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Individualization of Learning: An Investigation on Educational Technologies

**Olga Mikhailovna Karpenko¹, Anna Viktorovna Lukyanova,²
Vasily Vladimirovich Bugai³, Irina Alekseevna Shchedrova⁴**

Abstract

The paper discusses various approaches to the concept of “individualization of learning” and their relevant changes in connection with the development of educational technologies. An analysis of the relevant literature shows that a more precise content of this concept in each specific case depends on what goals are meant when talking about individualization. There are large differences found in different countries, among different authors, and in everyday educational practice when this concept is used. More than that, the authors demonstrate that the very notion of “individualization of learning” is replaced by “individual learning,” i.e. by the concept of “independently performing learning tasks.” The research also clearly shows that a number of opportunities for better individualization of training are limited in conditions of traditional didactics, as well as in terms of group work and the existing system of lectures and seminars. The authors argue that “individualized learning” is a part of “personalized learning,” since personalization is the realization of a person’s desire to be a person. And personality is a systemic quality of an individual. This quality appears in three spaces, one of which is the space of a person’s individual life. Another claim is that full individualization of potentials existing in education can only be achieved through a didactic-technological paradigm based on web-technology and application of intelligent robots in education. The second requirement implies administration of both education and educational process management. The authors additionally provide a case study of the “LUNCH Intellectual Information System” in order to support their arguments.

Keywords: Individualization of learning, Student, Didactics, Cognitive features, e-learning, Computerization.

¹ Candidate of Economics, Associate Professor, Chairman of the Board of the Autonomous non-profit Organization Institute of Continuing Education “Professional,” Moscow, Russia. E-mail: okarpenko@campus.muh.ru

² Candidate of Technical Sciences, Rector, Autonomous Non-profit Organization of Higher Education “Open University of Humanities and Economics,” Moscow, Russia. E-mail: rector@ogeu.ru

³ Candidate of Legal Sciences, Professor, Director, Private Professional Educational Organization “Nizhny Novgorod Humanitarian and Technical College,” Nizhny Novgorod, Russia. E-mail: Bugai_vv@mail.ru

⁴ Director, Professional Educational Organization “Smolensky College of Law,” Smolensk, Russia. E-mail: irinalex72@yandex.ru

Introduction

An important direction in modernization of higher vocational education is the individualization of education. It allows one to create conditions for the most complete realization of students' personal potential, their academic mobility, and the construction of an individual educational trajectory, i.e. to maximize education towards the student's personality.

The history of the formation of pedagogy as a discipline confirms that the process of training was individual even in the Ancient world (i.e. Socrates, Plato). In the Middle Ages, the economic conditions led to the need to increase the productivity of teachers: society's need to train a large number of people led to the new educational technologies used today. Back in 1649, the creator of the "Great Didactic," Jan Amos Komensky, described in detail the technology of class-lessons and lecture-seminars (front-line) for conducting classes (Plomin & McClearn, 1993). However, in the modern world, at the time of rapid developments communication technologies, the informatization of all spheres of human activity and priorities in education have changed dramatically. One of the top priorities is the individualization of learning.

The urgency of the problem of choosing an individual educational trajectory by students in the educational process is confirmed by the fact that at present, the concept of "individual educational trajectory" is included in the texts of legal documents, becoming an element of professional development of a specialist. The Law on Education in the Russian Federation provides for the possibility of applying a modular principle in the presentation of the content of educational programs, curricula, and the credit systems used in an educational organization. In this regard, the question of introducing an individual-oriented model for constructing an educational process, completely abandoning stream-group training, and the formation by each student of individual curricula and schedules are actively discussed in the scholarship (Petruneva, 2011).

However, in practice, fundamental changes have not occurred. The formal approach to the process of individualization of student's learning activities still prevails at universities. In particular, the technological and organizational implementation of students' individual educational programs is practically absent. Thus, individualization is still assigned to a teacher and is solved, as a rule, at the level of a specific academic discipline.

Definitions and Approaches

Before considering various aspects of implementing the concept of "individualization of learning," we would like to review the basic definitions that characterize this process. "Individualization of learning" is often used in various and sometimes even indefinite values. An analysis of the relevant literature shows that the more precise content of this concept in each specific case depends on what goals and means are meant when talking about individualization. When using this concept, large differences are found in different countries, among different authors, and in

everyday educational practice, when the notion of “individualization of learning” is replaced by individual learning, i.e. by independently performing learning tasks.

In the field of Russian pedagogy, the works of Davydov (1999), Kirsanov (1982), Unt (1990), and others are classic ones on the problems of individual approach. Let us turn to some definitions.

In the Russian Pedagogical Encyclopedia, individualization is defined as “... organization of an educational process, taking into account students’ individual characteristics, which allows one to create optimal conditions for the realization of potential opportunities in each student. Individualization of training is carried out in the context of collective study work within the framework of common tasks and training contents” (Davydov, 1999). Individualization here does not necessarily imply taking into account the peculiarities of each student; at best, researchers limit themselves to taking into account groups of students who have similar qualities in any complex.

Kirsanov (1982) defines this concept from the same position. He considers individualization of learning as “a system of educational and didactic means corresponding to the goals of activities and real cognitive possibilities of the collective of the class, individual students, and groups of students. This means making it possible to ensure each student’s learning activities at the level of his/her potential, taking into account training objectives” (pp. 56-57).

In turn, Unt (1990) expands the concept of individualization in a different way. In particular, he notes, “Individualization of learning takes into account individual characteristics of students in all its forms and methods in the process of learning, regardless of which features are considered and to what extent they are taken into account” (Unt, 1990, p. 78).

In the 90s of the twentieth century, under the influence of ideas from humanistic psychology (i.e. K. Rogers, A. Maslow) and personality-oriented training and education (i.e. N. I. Alekseev, E. V. Bondarevskaya, V. V. Serikov, I. S. Yakimanskaya), the shift of emphasis occurred from learning as a strictly regulated and uniform process, to learning as an individual activity of a student, a space of self-realization of a person, as well as discovery and development of its potential (Madd & Costa, 2008; Terry, 2016). This led to the emergence of new approaches to the problem of individualization. The traditional consideration of individualization as an organization of the educational process, taking into account individual characteristics in order to assimilate general knowledge, skills, and abilities, has given way to an orientation towards a holistic personality, individuality in its originality, and uniqueness (Spirina & Sagoyakova, 2014). In order for students to build their own path in education, creating an appropriate educational environment (a space of choice) is necessary. At the same time, a student should act as a subject of choice in order to develop and implement the educational process, his/her own educational trajectory. From these positions, individualization is considered in the works of A. P. Tryapitsyna, B. S. Gershunsky, and others (read more on this problem in Romiszowski, 1994). However, technologically, these ideas have not been developed enough. More than that, they have not been widely used in mass educational practice.

Analysis of the results of psychological and pedagogical studies of recent years shows that the introduction of federal educational standards in the educational process of the university involves

creating conditions for designing and implementing individual educational trajectories of students (Asadullin & Vasilyev, 2012; Berezhnaya, 2012; Sysoev, 2013; Bray & McClaskey, n.d.). Individualization of the students' learning process is becoming one of the most important tasks in the field of higher education.

The Future is Already Here: Key Challenges for Individualization of Learning

Content and organizational components are highlighted in individualized learning. These are various aspects of the same problem, and to solve it, the problem of individualization of education should be developed both from the perspective of selecting appropriate training content, as well as in terms of its organization. Individualized learning is a part of personalized learning since personalization is the realization of a person's desire to be a person (Tang & Wang, 2018). And personality is a systemic quality of an individual appearing in three spaces, one of which is the space of a person's individual life. The call is also coming from the UNESCO and the UN, "from education for life" to "education through life." A widespread requirement of continuity in education could be considered as a perfect example and clear proof of our previously made statement.

American sociologist and futurologist E. Toffler figuratively described the process of producing new knowledge. According to his research, "The innovation cycle, fueling itself, speeds up the pace. However, if the technology is viewed as a great engine and a powerful accelerator, then knowledge should be considered as its fuel. So, we come to the difficult issue of accelerating progress in society, because the engine is filled every day with more and more enriched fuel" (Toffler, 2008). The growing mass of knowledge causes a growing number of professions. The occurring transition of many activities into the virtual environment (business processes, science, education, culture, socio-cultural activities, interpersonal communications, etc.) makes new demands on specialists. A 21st century specialist of any profile must meet challenges of the era of Internet technologies and virtualization, fully own an e-society philosophy and a new technological culture (Karpenko, Karpenko, & Fokina, 2016).

If earlier dozens, then hundreds of professions existed before, then according to the information provided in the American Dictionary of Names of Professions (US Department of Labor, 1991), their number was about 40,000 in 1991. According to various estimates, at present, the number of different professions is approaching a total of 70,000 (World Economic Forum, 2018).

Experts believe that, perhaps, the number of professions will reach the number of people making up the economically active population. Or even it can exceed, especially if people would master several professions. The growing number of professions and the diversity of mastered competencies, knowledge, skills, and abilities within professions will require a transition to a degree of individualization of training. Apparently, this tendency will lead to personal educational programs. These programs will be formed according to the needs of each individual. A person in a cognitive society becomes a carrier of a unique set of knowledge, skills, and abilities (Karpenko, Karpenko, & Fokina, 2016).

In order to maintain the productivity of his/her labor in a civilization at the required level, a person has to constantly learn, and the quality of education is of great importance. The team of authors under the leadership of M. P. Karpenko, studying the quality of education, came to the conclusion that “the quality of higher education depends on a number of factors, among which the most important are the educational environment of the university and the ability of each student” (Karpenko, 2007). According to the results of sociological research, there are approximately 5% of gifted people in Russia, and more than 80% of the total population are those people who possess average abilities, constituting the bulk of the economically active population in Russia. About 15% of the whole population cannot overcome the basics of higher education due to a lack of ability. This means that 85% of the whole population can get educated, including those people with average abilities.

The need to train people with average abilities leads to new requirements for didactics. However, we have to admit that, in the view of modern high school didactics, a student is a kind of abstraction. Traditional university didactics does not distinguish students by gender, age, and properties of their nervous systems, whereas the differentiation of students according to their psychological, physiological, neurological, and cognitive features is necessary. Therefore, the task of educating a student as a cognitive person, who must develop the skills of self-study, self-education, self-development, self-improvement, has become highly relevant. While educating a student, one needs to help him/her to learn their abilities. In accordance with his/her needs, it is necessary to create conditions for the disclosure of his educational potential, which is possible only if the educational process is individualized.

Asadullin & Vasilyev (2012) in their research note that the traditional paradigm of education is characterized by the following properties: a structure of the educational process occurring at a particular university is inadequate to a structure of the future specialist’s developing personality. One needs to bear in mind the need to differentiate the logic of mastering educational materials from the laws of developing specialists as subjects of professional activity, taking into account the lack of attention devoted to building students’ own educational trajectories. In the current training system, a teacher acts as a translator of educational information, and students’ activities are mainly reproductive. They listen, record, remember, reproduce, have a predictable reaction to influences from teachers, sometimes act according to a predetermined algorithm.

Individualization of higher education is expressed in the development of students’ individual curriculum, in which all requirements of the federal state educational standard must be met. But each student needs an individual plan. It is important to conduct individual consultations, group classes, an individual accounting of not only attending classes but also monitoring the educational achievements of each student. An individual training schedule is possible: if a student is able to study faster than the average training schedule allows, we need to let him/her study faster; in contrast, if a regular schedule is met by him/her with tension, we should let them learn more slowly. A student must determine for him/herself an individual pace of learning, distribution of time, and a schedule of learning. In other

words, it is necessary to connect their adaptive mechanisms, giving them the opportunity to tune themselves. And this can be considered individual learning.

In a rapidly changing world, a specialist can remain “on the crest of a wave” only through continuous improvement (Berezhnaya, 2012). At the same time, the development of students in the process of independent cognitive activity and an ability to design their own educational trajectories have special significance and value. If necessary, this will allow students to independently acquire new knowledge and develop new skills in professional activities throughout their lives. First of all, the need for students to develop the skills of independent learning activities and the ability to design their own educational trajectory is determined by the social order for modern specialists.

Consequently, in the educational process at a university, the following contradictions are evident:

- Between a set of uniform requirements for learning outcomes in accordance with our federal standards, leading to the educational process unification and a significant difference in the initial development level of first-year students, the diversity of personal qualities and cognitive abilities of students;
- Between the prescribed forms of organizing the educational process at a university and those conditions that are necessary for constructing personal learning paths;
- Between the focus of teachers on providing students with ready-made knowledge using explanatory and illustrative teaching methods and the need to develop students’ abilities for continuous self-education activities (Usmanova, 2014).

It is obvious that in the conditions of traditional didactics, both the group work and lecture-seminar systems limit the number of possibilities for individualizing instruction. Individualization of learning can only be achieved in full through a didactic-technological paradigm, which is based on applying web technologies and intelligent robots both in the learning process and educational process administration. Thus, resolving the aforementioned contradictions can be successful only on the basis of an electronic information and educational environment, including both the latest information technologies and innovative e-learning didactics (read more in Robert et al., 2017; Robert, Neustroev & Goncharov, 2018; Robert, 2018a; Robert, 2018b; Robert, Polyakov & Kozlov, 2018). The electronic information and educational environment allow students to independently form their own curriculum, including choosing necessary courses and sequences in their study, and to master new knowledge at an individual pace. Thus, the electronic information and educational environment provide all opportunities for taking into account the cognitive characteristics of each individual and the individual need for new knowledge.

Designing new types of classes and combining them into dynamic intellectual systems-robots to meet the educational needs of each student after the diagnosis of his/her cognitive profile becomes an urgent task when building a modern educational environment (Karpenko et al., 2015; Karpenko, Karpenko, & Fokina, 2016).

When individualizing education in a mass distributed university that implements e-learning, large volumes of information must be processed to meet and manage students' individual appraisals in the educational process. In a traditional university, this causes a corresponding increase in the number of training and support staff, which is constantly engaged in collecting and processing information. Moreover, the centralization of educational process management in the presence of university branches is almost impossible.

Full implementation of individualization of education is possible only at those universities that are able to collect and process "Big Data" in terms of educational, organizational, personal biometric, and psychophysiological information about students, relying on modern information technologies (Yáñez, Okada, & Palau, 2015; Detterman, 2016). At the same time, the greatest didactic freedom of such a university lies in the formation of the individual cognitive profile of each student, on the basis of which the development and application of personal teaching methods become possible. And here, the task of developing rational teaching methods and forms of presenting educational material to students faces didactics. As well as the task of didactics is to objectively assess an achieved effectiveness level of educational products from the point of view of their influence on the quality of learning materials.

Apparently, introducing "Big Data" technologies into education will be associated with developing methods for collecting and processing personal biometric information. This condition will give the opportunity to form an individual cognitive profile of each student. First of all, a student's individual cognitive profile includes psychophysiological indicators: brain bioelectrical activity, electromyogram, galvanic skin response. Adaptation of these parameters to the technologies of "Big Data" is planned on the wave of ever-increasing interest in personal gadgets that evaluate the state of health and human activity.

The collection of personal psycho-physiological parameters in the information environment for the implementation of e-learning should be organized according to the following principle: an affordable peripheral gadget being connected to a tablet or smartphone, allowing the processing of centralized data and individual results in a "personal cabinet." In addition to stating the result, full monitoring necessarily includes corrective measures or optimization through a "personal cabinet." In this case, the personalization of educational programs is built on the basis of "Big Data", which allows one to formulate recommendations on the content, process, methods, and pace of learning. Consequently, an individual educational path is built for a learner. That is, any content (video, games, lectures) is taken, and a huge number of different metrics are used to understand how a particular person interacts with it. As a result, that content is recommended to a learner, which would be the most effective for him.

Case Study: The LUNCH Intellectual Information System

The “Luch” intellectual information system (IIS) developed at the Modern University for the Humanities (MUH) is an example of one of the Russian effective developments in the field of system solution of the automation of educational environments. The IIS “Luch” system refers to systems related to the “Big Data” processing technologies.

The IIS “Luch” implements a variety of functions of managing a distributed university: managing the development of educational content and providing students with access to it; academic administration (including interaction with students’ personal educational environments); administrative and economic functions of the university, etc. The IIS “Luch” provides information support and control of each student from the time of enrollment to the time of educational documents, electronic identification of students during certification procedures, the compilation of individual schedules, individual curricula, preparation of orders, etc. The IIS “Luch” provides for the formation of more than a thousand types of reports and references on all aspects of the administration of the educational process. The IIS “Luch” supports international standards for the exchange of educational materials (SCORM).

The team of authors under the leadership of M. P. Karpenko conducted a comparison of the functional capabilities of the popular domestic systems “LMS / LCMS” and the IIS “Luch” (Karpenko, 2015). This comparison shows that the following tasks are not solved in any system except the IIS “Luch”:

- Automated description, editing, and storage of all types of curricula (including individual ones) for a long-term study period;
- Automated recording of students’ progress during the long-term period of study;
- Automated generation of relevant orders and diplomas;
- Integration with personnel accounting system;
- Opportunities for mass testing of students and automated data processing for the formation of a student’s individual cognitive profile.

The above functional capabilities of the IIS “Luch” allow to fully implement an individual approach in education, ensuring that the administration process is fully centralized.

Conclusion

Exploring such a concept as individualization of learning, our research demonstrates that approaches to individualization vary depending on the development of educational technologies. Currently, the introduction of e-learning and distance learning technologies is no longer debatable, especially with the release of the Federal Law 273 on Education in the Russian Federation. The MUH example given in this article in the field of individualization of education clearly shows wide possibilities for using informatization and robotization for the individual development of a person in a knowledge society.

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