

Planning, Building and Development Distributed Integrated Blended Education Ecosystem at Different Levels

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Abstract. The planning, formation and development distributed integrated ecosystem blended education at various levels is a very urgent task today. Solving this complex problem can make it possible not only to eliminate the disadvantages inherent in the distance education system, but also to create the basis for building a full-fledged educational technology. The basis for building such an ecosystem, in addition to purely didactic developments, can also be modern achievements in the field of systems theory, digitalization and artificial intelligence. Big data modeling and analytics allow you to create a complete set of technologies for creating an outsourcing network and digital educational chains and predict learning outcomes.

Keywords: modern educational technologies, artificial intelligence, distributed ecosystem, blended learning, digitalization, Cluster Ecosystems.

1 Introduction

The current stage of scientific and technological development is accompanied by a fundamental restructuring of economic systems, putting forward new requirements to increase their intellectualization. In turn, the basis of the intellectualization of any economic system is to increase the role of knowledge, skills, experience and their use to meet the diverse needs of man and society, that is, the role of human capital [1]. World education is currently in a state of uncertainty. A turning point of epochs takes place, one of the signs of which is, for example, the rapid spread of digital communication and training formats. Another sign was the understanding that existing educational programs are hopelessly outdated, that a competent person in the twenty-first century should have a completely different set of skills than previous generations.

As an alternative to existing educational platforms, a distributed adaptive mixed education ecosystem can be considered. This type of ecosystem should not only minimize the disadvantages inherent in well-known education systems, but also create the basis for building a full-fledged educational technology. In addition to purely didactic developments, the basis for building such an ecosystem can be modern achievements in the field of systems theory, digitalization, and artificial intelligence. It is also important that an intensive adaptive education accompanies a person living in the present century throughout his entire conscious life.

The potential of Russia in forming a picture of the desired and possible future education for individuals, communities, nations and the world as a whole is historically quite high. There are three main tasks: • to understand the new social and economic challenges of this century, to determine the knowledge and competencies that will help everyone to live a prosperous and quality life; • create the most productive educational models that can be used by people and communities for lifelong learning; • understand how educational systems can become an instrument of change in order to achieve long-term sustainable development and protection of our civilization, the prosperity of all mankind and the biosphere [2,3]. At the same time, continuous personal development, personalization based on big data and artificial intelligence, constant updating of knowledge, skills and competencies, development of new technologies should be provided. New skills must also be formed: emotional intelligence, cognitive flexibility, the right to choose, interpersonal skills, etc.

2 A systematic approach to the main problems of modern education

A systematic approach, as one of the main methodological principles that substantiate research activities in pedagogy, is widely used today at the stages of design, organization and management of the educational process. The increase in efficiency in the activity of a holistic system, obtained as a result of the integration of separate interconnected components, occurs due to the emergence of new properties that were initially not characteristic of its initial components, and this phenomenon is called emergence. It seems logical that a systematic approach to pedagogy should lead to the emergence of emergent learning [4,5], which can be considered as a system consisting of specific teaching methods, tools and forms, as well as content designed and implemented in accordance with the indicated indicators of competency achievement. The balance between the traditional learning and the elements using the achievements of information and communication technologies should be based, apparently, on the analysis of the relevant educational standards, as well as on the basic categories [5] that affect the quality of training. The main structural components of educational systems - the teacher, students, goals, content, means, methods and forms - determine the whole system of activities of the teacher and student. In this list, learning tools were previously understood mainly as material and technical support of the educational process. However, recently there has been an intensive penetration into the educational process of their own mobile devices for accessing the Internet. Various devices are

used both for the initial search for information on topics of interest and for self-study, for example, on online courses. Thus, the role of the electronic gadget as a learning tool has significantly increased and transformed. And from the secondary component in the hierarchy of the structural components of educational systems, “tools” moved to a fairly separate position, and their functions now consist not only in transmitting information, but also in its accumulation and structuring. As practice shows, electronic learning systems are capable of influencing both the formation and transformation of learning goals, and the formats for presenting content, methods and forms of training. It is logical that significantly transformed digital teaching aids transform the properties of the educational system as a whole. Thus, at the present stage of development of education, independent implementation, distribution and use of electronic devices in the educational process are observed. This means that the education system is gradually becoming distributed.

3 Modern integrated network cluster ecosystems

The world economy has recently been seriously affected by the achievements in the field of artificial intelligence and the rapid development of Industry 4.0. The only opportunity to maintain and strengthen their position in the market, which will change rapidly in the coming decades, is the transformation of processes within the framework of new technological trends and integrated network cluster ecosystems. Technology has always had an impact on the business, for example, increasing productivity by replacing human labor with machines.

Digitalization opportunities are becoming important to enable collaborative production networks that can better adapt to future dynamic markets. With the rise in the prevalence of Internet technologies, production systems are turning into so-called cyber-physical production systems (CPPS). These include network, autonomous components with local intelligence control that can autonomously communicate with other devices, machines, manufacturing units and products through open networks and semantic descriptions. Thus, the traditional rigid hierarchical production will be replaced by decentralized self-organization, where the use of reengineering will allow the creation of significantly more flexible production systems.

In modern engineering, for example, there is an active implementation of intelligent integrated technologies in the entire production and distribution value chain [6-7]. This interconnection of digital and physical systems combines almost everything from designing and planning products to the supply chain and production. The reason for this approach is a short life cycle of products, a high level of customer focus in the face of fierce competition.

4 Transforming education in the face of rapid changes

Whenever the economic environment undergoes rapid and dramatic changes, in every area there are winners and those who are behind. Given the realities of the upcoming challenge, it is necessary to act now to become leaders and drivers of serious market

changes. For the correct use of the capabilities of artificial intelligence, it is necessary to carefully and critically evaluate which model of education we present and where we want to be, when “smart education” begins to become an objective reality. Refusal to solve these problems in this case is not an entirely suitable option: competitors will step up and force other market participants to either follow their example or drop out of the competition.

We can already observe this effect even today, although to a lesser extent. Why should educational service buyers put up with the fact that you cannot deliver to them what they want, when they want, and how they want. Value creation in this case is the key to success. Only innovative, flexible and customer-oriented competitors will remain on the market. Thus, the transformation of the model of education and ourselves is a task that needs to be started now, so as not to lag forever.

We need a corporate strategy, which, ultimately, will ensure sustainable market success, offering the necessary value for students. The proposals “value and usefulness” will be the main goal and future distinctive advantage, which is necessary for achieving the goal and interactive communication with students.

Therefore, the offer of a “personal” educational process will be a distinctive advantage of your university over competitors, in which you must invest and, thereby, create the ability to instantly satisfy requests. Modern digital advances allow you to quickly establish basic processes, instantly enable and disable functions with a single button and initiate a training program as soon as the final training model is agreed.

Decentralized learning and outsourcing can be two key functions for the successful application of artificial intelligence in education. Today, there are already the necessary tools to expand such a bottleneck as individual training in a group, by introducing artificial intelligence methods into the learning organization process. However, in order to really get around this bottleneck, it is necessary to have a localized flexible learning space that has decentralized capacities for working next to students. Moreover, the training should be sufficiently “smart” to accept and execute orders automatically using an intelligent system, reducing or completely eliminating the need for human intervention, in addition to making initial decisions [8-9]. Naturally, in this case, the training chain discussed above will be very vulnerable to external shocks, which makes viability the main task for the management team, whose functions should be significantly different from today's management.

5 Digital transformation and learning management

The transformation of the learning ecosystem is essentially a revolution precisely because there are not superficial, but radical changes: the ecosystem is being rebuilt from top to bottom. Learning models are changing, new universities are appearing, world-famous brands with a long history are being wiped off the face of the earth if they do not have time to join the ranks of digital innovators. Recipients of educational services have changed their behavior; they want an individual approach, unique training programs.

The type of managerial specializations required in the education system and their relative role in the management team have constantly changed since the advent of universities, which initially did not have positions based, for example, on “equality” or “sustainability”, since the need for them only developed over time. As the educational ecosystem develops, it will be necessary to develop, create, modify and replace managerial positions and responsibilities based on emerging needs.

The actual need for management will be reduced to managerial and business functions, depending on individual decisions and preferences. This “thrifty” approach to education management can be resolved only with a combination of artificial intelligence and digitalization, and to a large extent dependent on network outsourcing within the framework of the production and educational cluster [7]. Creating flexibility for a decentralized model of education will eliminate the need to hold on to unclaimed educational capacities that will actually begin to become a burden, not an asset.

All this will create the need for new managerial functions, as well as change the content and list of responsibilities for all departments.

The main idea of the development of Industry 4.0 and CPPS is the creation of self-organizing and self-adaptive dynamic network educational outsourcing structures and curricula throughout the life cycle of the university to implement the most flexible individual training with the costs of mass stream education. This trend is already clearly visible not only in education, but also in many key sectors of the world economy and political decisions are largely determined by the increasingly fierce struggle for markets for innovative products and services.

The introduction of digitalization in education is actively and effectively hindered by a number of factors, among which, in addition to doubts about the security of digital data and the need for large investments, there are insufficient qualifications of students and trainees at all levels, the lack of effective business processes and standards for using the advantages of the digital approach. It is this approach that can provide new opportunities for new educational programs. Integrated automation, informatization and intellectualization of the basic educational technologies will ensure guaranteed growth in turnover, flexibility of training, productivity and overall university efficiency. The main difficulty is that the introduction and use of Industry 4.0 technologies and cyber-physical systems will take place under the influence of various kinds of uncertain factors, for example, indifferent, targeted, related to the uncertainty of the goals of the subjects, etc.

Analysis of the uncertainty of competitors' actions can be based on multi-agent systems, various game models, and fuzzy logic methods. These approaches implement the principles of conflict management, as well as taking into account the so-called “soft” factors that are difficult to formalize, such as common goals, flexibility, trust, reputation, and so on. The digital revolution in the management of educational program chains and outsourcing can lead to a real increase in the efficiency of universities, a significant improvement in the quality of education

Very often, even the leading universities use home-made educational process management information systems, which leads to significant costs and time losses. It is much more advisable to use a multifunctional updated platform supported by a seri-

ous operator, while creating a single space for cooperation of all participants in outsourcing and educational chains.

Modeling, optimization and analytics of big data make it possible to form a complete set of technologies for creating an outsourcing network and digital educational chains, identifying the state model of all processes in real time. At each point in time, a digital double displays the status of outsourcing processes and educational chains with actual data on planning, preparing the necessary equipment, directly preparing educational programs, loading teachers, accounting and monitoring learning outcomes. The digital double can be used both for real-time decision making and for forecasting and planning outsourcing. In fact, an educational institution and companies providing outsourcing services within the framework of this approach are integrated into a single mechanism for solving flexible individual training tasks. If, for example, an emergency occurs in the educational chain, this deviation can be noticed by the risk data monitoring tool and transferred to the simulation model to form alternative options. Simulation in a digital double can help show the spread of the influence of emergency events in the system and provides effective adaptation of action plans in accordance with the situation almost online.

6 Building a distributed intelligent blended education ecosystem

Transformation of the sphere of education in accordance with modern challenges is inevitable. Technologies that have already become the driver of large-scale socio-economic changes have huge potential for application in the educational process. Already today, the use of big data processing technologies, artificial intelligence, personalization in training is no longer the subject of academic discussion and is becoming the content of real projects, educational services and platforms. To be able to respond to global challenges, participants in the educational ecosystem must very well understand the main trends in its development.

This is especially important for Russia, which for many decades turned out to be subject to "raw material dependence" and the accompanying significant centralization of public administration in everything, including education. Today, when natural wealth ceases to be the basis and guarantee of success of individual countries in the context of global competition, it is necessary to focus all attention on the development of the only truly inexhaustible resource for shaping a better future - human potential in all its manifestations

One of the most acceptable options here is Blended Learning - an educational concept in which a student gains knowledge both independently - online and in person - with a teacher. This approach makes it possible to control the time, place, pace and way of studying the material. Blended education allows you to combine traditional techniques and current technology. The model does not imply a radical rejection of full-time education, since it provides important speech and sociocultural skills. Thus, blended education is becoming an approach that educational institutions can apply "here and now", updating the educational process. The student attends "live" classes

in classrooms, but at the same time, the computer, online mode, mobile devices and special training programs, platforms and resources act as a mediator of educational activity.

Blended Learning is applicable to different audiences: it can be training for school-children and students, and it can be trainings and corporate training for employees. Blended Learning is based on Distance Learning, Face-To-Face Learning, and Online Learning. This concept allows you to maintain the level of training even in case of emergency. Blended Learning teaches to organize and plan work independently, independently obtain and analyze knowledge, search and select information, make decisions, develop skills for presenting projects, and engage in self-education. There are six main Blended Learning models with different emphasis, needs and costs [10]: Face-to-Face Driver, Rotation Model, Flex Model, Online Lab, Self-Blend Model, Online Driver Model.

It is important to analyze and carefully prepare the curriculum: to distribute the material of the course or academic year for full-time, distance and online parts; understand what can be improved with the help of modern technologies and programs; set time frames for each topic and determine the rhythm of work. It is also necessary to understand in what sequence and how often distance self-study is replaced by face-to-face exercises with “live” discussions. It is also necessary to develop or digitize a mass of working materials, select online resources and supporting programs that will be involved in training, and also create a training program or adapt online services for team work and project management to fit your curriculum.

In its pure form, these models are rarely used. Usually they are combined. The obvious advantages of Blended Learning are the flexibility of the educational process, the openness of training, the possibility of an individual approach, the development of independence, and increasing the motivation of students.

7 Conclusion

Within the framework of the proposed approach, it is possible to build a distributed educational environment integrated with the real objects of the economy of the territory, which is a component of the educational ecosystem. For territories with a high concentration of manufacturing enterprises and educational institutions, this model allows us to consider an integrated ecosystem based on the ecosystems of the territorial entities

The concept under consideration allows predicting and planning the training of required specialists, since the model of its work is closely related to enterprises in the real sector due to the fact that training takes place according to flexible programs that reflect the constantly changing requirements of enterprises to the competencies of their employees. In fact, an educational institution or a group of them is becoming an essential part of territorial industrial clusters, which makes it possible to increase the efficiency and quality of specialist training and to quickly develop new curricula and courses that will quickly develop competencies demanded by the real sector of the economy.

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