor began to assess the work of each team from a set of rubrics created and made available for this purpose. The assessment process was done from three perspectives: self-evaluation, co-evaluation and tutor evaluation.

Fig. 1 mentioned a Cross-Sectional Phase: Monitoring and Tutoring. This stage takes place from the very moment that all interaction between tutors and students begins with the respective formation of teams. A new role called "facilitator" is incorporated for the follow-up process. The facilitator's main responsibility was to be aware of the questions that came up within the groups related to platform management, and problem-solving organization.

The facilitator also served as a liaison between students and teachers. This was due to the large number of students per course, which made it difficult for teachers to closely accompany all groups in solving the assigned problems.

Throughout the experiment, the facilitator had time allotted for counseling, which was virtual at all times due to the situations generated by the pandemic, among others. The doubts were also solved on demand, that is, if a group had a specific concern, they could contact the facilitator for advice. In the event that the facilitator did not have enough elements to solve it, it was directed to the course teaching staff. As part of the follow-up, the facilitator also participated, together with the tutors, in the evaluation of the groups.



## 4. Experimental Design

The method explained in the previous section was applied to 130 students of the Civil Engineering Materials Resistance Course. This subject is taught in the third semester. Regarding sex, 25.38% are women, while 74.62% are men. Regarding educational background, 50% have a bachelor's degree, 40.5% a master's degree, 7.1% a high school diploma, 0.6% a PhD, and 0.6% a vocational/technical certificate. Only 1.2% of the population did not report information. Regarding age, a minimum of 19 and a maximum of 31 years old. Groups of 4 to 5 members were formed, using the roles already specified. The selection of the sample responds to a non-probabilistic sampling, the fundamental criterion of which consisted of belonging or not to groups of the Materials Resistance course in the period 2020-01.

For the deployed experiment, 6 problems were designed for each learning style, for a total of 24 problems. They were scored by three types of evaluators: students, peers and teachers through a rubric of specifications that allowed standardizing and having an objective measurement of the performance of those being evaluated. In this sense, for the rubric design, the evidence-based model was used, which allowed the construction of the specifications in the form of a waterfall, progressively descending to higher levels of detail in each of the aspects.

In particular, an aspect is considered good (4) if the student performs well and the quality of the work was good; fair (3) indicates that the student meets the performance but has conceptual and procedural errors; poor (2) means the student does not achieve the performance and the quality of the work has serious conceptual or procedural errors; and (1) if he/she does not achieve the performance or does not present the aspect. By way of monitoring the rubric, the percentage of agreement was calculated, which consisted of the quotient of the sum of the agreements among all the evaluators over the maximum possible of the agreements among all the evaluators. Finally, to classify the students to previously designed and classified problems, the K-means method was used because it is very fast and not very demanding regarding machine resources. On a practical level, the classification methods act as indispensable complements of the factorial axis methods, allowing the exploration and description of the structure of the data in a satisfactory manner. This method has two drawbacks: the number of classes and the starting points for those classes have to be provided; and the optimum depends on the initial points, that is, it is a local optimum, which may be far from the global optimum. At the end, the sorting method must classify the problems that will be presented according to the vector of the students' scores and their score vector presented in their learning style obtained from the Kolb test.

## 5. Results

In this section some partial results are reported after the execution of the experiment. The gender distribution of the participants is shown in Fig.7.

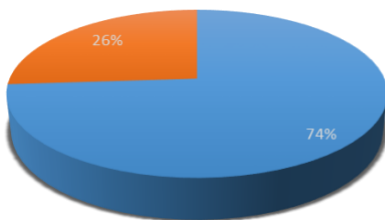


Fig. 7 Gender distribution of the participants in the pilot

Diagram on Fig. 7 shows the survey result of a total of 234 students, 173 are men, which is equivalent to 74% of the total sample and 61 are women, which is equivalent to 26% of the total sample. In the graph, it is obvious that the average values for the 2020 semester1 are comparatively higher with respect to the other two academic periods. The results indicate that the mean of the period 2019/1 presents an average of 2.30, in 2019/2 of 1.83 and in 2020/1 of 3.03 ( $F = 14.015$ ,  $p\text{-value} < 0.00$ ). In addition, a Tukey HSD test was performed to check which pairs of academic periods present these differences in the final grades. It was found that there are differences in means between the academic period 2019/1 vs 2020/1 and in 2019/2 vs 2020/1, both with a  $p\text{-value} < 0.05$ .

As mentioned in the method section, one of the first steps was the diagnosis through the Kolb test of each student’s learning style. The following Table 5 shows the mean and disaggregated standard deviation for each of the learning styles: accommodator, assimilator, converger and diverger. Also, for each dimension of the test: concrete experience, reflexive orientation, abstract conceptualization and active experimentation. Thus, the group corresponding to students with an accommodating learning style obtained higher scores in concrete experience with a mean of 82.70; the assimilating group in the reflexive orientation dimension with a mean of 71.19; the converger presented the lowest average in the active experimentation dimension with 48.08 and the diverging style presented the lowest average in the concrete experience score with 56.25.

With each of the test scores obtained by participating students, a problem-based learning strategy was presented every two weeks, which allowed participants to interact with problems designed with the characteristics of each learning style. In order to evaluate in a unified way each one of the previously designed problems, teachers, co-evaluators and the students themselves evaluated their own performance from the scoring rubric. This rubric was subjected to a percentage of agreement analysis in order to ensure that the evaluation instrument was properly calibrated.

In general, it can be stated that the percentage of agreement consists of the quotient of the sum of the agreements among all the evaluators over the maximum possible of the agreements among all the evaluators and where percentages of agreement greater than 70% and less than the 95% are expected. The following table shows each of the percentages of agreement that indicates the degree of agreement of all the evaluators corresponding to each of the aspects of the rubric. Therefore, it can be stated that the degree of agreement is higher than 87.81% in all aspects of the rubric, with an average rating of around 3.53 and a standard deviation between 0.926 and 0.941.

Table 5. Mean and standard deviation of each dimension of Kolb test disaggregated by learning style

Learning Style	$\bar{x}$	$\bar{x}$	$\bar{x}$	$\bar{x}$	Sd	Sd	Sd	Sd
	Concrete	Reflexive	Abstract	Active	Concrete	Reflexive	Abstract	Active
Accommodator	82.70	48.17	53.57	65.52	8.40	7.49	8.50	8.82
Assimilator	57.40	71.19	70.98	50.43	12.92	9.03	7.11	11.02
Converger	80.36	66.39	55.17	48.08	7.21	9.30	9.94	7.52
Diverger	56.25	57.02	67.54	69.19	9.89	7.95	10.28	13.64

Therefore, it can be concluded that the rubric presents excellent indices of agreement among the evaluators and constitutes an essential instrument for the evaluation of PBL (Problem-Based Learning) in virtual environments.

On the other hand, a grouping strategy was used so that different classes would gather the learning style of each student according to the grades obtained in the assigned problem. This strategy sought to find which would be the platform assignment that should be presented to the student given their accumulated performance in the problems presented and the scores obtained in the Kolb test. In statistical terms, a multiple correspondence analysis was performed for the defined variables (qualification of the rubric aspects and scores of the Kolb test). Then, from a hierarchical classification based on a mixed algorithm, which includes the Ward method and K-means grouping, four classes or groups of students corresponding to the four types of learning styles were identified. Thus, Table 6 shows the factorial plane corresponding to students and centroids of each of the problems identified by their learning style. For example, in the case of group 3, the group of students assigned in the second "convergent" type problem is identified in blue and in the center of the group with the figure of a square of a slightly larger size the centroid of the "convergent" problem is located. Group 1 or cluster corresponds to the accommodating learning style, group 2 to the assimilating and group 4 to the divergent style.

Table 6. Disaggregation of the percentage of agreement for each aspect of the qualification rubric

Aspect	% Agreement	Average	Deviation	Aspect	% Agreement	Average	Deviation
Scientificity	88.05%	3.52	0,936	Completeness	88.15%	3.3	0,941
Clarity	88.02%	3.52	0,941	Communication	87.81%	3.51	0,931
Originality	88.17%	3.53	0,938	Group work	88.25%	3.53	0,935
Relevance	88.06%	3.52	0,937	Viability	88.28%	3.53	0,926
Results	88.27%	3.53	0,943				

## 6. Conclusions and Future Work

One of the fundamental objectives in the training of professionals is to prepare them to face real problems in the business, teaching environment, or in any area where they wish to project themselves in the future. In this sense, the learning strategies that integrate theory and practice in addition to facilitating in the student the development of abilities to solve problems, enhance attributes such as independence, critical sense, innovative and investigative thinking and active position in society through significant contributions to the solution of needs [5].

Within these unconventional strategies, the one known as Problem-Based Learning (PBL) has managed to position itself as an effective strategy in the university environment. Thinking of improving the mortality rates of the Materials Resistance Course, the support of virtual learning platforms will also be incorporated to facilitate group interaction scenarios to solve the problem. During the design of the strategy, there was evidence of great potential for integrating PBL with the use of technologies.

Another preliminary conclusion is that master lecture-type passive learning generates less involvement of the student in their training process, which is why they cannot acquire all the necessary skills to apply the covered concepts. Having a sense of commitment to solving a real problem can impact the motivational factor, and the results can improve.

By doing an analysis on the development of the problems by the teams, in a differentiated way according to the learning style, it is possible to show that the students' performance improves significantly. During the co-evaluation carried out by the members of each team, points of improvement were detected, especially from the point of view of becoming aware and not grading well those who did not do the

assigned work. As future work, it is proposed to carry out an exhaustive analysis of the data obtained from the pilot and to find points for improvement with the intention of replicating the experience.

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# Applying remote photo shooting technology in ballet photography

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[https://doi.org/10.33847/2712-8148.3.2\\_5](https://doi.org/10.33847/2712-8148.3.2_5)

Received 21.10.2022/ Revised 15.11.2022/Accepted 23.12.2022/Published 27.12.2022

**Abstract.** This paper focuses on the topic of remote photo shooting technologies in photography. An attempt was made to analyze various methods and applications for photography during a pandemic and choose the best one. This article discusses the most effective solution from the point of view of my own project named Dance&Nature. Author took into account his experience and results and tell about it. The paper draws a simple and clear conclusion about the best set of functions and the quality of the result in terms of acceptability and convenience for the photographer.

**Keywords:** ballet, ballet photographer, photography, remote photo shooting.

## 1. Introduction

We all know very well that during the pandemic, the need to continue working has become acute. At the same time, it was necessary to be at a distance from customers, partners, colleagues. Some companies that are not associated with the production of a material product quickly adapted to this way of working and began to use actively remote technologies. Probably, IT, consulting, the financial sector and some other areas have adapted to this most quickly. All working meetings, discussions, conferences have moved to online services - in Skype, MS Teams, Google Meet, WhatsApp, FaceTime, Zoom. Exactly the same thing happened with personal contacts. Everyone who wanted and could do it switched to online communication.

It is difficult to imagine the process of creating photo content online, but still, many publications and photographers began to look for opportunities to continue cooperation and work through remote technology and remote photography. As a result, all possible options were tried and, probably, everyone was able to choose something of their own that suits them best. Author considers some of himself options and tell in more detail about the technology that was chosen and used for the photography project.

## 2. An overview of photo capture options using public conferencing systems

The very first thing that photographers tried to use was applications for individual or group teleconferencing, namely Skype, Google Meet, Google Duo, WhatsApp, FaceTime, Zoom and other similar systems.

When the corona virus pandemic began, author also had a question what to do next and whether it is possible to come up with something under these conditions. Author must say that at some point shooting was almost completely stopped as well as watching the outside world. Sometime later, author heard that some photographers began to shoot remotely. Then author also tried to figure out what applications he can use to switch to the online shooting format. Almost immediately, author thrown aside all online conferencing apps because the picture quality or the quality of the screenshots that some of the apps (Skype, for example) did not allow to satisfy me. Author also abandoned the option where you re-capture the computer screen with your camera and get the supposedly high-resolution image that the

camera can provide. Author was familiar with this method of photography for a very, very long time, when in the 70s was took pictures from the TV screen for my sister (to shot theater and TV idols for her). Yes, you can take pictures in any of these ways, but only if you yourself are ready to put up with the poor quality of the final image. However, at the same time, as it was said above, author had to take a break from filming, because during the epidemic author refused to attend theaters and events. Author periodically returned to real shooting only when the wave of the epidemic subsided to a minimum.

Periodically, author returned to the process of researching the situation around online photography. Author continued to get acquainted with different approaches to this process by reading publications of photographers and technical specialists. Photographer Maria Ionova-Gribina shares her experience and says that there are only three main ways to shoot online: you can take a screenshot, use the Live Photo function in the FaceTime application (only when shooting on iPhone and Mac) or take the screen of a tablet, laptop or computer to a professional camera. Each photographer chooses the method that is convenient for him [1, 2]. We can agree with this, but only in part, since there are other applications besides FaceTime that provide similar capabilities. However, the quality of all of them is about the same - not very high.

It makes sense to briefly talk about the pros and cons of taking photos using some of these applications.

### **2.1. Taking pictures with Skype**

Of the advantages of this application, we can only highlight that it is very simple, many people have already used it in their practice and inside Skype there is an opportunity to take a picture during an online session. The app provides a dedicated button to perform this action. I must say that in earlier versions of Skype it was possible to control the quality (resolution) of the final picture, and to choose the size of the final picture. However, later this option disappeared from Skype and the quality of the pictures was made quite low. The pluses include the fact that a screenshot in Skype is obtained without overlaying the photographer's image on the model's photo. The main disadvantages are the poor quality of the picture and the inability to control the photo parameters from the main screen during work. Opportunities for managing camera parameters are available only through the settings (which means that it is impossible to change them quickly, because you need to make at least a few clicks to get into the settings mode). The quality of the picture is greatly affected by the quality of the Internet connection, as with many other teleconferencing applications. At one time, author used the "snapshot" function only to take a photo of who are in author's phone book contacts.

The webcam settings in Skype are described in some detail in publication [3]. In order to make direct settings for the selected device, click on the "Webcam Settings" button.

In the settings window, you can adjust quite a few parameters - brightness, contrast, hue, saturation, sharpness, gamma, white balance, backlight, gain, and color of the image that the camera broadcasts. Most of these adjustments are made by simply dragging the slider to the right or left. Thus, the user can customize the image transmitted by the camera to his taste. However, on some cameras, some of the settings described above are not available.

### **2.2. Taking pictures with Google Meet**

Perhaps only one thing can be attributed to the pros is the simplicity of the application. By cons - the inability to control any parameters of the process of photography. Author practiced this method for photographing the participants of a online conference, which was organized by the Institute of Certified Specialists. The

disadvantages are the same - the inability to control any camera parameters in the process of taking pictures. As well as the influence of the quality of communication on the quality of the picture.

Similar conclusions can be drawn for other applications such as Zoom, FaceTime, Google Duo, and others.

Slightly better photo quality is obtained when using Face Time in Live Photo mode. The influence of the Internet is excluded. However, the resolution of the photo is still lower than that of the camera on the phone.

More detailed aspects of photography through Facetime, Zoom, Google Duo and others can be found in the publication of Oleg Lyubarsky [4].

### 3. Remote photography with professional applications The Shutter App and Clos

After a long search for applications that give a better resulting image output, author managed to find two new applications that appeared during the epidemic. These applications are designed in such a way that at the output we get photos in the highest quality that a mobile phone can give. Author review only one app, The ShutterApp, because it was author's choice. The reason for choosing ShuttarApp is quite simple. This application, unlike the Clos application, works on both type of smartphones - Android smartphones and iPhones. While Clos only works on the iPhone, which greatly limits the possibilities of the photographer.

As we know, modern phones have very good parameters for the size of the resulting photos. Here is just a small list of some of the flagship phone models (December 2021) with the number of cameras and their parameters.

Table 1. Smartphones digital cameras' parameters

	Phone model	Main cameras	Front-camera	
1	Apple iPhone 12	Ultra wide angle Wide angle	12 MP 2x F/2.40 12 MP F/1.60	12 MP
2	Apple iPhone 12 Pro	Ultra wide angle Wide angle Telephoto	12 MP 2x F/2.40 12 MP F/1.60 12 MP F/2	12 MP
	Apple iPhone 13 Pro	Telephoto Wide angle Ultra wide angle	12 MP F/2.80 12 MP F/1.50 12 MP F/1.80	12 MP
3	Samsung Galaxy S21	Telephoto Wide angle Ultra wide angle	64 MP F/2 12 MP F/1.80 12 MP F/2.20	10 MP
4	Samsung Galaxy S21 Ultra	Wide angle Ultra wide angle Telephoto	108 MP F/1.80 12 MP F/2.20 10 MP F/2.40 10 MP F/4.90	40 MP
5	Xiaomi Mi 10T Pro	Main camera Ultra wide angle Macro	108 MP F/1.69 13 MP F/2.40 5 MP F/2.40	20 MP
6	ASUS Zenfone 8	Wide angle Ultra wide angle	64 MP /F/1.80 12 MP F/2.20	12 MP
7	Sony Xperia Pro-I	Main camera (50 mm) Wide angle (24 mm) Ultra wide angle (16 mm)	12 MP F/2.4 12 MP F/2.0, F/4.0 12 MP F/2.2	
8	Honor 50	Main camera Wide angle Bokeh sensor Macromodule	108 MP F/1.9 8 MP F/2.2 2 MP F/2.4 2 MP F/2	32 MP (F/2.2)

		Older Honor model	
9	Honor 9 Premium	12 MP F/2.2 20 MP F/2.2	8 MP
DSLR and Mirrorless professional photcamera			
10	Canon EOS 5D Mark III	22,3 MP	
11	Canon EOS R5	45 MP	

Older premium model of Honor phones and a Canon EOS 5D Mark III DSLR camera added to Table 1 for a comparison, since it still uses to shoot. It also included Canon's latest digital full-frame camera, the Canon EOS R5.

Table 1 clearly shows that some models of new phones are already ahead of professional cameras in terms of resolution. Perhaps the only big disadvantage of all phone cameras is the high depth of field of the entire image and the almost complete absence of the background blur effect.

### 3.1. The Shutter Application

The Shutter App platform includes two components. The first one is a portal for photographers that runs in a web environment on a computer (Fig. 1-4). The second part is a client application that is installed on the phone of the model and can work both on the iPhone running the iOS operating system and on smartphones running the Android operating system (Fig. 5).

After installing the application on their phone, the client launches it and receives a unique ID for their device (Fig. 5). Further, the client informs the photographer in any way of his ID number. The photographer enters the client ID on the portal, where he starts a new photo session with his client (Fig. 1-4). As soon as he does this, a request appears on the client's phone to start a photo shoot. By confirming this request, the client thus allows the start of the photo session. After that, the actual photography process begins.

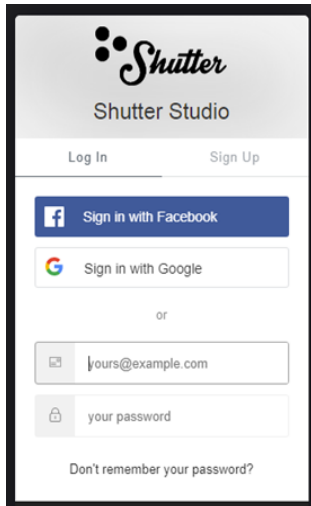


Fig. 1

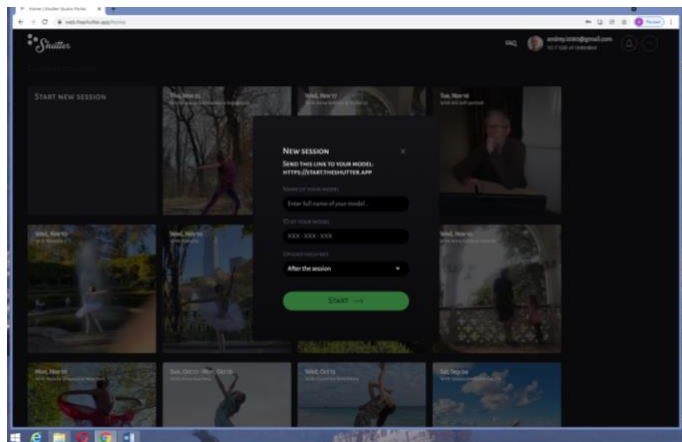


Fig. 2



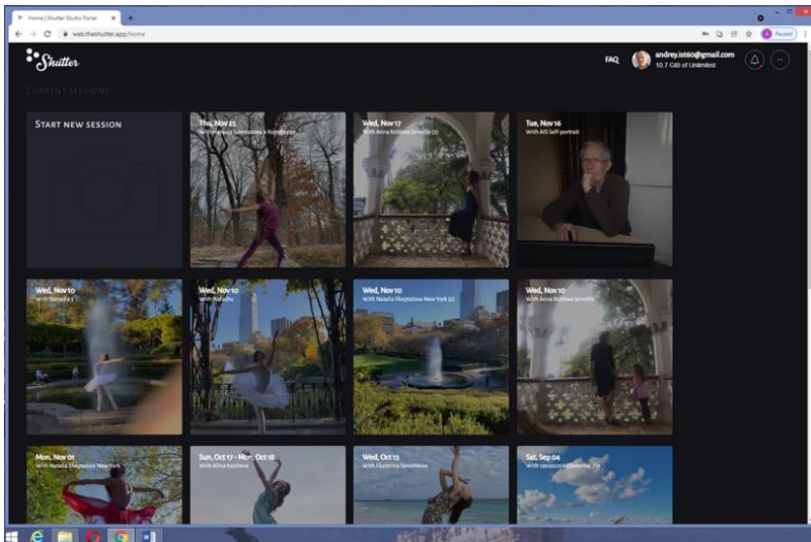


Fig. 3

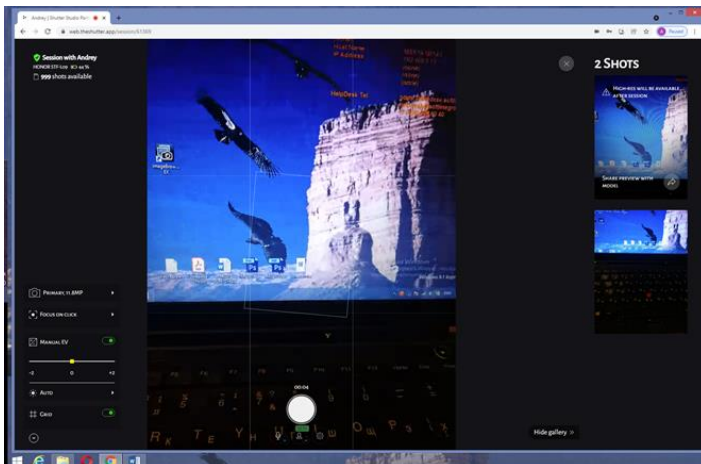


Fig. 4

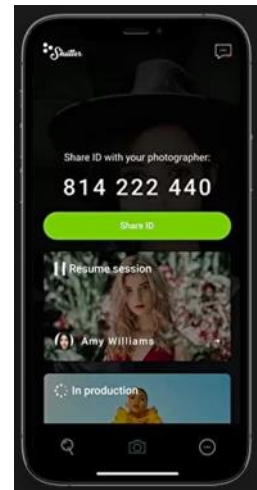


Fig. 5

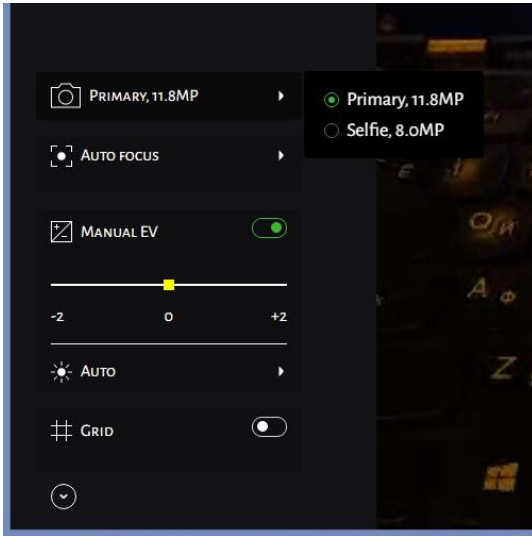


Fig.6

In the following pictures you can see the basic camera settings and shooting control options in ShutterApp (Fig. 5-8).

Before shooting and further in the process of shooting, it is possible to select one of the cameras that the mobile phone is equipped with (Fig. 6).

This is especially true for the latest flagship smartphones, which have up to four different cameras installed. In this case, the photographer has an extensive choice between standard optics, wide-angle and telephoto. In essence, this becomes similar to the ability to change and install various interchangeable lenses, as is done in professional cameras (Fig.6, Table 1).

The photographer can also choose the focus mode, choosing manual focus on a point that he himself can indicate with the cursor on the screen, or autofocus mode (Fig. 7). In addition, the photographer can control the camera exposure, changing it up or down, depending on the lighting conditions by moving the yellow slider (Fig. 6-8).

Another very important feature for photographers - white balance control. Options can be, as on many cameras - auto, incandescent, fluorescent, daylight, cloudy (Fig. 8). You can also turn on the grid mode in the frame to better track the correctness of the framing vertically and horizontally and to build frame proportions. In the paid version of the application, there is also a choice by the type of resulting image. It can be done in either JPG or RAW format.

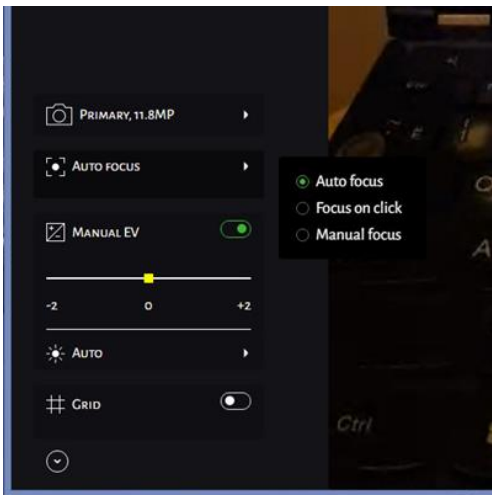


Fig. 7

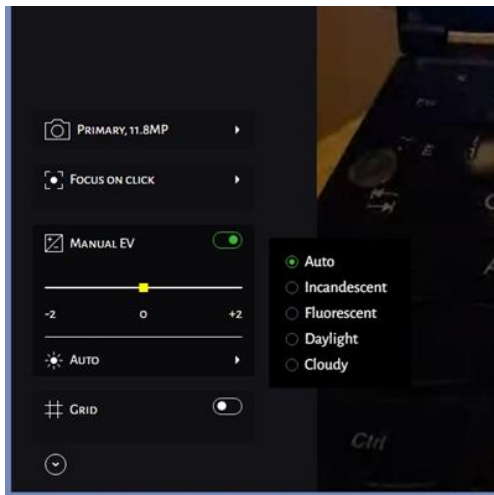


Fig. 8

During the photo session, the photographer sees his model through her phone camera and can communicate with her by voice over the speakerphone. The

quality of the Internet signal does not affect the result, but only affects how well the photographer sees his model. By pressing the shutter button, the photographer, as in the usual process, takes a picture of his model, which is immediately placed in the tape of captured photos and can always be viewed in preview mode. At the same time, the preliminary images are small, but this is enough to make a preliminary assessment of the photo.

During this process, the photographer has the opportunity to quickly send a preview of the photo to the model's phone so that she can look at the result and discuss any adjustments for further photography with her. This option is quite useful and allows you to correct the process of taking pictures from two sides.

The captured frames are first recorded on the model's phone and are not available to her for viewing. Upon completion of the photo session, the frames obtained as a result of the shooting are transferred to the portal in the photographer's account. Where the photographer can immediately view the photos and sort them by removing bad shots. Moreover, download all the good shots to your computer and work on with them, as he always does.

Once the resulting photographs have been selected and are ready to be passed to their model, this can be done in a number of ways. You can upload photos to the portal in the section of edited photos. Then the model will see the pictures in the ShutterApp application on her phone (Fig. 9). On the other hand, you can transfer pictures in any other way bypassing the ShutterApp application.

The photographer also has the opportunity to create their own portfolio in ShutterApp and share it with their clients.



Fig. 9

#### **4. Remote photo project Dance&Nature**

The "Dance&Nature" photo project was born as a response to the challenge of the time when photographers were forced to look for new ways to work during the corona virus pandemic. It was born because of love for the beauty of nature, as well as for the beauty of human, which is best expressed through dance, movement, sports. Even the ancient Greeks long ago praised the beauty of the human body. Remember, for example, the statues of David or Venus de Milo.

For many years author shots only one nature and it was liked. When you see a landscape, it puts you in a certain mood. It can calm you down or, on the contrary, add bright colors and impressions. Moreover, it can even lead to indescribable delight. We are all familiar with this from early childhood. The language of nature is simple and understandable, you just need to learn to feel and catch it.

Much later, author became interested in filming dance. I spoke in detail about my immersion in ballet photography in an article in the first issue of the Journal of Digital Art and Humanities [5]. Shooting classical ballet or modern dance, author realized that these are not just beautiful movements and forms, but a certain language of dancers that they use to communicate with the world. A dancer can express a lot through the language of dance, and sometimes even tell a whole story. In author's view, this project combines the most beautiful thing that surrounds us from the beginning of our life to its very end - Human and Nature. And author wanted to combine all this in one frame so that the language of nature and the language of dance would speak together about the same thing - about beauty, about love, about our feelings, relationships, experiences, aspirations, about the fight against evil, freedom of spirit and about many other things.

The impulse that pushed this project was the publication of my photographs in Dozado Dance Magazine - "Rocio Molina descended from heaven and Russian autumn motifs. Andrey Stepanov's photo gallery" [6]. Author is grateful to the editor of the magazine Svetlana Polskaya for the idea to combine the pictures of flamenco and Russian nature in one publication. It was long wishing to combine these two themes of author's work. For publication, author spent a long-time selecting shot with the world-famous flamenco dancer Rocio Molina, whom author shot in Moscow, and shots of nature. Photographer liked the colors of the landscapes to echo the mood of her performance, which she gave at the Russian Song Theater as part of the Viva España festival. Here are just a couple of examples of how it was done for the article (Fig. 10-15).

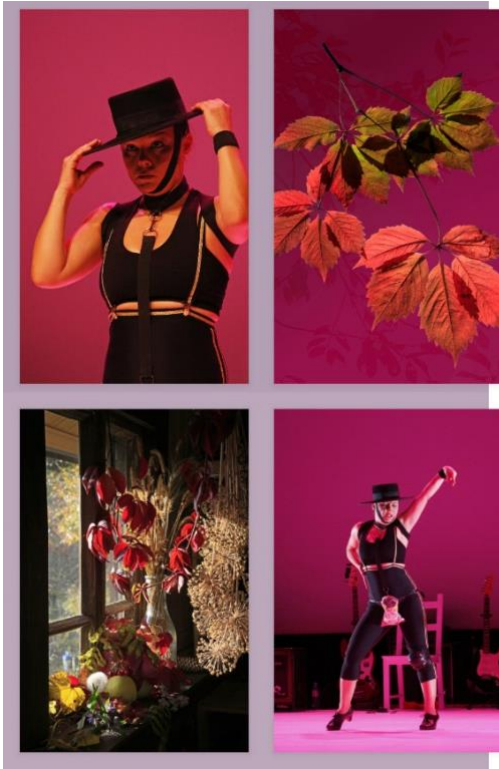


Fig. 10

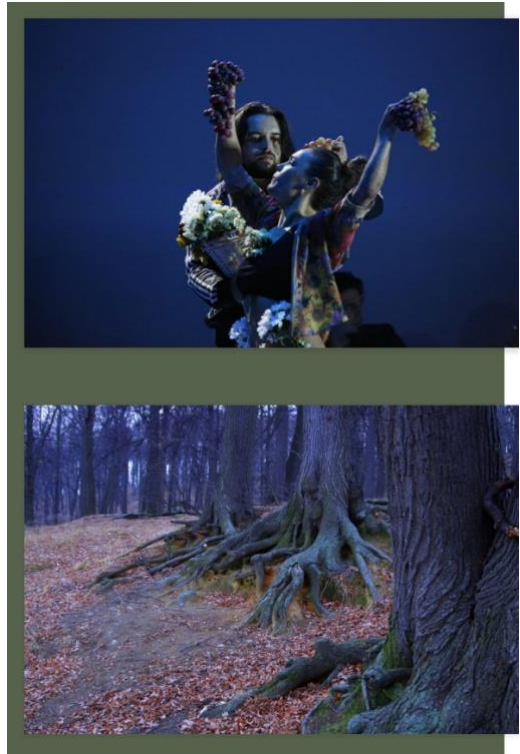


Fig. 11



Fig. 12

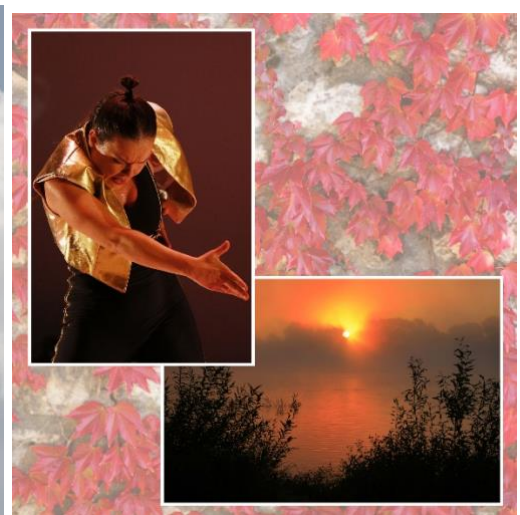


Fig. 13



Fig. 14



Fig. 15

Then came the idea of making collages. This is also an interesting option, but rather time-consuming and complicated. As a result, sometimes such works made in different collage techniques began to appear (Fig. 16-18).



Fig. 16



Fig. 17



Fig. 18

Subsequently, the ShutterApp application was found, and then author got remote sessions for dancers and, in fact, the Dance&Nature project appeared and finally took shape. The first remote photography was carried out on the Kurisches Sand Bar, in the Maldives, in Sudak, in Gagra, in New York (USA), in Joinville (Brazil), in Hartford (USA), in Spain, Slovakia and others places (Fig. 19-38). My friends in social networks learn about the project and express their desire to participate in it. Many dancers are very busy in the current theatrical season, so some photo shoots are postponed for the future. Many plans and agreements have been formed for new photo shoots, which author was slowly implementing. The project is designed for a rather long period - it began at the end of 2021 and will continue throughout 2022 and possibly longer. Below are some shots of this project.



Fig. 19



Fig. 20



Fig. 21



Fig. 22

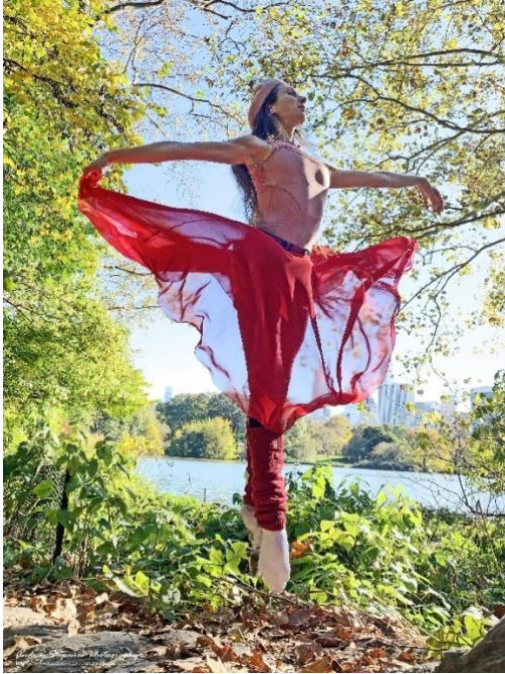


Fig. 23



Fig. 24



Fig. 25



Fig. 26





Fig. 27



Fig. 28



Fig. 29



Fig. 30



Fig. 31



Fig. 32



Fig. 33



Fig. 34



Fig. 35



Fig. 36



Fig. 37



Fig. 38

Below is the brief information about the pictures (Fig. 10-29) - the location of the shooting, the idea of shooting. More detailed information about the idea of each shooting can be found in the social network account VKontakte [7].

Fig. 19-20. Russia, Kaliningrad region, Kurisches Sand Bar. Conversation with the wind.

Fig. 21. Abkhazia, Gagra. The delight of free flight.

Fig. 22. Russia, Moscow, Zaryadye Park. In the country of birch chintz. Unity with nature.

Fig. 23. USA, New York, Central Park. In search of nature in the big city. Free flight.

Fig. 24. Russia, Moscow. In search of nature in the big city. In dialogue with nature and oneself.

Fig. 25-26. USA, New York, Central Park. In search of nature in the big city. Mood - Autumn in New York.

Fig. 27. Russia, Republic of Crimea, Alushta. Free flight before sunrise.

Fig. 28. Russia, Moscow, Zaryadye Park. In search of nature in the big city. The delight of communicating with nature in the city - a natural green oasis under a glass dome.

Fig. 29. Spain, beach under the Barsezona. In dialogue with the wind.

Fig. 30. Germany, between Mannheim and Ludwigshafen. At sunset, on the banks of the Rhine. Farewell to autumn.

Fig. 31. Slovakia, Bratislava, on the banks of the Danube. Privacy. Dialogue with the outgoing autumn.

Fig. 32. Russia, Republic of Crimea, Alushta. In dialogue with the sun.

- Fig. 33. Russia, Moscow, Filevsky Park. Dialogue with the enchanted forest.  
 Fig. 34. Russia, Republic of Crimea, Alushta. Ode to the sun.  
 Fig. 35. Russia, Krasnodar region, Adler. Dialogue with southern nature. In search of the main and secret.  
 Fig. 36. USA, suburbs of Hartford. Last leaves. Dialogue with the outgoing autumn.  
 Fig. 37. Russia, Krasnodar region, Adler. Return to the origins of nature.  
 Fig. 38. Spain, Lake Salinas de Torrevieja. Melt from the heat. In the blue ocean - between the sky and the lake.

## 5. Conclusion

Studied project will exist in all three versions - photosets, collages and shooting directly in nature. Moreover, the latter option will exist mainly in a remote format, and only in Moscow it can be ordinary photo shoots.

Remote photography technology helped author to expand the geography of project and erase the boundaries. Using this technology, author can now shoot nature and dancers anywhere in the world where there is a mobile connection. This opened up new opportunities in virtual travel around the world and in new acquaintances with interesting dancers around the world, including the vast territory of Russia.

The project is non-commercial and has no boundaries. In addition, it seems that it has already become gradually international. Dancers from all over the world can participate in it thanks to the technology of remote photo shoots.

Author welcome people who has their own idea and who has something to tell other people through their art of dance. Together with models, author tries to choose a place where our general idea will sound the most powerful and convincing, where the dancer can fully associate himself with nature.

## Acknowledgments

Author is grateful to Dozado Dance Magazine, which expressed its willingness to support my photography project. The editors of the magazine intend to publish the best photo stories captured in frames in the magazine in my personal column. Also, as a result of the project, it is planned to organize a photo exhibition in the future.

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# Digital Transformation of Church Services and Fundraising in Cyprus

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[https://doi.org/10.33847/2712-8148.3.2\\_6](https://doi.org/10.33847/2712-8148.3.2_6)

Work in progress

**Abstract.** Nowadays Cyprus does not have academic traditions in Theology at the institutional level that go back that long. The argument put forward in this paper is that, there is not so many of theology around Cyprus, which has never been acknowledged. The jury is still out as to whether we can speak of Cypriot theology schools, derived from the conjuncture of global, regional and local factors and the dialectic of social/geopolitics, with the exception perhaps of the Cypriot strands which primarily address identity issues. In any case, theology has long transcended national or ethnic boundaries, but location and rooting still matters, as it provides perspectives from specific vantage points. We can see that trends derive from different traditions, and they have always been connected to and have co-existed with global or regional tendencies, although not necessarily peacefully with or in recognition of each other. This paper considers the development of Cypriot churches toward the use of digital technology in worship and fundraising. In the case of religious organisations, at first glance, support from their followers is the most obvious resource. However, the resources of a religious organisation are not limited to its electoral capabilities. It should be borne in mind that well established Cyprus churches have significant influence on the economic and social sphere, acting as a beneficiary or co-owner of economic enterprises and a founder of socially significant organisations (e.g., hospitals, schools, universities, colleges, charitable foundations, and orphanages).

**Keywords:** Theology, Cyprus church, fundraising, digital transformation.

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95a Lunacharskogo str., Perm, Russian Federation

**Journal URL:** <https://ics.events/journal-of-digital-art-humanities/>

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