

PROSPECTS OF INNOVATIVE TECHNOLOGIES INTO EDUCATIONAL SYSTEM INTRODUCTION

P. Machashtchik,

Doctor, rector,

State Higher Educational Institution named prof. Stanislaus Tarnowski

I. Britchenko,

Doctor of Economic Sciences, professor,

State Higher Educational Institution named prof. Stanislaus Tarnowski

Educational system innovative development, innovation management and marketing technologies and tools active improvement, learning technologies improvement and multiplication have become an integral attributes of educational technology of the majority countries in the world. Innovations in educational system development is the basis of a state's innovative and technological policy.

The need to improve educational system and introduce innovative technologies is an essential prerequisite able to ensure countries into the world economic community untrammled integration. In this context it should be noted that modern information and communication technologies application enables to significantly speed up information search and transfer process, transform mental activity nature, and automate human labor.

Erudition and the ability to manage information have long become wealth and power basis in most of economically developed countries. The OECD (Organization for Economic Cooperation and Development) report noted that: «in the knowledge-based economy science and technology are the most important sources of economic growth and welfare».

OECD experts all definitely agreed that: «the basic long-term economic growth rate in OECD countries depends on knowledge base maintaining and expanding ... In many OECD countries value added real growth in the knowledge-based industries has consistently outpaced the overall economic growth for the past two decades. Globalization process has accelerated these trends... Countries comparative advantages are less determined by natural resources richness or cheap labor but increasingly by technological innovations and knowledge competitive application... Economic growth today is as much a process of knowledge accumulation as it is a capital accumulation process»[1].

According to analysts, educational technology is one of the most promising sectors for investment. Despite the fact that educational technology is a market with \$5 trillion a year turnover, it is completely shaded by not just fintech but by other investment spheres as well. But according to TechCrunch journalists the situation tables have begun to turn. According to the EdTechXGlobal and IBIS Capital report, investment in education and training will have reached \$252 billion by 2020 [2].

Besides the fact that this industry has direct access to schools, institutes and universities, it also is the most reliable object for investments. In contrast to the financial market ups-and-downs, education remains constant and secure from geopolitical storms. According to TechCrunch experts, digital education is the largest and probably the most profitable IT sector [3].

Geoff Mugan, the Chief Executive of Nesta – a British Innovation Institute – has adopted four technological trends in education, which he considers to be the most promising for GovInsider, they are: digital textbooks, blockchain, crowdteaching and adaptive learning [4].

More detailed analysis of modern innovative technologies, which may significantly change educational system configuration in the nearest future, is deemed necessary.

Education, along with a number of other sectors (such as health care and telecommunications) are subject to significant changes due to digital technology increasing distribution. As is usually the case, commercial organizations such as private universities, business schools and corporate universities set trends for digital technologies in educational and research activities implementation. But public universities and institutes are increasingly starting to consider digital transformation [5].

Rapid online learning adaptation, which is expressed in the form of blended learning development and MOOC (Massive on-line open course) active development should be noted among the challenging digital innovations.

The term MOOC was invented in 2008 by David Cormier of the University of Prince Edward Island of Canada and Brian Alexander of the National Institute for Technology in Liberal Education [6].

Massive on-line open course (MOOC) is a training course with a mass interactive participation by means of e-learning technologies and open access via the Internet [7], and is one of distance learning forms. As

additions to traditional curricula, such as videos, reading and homework assignments, massive on-line open course provides an opportunity to use interactive user forums that help to create and maintain students, teachers and assistants' community.

Online learning development dynamics is demonstrated, in particular, by available online courses growth, the number of which is doubled every year in more recent times. At present more than 4,200 courses from over 500 universities are available.

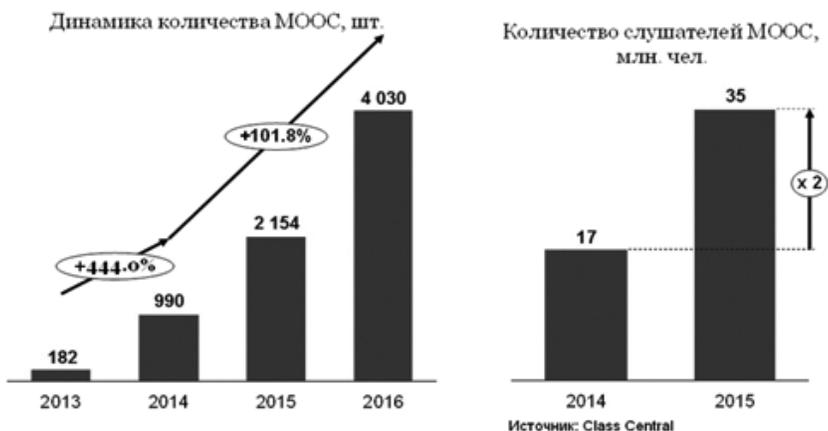


Fig. 1. Online Learning Development Dynamics [5]

Advancing online segment of educational services emergence can completely change this sector landscape: according to some estimates in addition to the number of courses offered and the number of trainees annual doubling MOOC market projected consolidated revenue will grow more than fivefold by 2020.

Development of digital libraries and digital universities' campuses, which have already been implemented by many universities in America and Europe, are additional areas of digital technologies in education application.

Currently three major MOOC platforms are successfully in operation in the USA, they are: edX, founded by Harvard University and Massachusetts Institute of Technology, Udacity, a structure, formed on the basis of Computer Science syllabus at Stanford University, and Coursera.

MOOC is being developed in other parts of the world as well: Iversity in Germany (300 thousand students, more than anywhere else in Europe), Open University in the UK, Crypt4you in Spain, OpenupEd which is a spring of the European Union educational structures, EduKart in India, etc.

Americans were the first to launch, so their MOOC magnitude is beyond competition: 1.6 million audiences (or users) in edX, as many in Udacity, and as many as 6.3 million in Coursera [6].

However, the opinion of A. Chikunov [8] is shared by us and along with undeniable advantages online learning disadvantages shall be critically catalogued.

MOOC is a good example of technological solutions into educational field implementation. In fact, it is a tool that allows to change material delivery method: instead of lectures at universities, interesting video lessons can be viewed, interactive tasks, exercises, etc. can be solved. But it emerged that MOOC proved to be ineffective in traditional learning formats competing due to the fact that the same level of material understanding was impossible to be reached. MOOC offers lectures interpretations, simple tests and surveys — but all this is not enough to memorize the material. A person often needs direct communication with the teacher. In addition, not all training fits into the lecture format — there are also exercises, laboratory classes, as well as design work.

The matters, that colleges and universities are facing now, are limited to the further development strategy choice and direction to focus on selection. It is obvious that digital transformation program for transition to a competitive educational and research model in the future should now be developed.

Artificial intelligence is another innovative technology that is rapidly developing in educational sector.

Artificial intelligence (AI) is a research area associated with methods for modeling individual functions of intelligence by means of software and hardware development [9].

Many AI application areas are available: theorems proving; games; patterns recognition; decisions making; adaptive programming; machine music composition; data processing natural language; knowledge-based networks (neural networks); verbal conceptual learning are among them.

Thus, according to the Laboratory of Knowledge of University College in London and Pearson report [10] many schools and universities already

apply artificial intelligence technologies for educational purposes. Most of them combine AI with Big Data technologies in order to monitor whether the students attend classes and do tasks.

Due to artificial intelligence introduction intellectual training systems that are programs that simulate the teachers' behavior have appeared. They are capable of checking the students' standard of knowledge by analyzing their answers, reporting feedback and even scheduling personalized training programs.

At the moment, the following examples of introduction both applications as chatbots and artificial intelligence in educational sector are known:

1. Automated valid classification. Automated written work, e.g. an essay, assessment is a challenging task faced by many teachers. For instance, both tests and essays are evaluated by artificial intelligence on such online platforms as Coursera, EdX and Udacity. Such training programs as Carnegie Speech and Duolingo use natural language processing technology to identify mispronunciation and correct it.

2. Intermediate interval training. Thus, a Polish inventor Peter Wozniak came up with an educational application based on the interval effect. This application back traces what is studied and when. By means of artificial intelligence the application can track when the information is likely to be forgotten and recommend to revise it. It only takes a few refresher courses to make sure the information is stored in memory for many years.

3. Feedback. Feedback, that is, students' assessment of teachers, has a century-long history. Due to modern technologies, such as AI-driven chat robots, computer-aided learning and natural language processing a lot of interesting opportunities for feedback quality improvement are now available. Chatbot is capable of collecting opinions via a dialog interface with the same benefits as a «real» interview, but with a smaller amount of work required. Conversation can be adapted in accordance with answers and student's personality, the chatbot is even capable of investigating this or that opinion cause.

Besides the fact that it is a good option for conducting surveys, the chatbot provides many other benefits to the teachers who seek to improve teaching effectiveness. By attracting more data sources such as self-assessment, evaluation, peers' feedback, and the latest scientific evidence on how to effectively teach a more aggregate picture of training effectiveness can be

created. Own data with other teachers around the world data comparison should enable the system to offer new and powerful ways to improve teaching methods as well as results in teaching community sharing.

4. Teacher's assistant. At the Georgia Institute of Technology, students enjoyed communicating with the new teacher's assistant, Jill Watson, who quickly and accurately answered their different questions. But the students did not know that Ms. Watson's true identity was actually an IBM-AI-system-equipped computer with the same name. With the help of Ashok Goel, a Professor of Computer Science, the teacher's assistant Watson responded with more than 40,000 posts on the forum.

Having received huge advertising, Jill Watson is now being introduced to universities around the world. One of the last to be added to the list, is BI Norwegian Business School in Oslo, Norway.

5. Chat campus. A bot that helps students who have just gone up to the college «to get accustomed» has been created in AdmitHub: students can apply for scholarships, register for courses, issue a plea for a place in the dormitory by its means. Cornell University uses the CourseQ bot to interview students about various problems associated with the new school year start.

And at the University of Deakin in Victoria (Australia), the chat campus is now being tested in service. As with the teacher's assistant case the intelligence underneath it is IBM Watson supercomputing system. The chat-campus being implemented is capable of answering questions related to everything a student may need to know about the campus life, such as: how to find the next lecture hall, how to apply for the next class of the semester, how to obtain assignments, where to find a parking place or how to contact a consultant. All these issues can be solved by the so-called «djinnns» i.e. chatbots [11].

6. Feedback from students. A new approach to student-centered educational models where an individual personality and a student concern are the most crucial factors in curriculum development is being studied.

The content is adapted to the individual pace of training and can consistently offer more complex challenges to accelerate learning process. Thus, both fast and slow students can continue training at their own pace.

Thus, AutoTutor, for example, teaches Computer Literacy, Physics and Critical Thinking by communicating with students in their preferred lan-

guage. And Knewton Software takes into account each student's training specifics and allows to develop a personalized learning plan, taking into account the degree of mastering the material, as well as student's frequent mistakes.

Bill Gates suggested that chatbots can also be used as tutors [12]. Theoretically, these services can teach almost anything.

Thus, Nerdify Bot helps students do homework, and Ucheba_bot recommends courses, universities and colleges for applicants. Dozens of bots related to education are already available around the world: some help practicing signboards, legal issues, history, etc., others present rare and interesting facts. However, in our opinion, a foreign language study remains the most popular area in the bots' application. This problem is come to grips with by Russian startup Edwin as well. The company's emphasis is made on English language skills training. The service combines artificial intelligence (it personalizes training plans, communicates with the user in the chat, manages different language skills training equipment, supports study, etc.) and tutor's services (e.g., the service is needed for individual lessons on spoken language practicing) [8].

The authors of the Laboratory of Knowledge of University College in London and Pearson report note that artificial intelligence is already actively being introduced into the group learning process. It is used to appoint groups of students with the same level of knowledge, analyze the discussion between people and mark the moments when the conversation participants get off the topic.

The report states that artificial intelligence technologies are capable of tracking each student progress. Such a monitoring may become mandatory in the future to ensure schools, districts and a country as a whole performance evaluation, as well as effectiveness of various training programs testing.

Researchers believe that the future will offer «educational partners» that will teach a person throughout his life-time. «Being in the cloud, they will be available on each device as well as in offline mode. Instead of teaching all subjects, these partners will be able to contact an expert in a certain field on requirement and then inform the user about his point of view «[10].

Artificial intelligence technologies, which are already called «new electricity», are rapidly entering new verticals, and EdTech is not an excep-

tion. It is obvious that AI in education application will significantly change learning process in the future [13].

Many important problems can be solved by means of blockchain technology into education introduction. Thus, currently the distributed blockchain database is increasingly being integrated into document storage and control systems. This technology advantage is lack of practical capabilities to manipulate the data recorded in the system due to the fact that the information in the database can only be added, but not recirculated. Conversely, document authenticity can be easily traced, as everyone can trace whom it was recorded into the blockchain by. Along with identification papers and banking sector “Kryptorevolution” has not ignored educational system as well.

Crypto-currencies, including Bitcoin, operate on its basis. The main blockchain feature is its immutability. Posted into the database transaction data can neither be deleted nor edited, since huge computing resources are required for the smallest revision [14].

Blockchain is a technology enabling to store information in a distributed form. If a user has a key to this database, he will have access to the materials posted, which will provide some openness and transparency to many areas of life. However, like any new technology, the «blockchain» system to date causes a lot of questions and disputes that require solutions from the experts.

It should be noted that currently situation in digital economy market in the education development sphere is in the initial development stage.

The University of Nicosia has become the first to officially use blockchain to store their diplomas and certificates. Importantly, it also became the first university to accept Bitcoin as a payment. Massive On-Line Open Courses (MOOC) of the University of Nicosia are available in 83 countries. It is also a member of European Universities Association (EUA) and European Association of Higher Education (EURASHE). It means that its diplomas and certificates are recognized worldwide.

Such organizations as Open University (UK), Sony, Massachusetts Institute of Technology and others have become inheritors [15].

Sony Corporation and Sony Global Education (SGE) have created a system with blockchain technology in educational field application. The system enables centralized data within several educational institutions management. It enables making links, recording information, and perform-

ing digital manuscripts. The system eliminates data falsification possibility, as well as controls the access to the records that allows transferring data to authorized third parties in the proper form. The program will operate on the basis of Hyperledger project, in which blockchain technology is actively being implemented.

It is noteworthy that the current system will enable operators to link previously collected data to training systems and students data systems, even though such data is collected from different sources. Further, the users can see the overall academic performance picture, perform digital decoding and send it to an appropriate authority.

In addition, the presented system allows to analyze data and records by means of artificial intelligence and subsequently suggest ways to improve curriculum as well as educational institutions management mechanism [16].

The Company representatives stated: «This technology holds the potential to develop an innovative infrastructure system for the data on the network various secure distribution, providing incredible opportunities for dealing with academic records and their evaluation».

Sony Global Education innovation will help to facilitate open and secure data management that will further result in new services in educational field emergence. Moreover, the new system will attract attention of numerous educational institutions representatives to the network, which will increase the level of confidence in testing procedure.

The company representatives added: «Sony Global Education is planning to launch the new system development as early as in 2017 by implementing applications based on blockchain technology in the services provided commencing with Global Math Challenge.»

Global Math Challenge is an international online competition, which participants are assessed on mathematical knowledge and logical abilities level. More than 150 thousand enthusiasts from more than 80 countries have taken part in the competition. It is noteworthy that the results are determined not only based on correct and incorrect answers calculation. In addition, overall performance, including time spent on the proposed tasks solution, is also assessed. The final assessment is a participant's abilities confirmation which meets international standards requirements [17].

As for academic progress data with blockchain recording, the San Francisco Engineering School of Holberton outstripped the Japanese giant

by signing an agreement with Bitproof to transfer its own diplomas to the blockchain.

Educhain is a blockchain startup in educational technology field, which has become a Dubai Future Accelerators (DFA) program “graduate”. The company is planning to launch its pilot project in the selected institutions in Dubai, which will affect all system levels. The launch is scheduled for early 2018.

This project enables academic institutions to issue their official diplomas in digital form and automate their verification. Control over making entries in such a document is at the Registrar’s directly, and a student himself can see who exactly looks through his records. This approach reduces administrative costs and at the same time saves institutions time on processing information. Ultimately, Educhain platform can completely change documentation storage, management and processing by eliminating unnecessary middlemen and creating benefits for institutions, students and employers.

At the end of 2017 the DFA invited Educhain for cooperation with KHDA (Committee on Science and Human Development), the regulatory body of Dubai, providing the quality of education. The goal of creating self-regulating school institutions, ready for challenges of the future and able to become a world’s best by 2025 was set. Educhain and KHDA has investigated startup blockchain solutions potential to ensure certification practices and certification system to digital rails transfer. This is required by the Dubai Blockchain Strategy-2020 [18].

In January 2016, the Ministry of Education of France announced plans to create a new digital platform, which allows diplomas confirmation.

Blockchain technology is of great interest to French universities these days due to great potential for innovation in educational sector especially when it comes to degrees and diplomas authentication. All current procedures could be shortcut quite simply, while at the same time providing all safety measures and confidentiality. Due to this, future headhunters can go online and check out information from an applicant’s CV in a matter of minutes [19].

The European Commission has published a report [20], which presents the results of their research on Blockchain technology in education application. Among other things, the Commission has analyzed such areas as feasibility, possible problems, benefits, and risks as well as the technology

application in universities and schools. 8 possible blockchain technology in education applications are mentioned in the report. The most relevant issues that can be solved by the blockchain is documents accreditation and transfer, digital certification, multi-level accreditation and students' fees payment.

In conclusion, the Commission has recognized the fact that blockchain in this field application is still in its infancy. It also stated that only a «completely open» process of the technology implementation can produce real results and give Blockchain Technology an opportunity to support educational sector [21].

All the above allows to assert that getting education, being anywhere on the planet, is possible in the modern world. And although traditional forms of getting education do not lose their ground, the given advantages of innovative technologies in education are undeniable.

Today we are witnessing a new educational system, focused on integration into global information and educational space emergence. This process is accompanied by significant changes in learning process organization, which should correspond to modern technical possibilities. Modern information technologies in education penetration can qualitatively change educational methods and organizational forms, having made it much more convenient and accessible.

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