

# Digital Twin of an Educational Institution: An Innovative Concept of Blended Learning

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**Abstract:** The actuality of this work lies in the fact that it features and singles out the problems occurring in organization of educational process during the period of forced breaks and formed needs of information society. It highlights the necessity of introduction of blended learning used to support the educational process continuity and to ensure the formation of motivation and interest of students/learners in process of knowledge acquirement. It shows the need to update the educational environment in conditions of digital prototype of educational institution, created in order to provide quality knowledge and ability to build an individual development trajectory for each learner. For the first time the use of state-of-the-art Digital Twin (DT) technology has been proposed to build a digital prototype of educational institution. It is shown that this technology is quite actively used in various fields. An analytical review of successful DT practices and clarification of problems caused by COVID-19 quarantine leads to the conclusion that DT can be used effectively in slowing down and limiting the spread of the disease, as well as preparing for possible long-term disruption of school attendance by learners. It is assumed that the usage of DT for each educational institution requires the creation of authentic digital environment (web environment) aimed to support the educational process in blended learning format and based on integration of traditional teaching aids and digital resources. It is justified that the involvement of DT in education will logically combine physical and digital spaces as well as functional components of each educational institution and create their digital prototypes, which will actually function as dynamic and open web resources. DTs open to all participants of educational process the opportunity to obtain quality results in any circumstances that may be dictated by the society, while maintaining the integrity of educational system and pedagogical values of each educational institution.

## 1 INTRODUCTION

The experimental process of urgent introduction of distance learning technologies in 2020 became global, with forceful involvement of educational institutions (EI) all over the world quickly entering the digital world. It is already clear that this process has launched an innovative path in the development of educational systems in all countries. In the nearest future, distance learning in various formats will be improved and gain capacity. Which, in turn, will lead to

changes in popular traditional teaching methods and approaches or to total reformation of educational systems in general – digital technologies (DT) continue to transform modern classrooms, teaching methods change according to expectations and learning styles and interests of students/learners.

Referring to DT potential in the field of improvement of teaching and learning, alongside with increasing access to information and data management coordination, the researchers claim that rapid changes will force most EIs to either adapt or cease to exist (McCluskey and Winter, 2012).

Analytical research shows that forced disruption of educational process caused by COVID-19 quarantine has become a powerful stress-test for educational systems around the world; this disruption, as a “vor-

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tex” event, also gave them the impulse to elaborate alternative long-term education development plans. After all, we realize that the educational process and cooperation of its participants may no longer be carried out in the traditional format. It is known that the COVID-19 pandemic has closed educational institutions around the world, and the UNESCO report dated March 18, 2020 stated that “more than 899 million young people were affected” (Otsu, 2020). It is noteworthy that as of March 24, 2020 various countries have already developed the emergency plans including the following:

- continuous provision of information and training related to virus spread and impact (France, USA, Italy);
- creation and training of working groups consisting of counselors and teachers to support parents and pupils / students (USA);
- deployment of online classes (China, Singapore);
- training of teachers and directors (EI) for remote work (Italy, United Kingdom, China).

Some countries, as soon as in March 2020, have provided for future backup plan of educational institutions closure, both at the national level (e.g. China, Italy, Korea, Japan), regional level (e.g. France, Germany, Portugal, Spain) and narrow specialization level (e.g. USA, United Kingdom). The Estonian Ministry of Education put forward the idea of cooperation with neighboring countries and free exchange of information resources on the Internet with the world. With participation of three Baltic States, Latvia and Lithuania, as well as northern Denmark, Finland, Iceland, Norway and Sweden, more than 40 online learning solutions were collected. At the end of March, there was also held a webinar for parents from Estonia on the subject how to approach home schooling organization (Otsu, 2020).

It is clarified that higher education institutions in almost all countries of the world are the most provided with Internet materials and electronic educational resources (EER), as many of them have provided distance education services using online courses in the last decade. As an example, we can cite the following resources:

- powerful electronic database of educational and scientific materials of Duquesne University ([guides.library.duq.edu](http://guides.library.duq.edu), 2020);
- resources for teaching on the Internet Institute of Food Technologists ([www.ift.org](http://www.ift.org), 2020) (USA);
- resources for teachers and researchers (Japan) (Toho University media center, 2012);

- ezines, ebooks and databases to which Osaka University attracts other universities (Osaka University Library, 2012), Kyoto University provides university staff with ezines (about 40,000 titles), ebooks (about 50,000 titles) and databases (about 100 types) (Kyoto University Library Network, 2016) etc.

However, all above mentioned cannot be systematically and in full volume attributed to primary and secondary education. That is why there is an urgent need to address this issue as an explosive problem.

## 2 COVID-19 AS THE DRIVER FOR BLENDED LEARNING

We have found a number of new solutions to solve the problem of learning disruption, such as:

- Assistance to the Malala Foundation – it helps to shape global and national responses to the COVID-19 challenge, which in some particular countries are manifested in the following formats ([www.malala.org](http://www.malala.org), 2020):
  - Nigeria – Cooperation with school teachers and education authorities has been intensified with the purpose of implementation of radio program that broadcasts school lessons, including reading, writing and STEM. Radio program helps Nigerian children who do not have access to Internet resources to learn on the radio.
  - Lebanon – the following digital educational solutions are offered: development of digital lessons on the basis of state program in the scope from kindergarten to high school; these lessons are now available to everyone on the Internet. These solutions also provide training for teachers helping them to conduct interactive classes at a distance.
  - Pakistan – there has been developed a digital application called Taleemabad, which digitizes Pakistan’s national curriculum. Taleemabad broadcasts cartoons of standard lessons for all who cannot attend EI. In order to respond to growing demand caused by the pandemic and to cover at least one million pupils / students across the country, Taleemabad is expanding its national curriculum and broadcasting lessons through the educational television program.
- Northern Macedonia – access to new digital platform with video classes and game-based learning activities for usage by teachers of primary, vocational and higher education institutions has

been made available in shortest possible terms (eduino.gov.mk, 2021).

An analytical review of educational process organization experience in conditions of COVID-19 spread shows that educators in many countries began to develop and implement emergency plans quite quickly. It is clarified that the managers of educational sectors are aware that in current conditions various forms of Internet education an EER development and use should be mobilized. In general, EER are aimed at slowing down and limiting the spread of the disease, as well as at preparation for possible long-term disruption of EI attendance by the participants of educational process. As UNICEF spokeswoman Patricia Di Giovanni said in spring 2020: “Our teams have been working day and night during past two weeks to find a solution to ensure that children’s right to education is not violated by a new measure to prevent the spread of coronavirus in the country” (UNICEF, 2020).

Due to intensification of anti-epidemic measures, the pupils in Ukraine have been prohibited to attend schools from January 8 to January 24, 2021, at the same time EI have been entitled to announce vacations for this period. It is already known that at this time the educational process was carried out in remote format, while in future it is planned to continue training in traditional full-time format. However, no one can guarantee the use of only one format (full time or remote) even in the nearest future. As the experience of 2020 has shown, educational institutions must be organizationally and methodically prepared for the transition to one or another format, without compromising the quality of educational process. According to (Holiver et al., 2020; Kukhareno and Oleinik, 2019; Spirin et al., 2019; Vlasenko et al., 2021; Zinovieva et al., 2021), one of the options to be chosen for realizations of this problem can be readiness for introduction of blended learning. We believe that this format of learning organization quite effectively combines the advantages of traditional learning with distance learning. As it has been found, the term “blended learning (hybrid learning)” has different definitions in literature. In general, it is a combination of offline and online learning in various proportions. The concept emerged in the 1990s as a counterweight to online learning (blog.ed-era.com, 2019).

Caraivan (Caraivan, 2011) grounded that blended learning involves the use of two or more different teaching methods, i.e. a combination of methods that meet the needs of pupils / students, regardless of the subject they are studying. It may include such combinations as:

- traditional training sessions with online learning;
- online instruction with access to the teacher;
- modeling with structured courses;
- on-the-job training with some informal classes;
- management coaching with distance learning activities.

At the beginning of the XXI century, the concept of blended learning appeared in discussions about education, at the time when the concept of distance learning began to lose its credibility. In conditions of distance learning format, students were not highly motivated and independent; they felt isolated and unsupported by teachers during their studies. Thus, there was determined a necessity to find new conceptual approaches allowing to avoid obligatory changes in distant learning and to provide a supplement for it (Caraivan, 2011).

Jarman (Jarman, 2019) give several reasons why blended learning should be used:

1. *Obtaining qualitative results of learning.* As confirmation, we use the results of the study conducted at the Iowa University: 95 % – best performance rate of students who studied in blended courses section; respectively 82 % – in sections of lecture halls and 81 % – learning on the Internet only.
2. *Encouragement and growth of pupils / students independence.* Using distance learning, students learn to set and manage personal learning tasks. In addition, blended learning contributes to their academic responsibility while maintaining the control needed for support. As blended learning uses online programs, students can learn at their own pace and according to their personal level of understanding and perception of information, thus building an individual learning trajectory.
3. *Preparation of pupils / students for functioning in conditions of society focused on DT.* Thanks to integration of DT teachers have the opportunity to ensure better preparation of students for future professional careers and civic life..
4. *Reduction of training costs.* From an administrative point of view, blended learning is a good investment because it maximizes the saving of costs obtained in the result of online learning. Blended learning can reduce the need for EI facilities, their repairs and maintenance. Reduced workload of teachers may result in achievement of higher ration of teacher-to-student communication and more efficient use of time.
5. *Improving the effectiveness of cooperation.* pupils / students can meet with teachers and other pupils

/ students whenever and wherever. At the same time educators can find better ways to cooperate. Teaching in a team mode is much easier in online environment, where everyone gets the flexibility to work on their own schedule.

6. *Formation of interest and motivation to study.* Nowadays some students find online programs and software more interesting than standard full time sessions. Blended learning can break the monotony of the traditional classroom by introducing information and concepts into different contexts. Of course, DTs can be a distraction, but they can also present information in new and exciting ways, including interactive software, 3D animations, and video games.

We see it necessary to add that blended learning can take the first place among other formats and become popular and necessary in the nearest future.

Given the prospects of blended learning as an innovative model of education, which is relevant not only in the period of quarantine restrictions, we emphasize the specific features of educational process management during its implementation.

In conditions of blended learning the organizational accuracy of educational process which is provided in management through change of educational process schedule, acquires a special value. In conditions of stable functioning EI can determine the periods of distance and full-time training, their sequence and duration. Under conditions of quarantine restrictions, periods of distance and full-time training may be held not under schedule, but spontaneously, depending on the epidemiological situation. Therefore, one of the first managerial tasks is to establish an accurate schedule of educational process and provide recommendations to its participants on actions in case of unplanned changes.

In management of blended learning, communication between managers, teachers and students is changing. It cannot be the same in at full-time training, as the possibilities of direct contact are limited. This necessitates the definition of methods and resources for communication to solve a set of tasks of various levels and orientations. In particular, during periods of distance learning the main focus is placed on communication between teachers and students both in course of educational process and in format of individual work, tutoring, counseling, mentoring and more. Communication between managers and teachers, as well as between teachers themselves, can take place both in face-to-face and remote mode at all stages of educational process.

The next factor influencing the management in conditions of blended learning is the necessity to

change the scientific and methodological support of educational process. Educational content is being changed and updated in view of peculiarities of full-time and distance learning, respectively, the programs, training materials, learning evaluation criteria for students etc. require consequent adaptation. We can say that at present stage of blended learning introduction the problems of scientific and methodological support are becoming relevant (definition and structuring of content, teaching methods, assessment).

Thus, blended learning leads to changes in management of educational institution-digital twin in three main areas: educational process organization, its scientific and methodological support and communication between its participants.

### 3 DIGITAL TWIN OF EDUCATIONAL INSTITUTION

The format of blended learning introduced in EI digital twin should open the possibility for unimpeded transition from traditional to distance learning and vice versa. This is explained by the fact that in order to prevent EI closure, it is but natural to suggest that teachers should use digital tools to complement the traditional format of teaching. After all, according to experts, “every week of EI closures leads to considerable losses in development of global human capital with significant long-term economic and social consequences. Accordingly, the governments and Education Ministries of many countries have already developed plans that summarize the following items” (OECD, 2020):

- *Use of existing online distance learning platforms – learning management systems (LMS).* It is important that at present online platforms can incorporate training courses and resources in digital formats (text, video lectures, etc.), usually with a bank of relevant EER. Typically, teachers can select lectures and exercises assigning them to students for usage through synchronous lessons. In educational institutions where such platforms do not exist, open EER can similarly be used.
- *Development of new open online educational platforms (virtual classrooms) –* teachers can remotely teach their pupils / students while they are at home, using various platforms. Some “virtual audience” services already exist within countries, and they have been located in China and Singapore, regardless of ownership type.
- *Partnership with private educational platforms –* one of identified difficulties in usage of existing

EERs is that their mass simultaneous use is not always possible. In order to empower educational institutions, some platforms belonging to private sector have already opened their own EERs with free access just at the beginning of global quarantine (for example, in China and Japan (Saiki, 2020)).

- *Cooperation at the international level for consolidation of existing online EERs* – although educational institutions in different countries, and sometimes some regions (states) within the same country, have different curricula, they usually teach similar disciplines and that is why it is possible to consider the potential for the organization of distant learning which consists in translation and use of foreign EER and digital resources, respectively, coordinating them with authentic curricula.
- *Use of all necessary electronic means* – return to usage of some obsolete electronic means, such as television or radio broadcast lessons, for regions where the infrastructure is low.
- *Providing teachers with digital learning opportunities* – educational policies should be aimed to provide continuous assistance to teachers in mastering of online teaching methods (for example, as has been done in Italy). Such activities can be carried out through open web platforms designed for sharing with possibility of exchange of author's developments – EER.

At the same time, forming responses to possible necessity of EI closure, educational policy makers should consider ways to:

- care for the emotional health of pupils / students;
- making necessary technological decisions to ensure continuous relationships between all participants of educational process, their interaction and support of teachers in teaching process;
- providing access to devices – pupils / students should have access to technical equipment; respectively it is necessary to start projects to provide devices or provide alternative resources (printed workbooks) (for example, as it is done in the UK (www.gov.uk, 2021a,b));
- IT infrastructure access management – simultaneous connection of all pupils / students can be problematic in some regions of their residence, so access to IT infrastructure should also be controlled to ensure the quality of education for all, perhaps even be regulated by way of setting certain time limitations;
- balancing traditional and digital approaches used in educational process replacement of traditional

forms of learning by digital format is likely to affect both the health of students and the quality of learning outcomes; it is logical to reduce duration and number of lessons / classes and their combination with digital educational formats;

- security of web systems used in exams – exams often require strict identification of pupils / students; Appropriate technological and software solutions already exist for face recognition; introduction and use of these aids must be extended.

Thus, the explosive wave of urgent EI closures offered educators the opportunity to experiment, to develop and to implement new models of educational systems and new approaches to distribution and use of learning time. Educational institutions must be prepared to provide quality educational services, they have already faced a difficult choice of how to get prepared for blended learning.

From now on, and in view of present circumstances, education managers around the world need to create a model of updated educational environment. They should answer the question: how to help educators to get prepared for execution of quality professional activities and provision of quality educational services in updated educational environment?

The digital twin of EI is actually an updated educational environment. The process of digital twin functioning must be based on the same managerial principles as actual EI, but in view of specific features of virtual environment and digital technologies. The functioning of digital twin cannot be seen, but it is possible to take part in it and perform the same functions, to act, to achieve tasks, to get real results. To exercise the management of digital twin, EI uses a modeling method that allows to present the main subsystems and processes of real EI in the form of schemes and models; it is done in order to select digital resources for appropriate support in cyberspace, and on this basis – to involve the participants of educational process in these activities. Thus, EI will exist and function in two dimensions – real and virtual. Thus, the task of management is to model a virtual reality of an educational institution. When creating a digital twin of an educational institution, the management should focus on common strategy: in virtual dimension there must function the same educational institution as in real life, which ensures full implementation of all functions and has clear structure.

Management process of EI digital twin includes the components, similar to those of real EI: strategic, organizational, financial management, personnel management, infrastructure management, marketing of educational services, operational management. These components are described below:

- strategic management – determining the strategy for the development of EI digital twin, blended learning, as well as criteria for achieving planned results;
- organizational management – ensuring the activities of EI digital twin, medium-term planning, coordination of structural units activities, monitoring the condition of subsystems, analysis of their activities;
- financial management – EI cash flow control, cash flow directing to achieve certain goals, minimizing risks;
- personnel management – selection of personnel, personnel preparation for implementation of tasks related to blended learning, personnel professional activity in conditions of EI digital twin functioning;
- infrastructure management – creation of material and technical base to ensure the functioning of EI digital twin, creation of comfortable working and learning conditions, accessibility for all participants of educational process;
- marketing of educational services and PR – promotion of blended learning in the market of educational services, meeting the educational needs of consumers, communication with general public in order to create positive perception of distance and blended learning, quality assurance of educational services;
- operational management – short-term planning and solution of current problems related to EI functioning.

It is seen that first of all there must be formed a digital environment (web environment) of each separate EI, the conditions of this digital environment should provide for the implementation of educational process in mixed format, based on integrated use of traditional tools and Internet resources. In turn, the pedagogical community from now on must think about development of innovative organizational and methodological approaches to be used for provision of educational services in web environment. The conditions of above mentioned EI web environment should be formed in view of equal access to knowledge for all participants, in accordance with personal needs and qualities. After all, according to Caraivan (Caraivan, 2011), “The environment is a mixture formed by mass media and various methods leading to interactions. Educational experience is based on memorizing interactions and practices exercised during interaction, so that communication is, in fact, the main “ingredient” of the mixture”.

Performed scientific researches demonstrate realizations of various authors, where the “Digital University” concept is the most remarkable.

The authors’ understanding of “digital university” phenomenon is based on the conceptual “matrix” consisting of four components: digital participation, information literacy, learning environment, curriculum and courses design. According to the authors, none of these components can be considered new if regarded separately, but their combination and analysis of their interrelations provides a holistic way to understand the digital university (Rowell, 2019).

- *Digital participation* – provides for involvement of university societies to spread the idea of universities being a public good for the whole society.
- *Information literacy* – stands for the idea that students develop digital literacy skills in order to improve their academic potential and opportunities for personal development.
- *Learning environment* – means a combination of digital and physical spaces that exist within and outside the university; it is more than just a virtual learning environment of EI.
- *Curriculum and course design* – these are formed through “constructive coordination”, evaluation and transition to the latest developments, such as digital analytics.

McCluskey and Winter (McCluskey and Winter, 2012) offer thesis: “Digital University is fundamentally different from traditional university”. Declaring this idea the authors put forward their thesis that education must change in response to growing demands for public accountability. Researchers claim that this goal can be achieved by the usage of advanced DT capacities.

There are many examples of digital universities functioning in educational space of various countries. For example, “universities and educational experts from Germany, Austria, Russia, Georgia and Ukraine are actively involved in international cooperation: they have established the International Digital Network University, thus laying the basis for education to function by way of crossing the borders between the countries. According to the portal, “Network University is a virtual association of universities and higher education institutions created for long-term cooperation. Participating educational institutions provide online training courses certified by the European System ECTS, are recognized by all network partners and can be taken by students as electives”. The most important task of network university is to promote mutual comprehension. This is

being achieved through structured intercultural exchange and joint development of educational proposals in the fields of education for constant development, inter- or transculturalism, conflict prevention and peace-seeking, as well as proposals for integrated subject-language learning in German CLILiG (Content and Language Integrated Learning in German) (www.goethe.de, 2019). The network university includes:

- University of Bremen;
- Virtual Academy of constant Development (Germany);
- Ruhr University in Bochum (Germany);
- Viadrina European University in Frankfurt on the Oder (Germany);
- Kazan Federal University (Russia);
- Tyumen State University (Russia);
- National Research University “Higher School of Economics” (Moscow, Russia);
- Ilia State University (Tbilisi, Georgia);
- Mariupol State University (Ukraine);
- Vienna Higher School of Agricultural and Environmental Pedagogy (Austria).

However, according to the author’s concept, there is a necessity to develop not only digital IE (universities, schools, gymnasiums, lyceums, etc.), but, for the most part, digital prototypes of real educational institutions.

The analytical review of digital innovations showed that one of the 10 best strategic trends determined by the research and consulting company Gartner Inc. in 2017 is a digital technology called digital twin (DT-technology) (Ismail, 2019; Deloitte University Press, 2017). The digital twin concept is based on the idea of the convergence of physical and virtual worlds, where each object receives its own dynamic digital representation (imprint). DT tools include powerful components such as big data, Internet of Things, machine learning and artificial intellect, which are primarily used in industry. Wide access and use of these tools have made DT more cost-effective and accessible for the business world, including, in our view, the educational sphere as well.

According to Mussomeli et al. (Mussomeli et al., 2020), “digital twins are multiplying as their capabilities and sophistication grow. But full-fledged realization of their promises may require the integration of systems and data into entire organizational ecosystems”.

It was found that DT is increasingly used in advanced industries to achieve various goals. According to research conducted by the Deloitte company, DT technology is spreading rapidly in industries such as aerospace, retail, healthcare and others. In industry, DTs are used to optimize operation and to provide maintenance of physical systems and production processes, where digital twins are understood as digital copies of physical models with possibility to observe their behavior (both digital and physical format) simultaneously in real time mode. Developed DTs allow to visualize objects or to be used for evaluation of technological solutions. Digital representation of objects provides for both development of individual elements and functioning dynamics of its physical analogue. In the industrial sector, there are too many digital twins (equipment, systems, separate machines, or even enterprises) which are developed before the startup of large-scale and high-speed production (skellia.com, 2020). That is, DTs can imitate any aspect of physical object or process. According to the Deloitte report, the global market of DT technologies will reach the point of \$ 16 billion by 2023 (Mussomeli et al., 2020). We have identified several definitions for the term “digital twin” (Ismail, 2019; Gartner, 2020):

- digital representation of real object or system;
- software analogue of physical device simulating internal processes, technical characteristics and behavior of real object under the influence of interference and environment;
- fundamental technologies evolving and covering physical and digital spheres and make it possible to obtain increasingly important digital results;
- digital copy of living or non-living physical object;
- digital replica (imprint) of potential and actual physical values, processes, people, places, systems and devices.

Researchers suggest the following classification of DT (www.it.ua, 2020):

- *Digital Twin Prototype (DTP)*. The DTP duplicate contains the information needed to describe and create physical versions of real objects; this information includes geometric and structural models, specifications, and conditions, as well as cost model, calculation (design) and technological models of the object. A DTP duplicate can be considered as conditionally constant virtual model of the object.
- *Digital duplicate instances (Digital Twin Instance, DTI)*. DTI of object describes a specific

physical instance to which duplicate remains associated throughout its life. DTs of this type are created on the basis of DTP-duplicate and additionally incorporate production and operational models which include history of work production, applicability of materials and accessories, and also statistics of failures, repairs, replacement of assemblies, aggregates, etc. Thus, the DTI-duplicate of the product is subject to change in accordance with changes of physical object in process of operation.

- *Digital Twin Aggregates (DTA)*. DTA is defined as an information system for management of physical instances related to family of objects; it has access to all of their DTs.

According to classification given above, each type differs in functionality, complexity and technologies integration level. In summary, we can conclude that DTs can be divided into digital models of system, certain line and separate component of certain line. Digital twins can form connections between all objects of real physical system and enable cooperation in the team/teams and interaction between teams. While functioning in DT mode, you can create, assign, and track tasks meeting business priorities and needs of real facility. We can single out the reasons of sudden demand for digital twin technologies (Ismail, 2019):

- 1) they bring considerable value to business and become essential for digital strategies;
- 2) the rapid growth of digital technologies introduction is explained, in particular, by active marketing and organization of training performed by their suppliers.

Nowadays, given that DT technologies have rather strong support from IT giants, including IBM and SAP, various companies have already paid close attention to digital technologies. Already now, in times of forced quarantines, it has been reported that many well-known companies have ensured the efficiency of continuous production process in conditions of their digital twins.

An important feature of digital twin is that its functioning as a model or as a system is possible in both online and offline modes. For the purpose of presentation and improvement, the functionality of DT is constantly updated from several sources (Deloitte University Press, 2017). For example, in marketing activities, virtual avatars can provide tours for visitors interested in DT real estate. Accordingly, in real time mode, visitors can provide feedback and put questions to the owners. DT also allows to organize training for new employees for the performance of their profes-

sional duties and usage of equipment, regardless of their location in the world.

As mentioned above, DT technology is spreading rapidly in various fields and, ultimately, according to the author's vision, should affect education. Already in 2019, Gartner included the concept of Digital Twins in the TOP-10 list of technological trends and predicted that "in the near future, there will exist digital twins for billions of things" (Ismail, 2019). Over time, the DT trend will evolve and expand – individuals, teams, services, businesses and even cities have or are in process of formation of their digital twins. So, in the coming years DT technologies can be expected to be widely deployed in education as well. Given the specifics and qualities of DT, we can assume that their qualities, combined with development of Internet powers, will open opportunities to monitor, control and optimize the educational process in EI both in distance and full time traditional format, as well as to use their integration form – a mixed format.

Due to fast interactive feedback, the emergence of EI digital twin will help to develop innovative solutions of complex educational problems – in particular, to build an authentic innovative educational web environment for each separate EI. After all, the benefits offered by DT can provide many opportunities which are not available in physical educational space of educational institutions. Nowadays, when educational institutions have to learn to work virtually, digital twins can become the only opportunity to create EI web environment with comfortable conditions for the development of all participants of educational process and for provision of quality educational services in blended learning. We acknowledge the possibility and the necessity for building of EI digital twin, using EER and LMS as a basis, in view of their capabilities to support the entire life cycle of educational institution. After all, DT-technology, taken as digital dynamic resource, can ensure the creation of "digital" or virtual "building" inside the educational institution and provide for the following:

- to combine previously incompatible systems, resources and formats in order to gain new insights, optimize management of educational process and remote monitoring;
- to plan and implement a sequence of production tasks and find ways to distribute them among the performers;
- to provide influence at organizational level – for EI managers there appear opportunities to develop planning of all production processes in advance and to manage them remotely;
- to provide control and monitoring of teachers'

workplaces and conditions of real educational environment, thereby improving the experience of EI administration staff;

- to minimize the presence of participants of educational process in EI facility and protect them from possible risks.

It is seen that in the “walls” of EI digital twin there should be integrated all the traditional components of educational process and digital resources used in teaching. The main feature of EI digital twin is the possibility of continuous updating in accordance with changes in its educational and technological contents, as well as in accordance with development of digital technologies in general. According to the author’s vision, EI digital twin, as an integral web resource, should include all its real components in digital format:

- means of educational process organization;
- EI structure (classrooms, study rooms, electronic library, administration offices, teachers rooms, rooms for methodologists, psychologists, etc.);
- teams (groups) of participants in educational process;
- total amount of workload and expected learning outcomes of students;
- list, content, duration and interconnection of subjects, disciplines, etc.;
- description and tools of internal system of education quality assurance;
- teaching aids;
- means of technological and technical equipment;
- nomenclature and technologies used;
- system of collection and storage of educational and methodical information – web library;
- other educational components (by decision of EI administration).

The more efficient technological systems and resources are included in process of construction of EI digital twin, the more functional educational web environment becomes, forming digital streams that add opportunities for EI. It is assumed that in conditions of web environment of EI digital twin it is possible to exercise the following tasks:

- to implement management, organizational, educational processes in blended learning;
- to coordinate the logistics of institution activity;
- to configure virtual training modules for educational tasks;
- to carry out remote analysis and diagnostics of processes taking place in each classroom.

## 4 CONCLUSIONS

Among the main conceptual provisions of DT application in EI we would like to accentuate the following: “digital representation and system support of EI real life cycle – ensuring quality implementation of all educational functions”. Accordingly, EI digital twin is created to facilitate the tasks for the following groups involved in educational process:

- manager:
  - to keep in control all complexity of educational process;
  - to provide entire educational environment for data that has been represented in various systems and EERs;
  - to analyze operational data related to implementation of educational process;
  - to outline the opportunities to improve the quality of educational process, etc.;
- teacher:
  - to carry out educational process (including the use of such components as: schedule, assessment system, teaching materials for disciplines, home assignments, electronic communication, e-library, etc.);
  - to implement self-learning and self-improvement, etc.
- pupil / student:
  - to gain access to quality education due to usage of quality access and quality resources.

Although the development of operational digital model of EI digital twin can be considered a rather difficult task for practical implementation, we should not forget about its expected value, which mostly lies in implementation of basic functions:

1. Ensuring support for organizational and managerial decisions.
2. Reproduction of educational process in real time mode for everyone.
3. Ensuring the integrity of educational system.

If educational institution is ready to create its own authentic digital twin which will be an innovative solution and provide comfortable and understandable conditions for educational process functioning, it can proceed to development of digital twin and pre-answer the following questions:

1. Which of the systems, processes, tools, digital resources would be powerful and effective components for inclusion in EI digital twin?

2. What infrastructure platforms and LMS can be used as a basis for building of digital twin?
3. How EI digital twin can reduce EI expenditures on organization of blended learning?

The found answers will facilitate logical approach to formation of purpose, tasks and ways of digital twin formation, and also the choice of comfortable, clear and accessible web toolkit of its construction. The digital twin as a holistic web resource should cover and combine physical and digital spaces of educational institution and enable all participants of educational process to obtain quality results under any conditions that may be dictated by modern society.

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