

## Article

# Content Aspects of Professional Training of a Specialist in the Development of Individual Educational Trajectories

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**Abstract:** This article lists the prerequisites for the emergence of new interdisciplinary professions at the intersection of pedagogy, information and communication technologies. A new promising profession of a developer of individual educational trajectories is given, described in the “Atlas of New Professions 3.0”, developed under the auspices of the Agency for Strategic Initiatives. As conceived by the authors, this is a professional who creates a route for training new specialists from courses offered by educational institutions, including those available online, as well as simulators, simulators, internships, etc., and develops an educational track based on them, considering the psychotype, abilities and goals individual person. Since a brief description of this profession in the Atlas does not give a complete picture of its content, for the purposes of understanding the meaningful aspect of the professional training of such specialists in a multidisciplinary university, a description of the methodological basis of the developer of individual educational trajectories is given. The authors of this article describe the principle of operation of the constructor, developed at SPbPU and allowing the selection of the content of professional training of the developer of individual educational trajectories in a multidisciplinary university.

**Keywords:** atlas of new professions; professional training of teachers; learning content; individual educational trajectories; multidisciplinary university



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## 1. Introduction

The changes taking place in society and in science as well as in the labor market stimulate changes in the pedagogy of higher education. In this situation, the professional training of teachers requires updating the latest requirements of regulatory documents for the purpose of training high-quality specialists of a new type. The quality of education is invariably one of the fundamental foundations of quality of life. In a modern post-industrial society, an increase in the level of education quality is possible only with its modernization, using information and communication technologies with a focus on the current social order [1,2]. In order to improve quality and competitiveness, the compliance of the domestic education system with the modern demands of the state and society is a long-term perspective for its development [3,4].

Informatization of education in a broad sense is the process of providing the education system with the theory and practice of developing and using new information and communication technologies [5], focused primarily on the implementation of the goals of education and upbringing. As a multidimensional process, the informatization of education affects the requirements for the competence of teachers, teaching materials, means of information

and communication technologies, as well as the motivation of the activities of the subjects of the educational process.

The modern economy requires new personnel who are well-oriented in the digital environment [6,7]. Therefore, one of the most important areas of informatization of education is the organization of multi-level systemic training and retraining of teaching staff capable of developing the educational process with the purposeful and methodologically justified use of information and communication technologies [8,9].

Currently, there is a transition from an educational culture formed by the printed word and oral speech to a new form of educational practice [10], in which interaction within the educational process through the Internet is of key importance. This new educational reality [11,12] requires teachers to be able and ready to build new network forms of educational interaction [13].

## 2. Materials and Methods

Speaking about professional training of specialists of a new type, it seems to us that the “Atlas of New Professions 3.0” is a promising document for analysis (developed under the auspices of the Agency for Strategic Initiatives). As conceived by the authors, the document is a career guidance tool for the 21st century, exploring non-obvious but promising and relevant professions of the future. The main idea of the Atlas is that the landscape of the professions of the future will be determined by digitalization, which today is rapidly breaking into all areas of human activity and dictating their development. It also notes the ongoing reorientation from mass production of goods and services to individualization and customization, which is the most important factor for the formation of new professions since it creates the prerequisites for the emergence of qualitatively new specialties. The authors acknowledge that the content of the Atlas looks very far from the content of existing regulatory documents in Russia such as the Professional Standard or the Federal State Educational Standard, but its purpose is to try to go beyond the existing training programs on the educational market, outlining promising areas of development [14].

The “Atlas of New Professions 3.0” covers 27 areas of professional activity. However, the section on the professions of the future in the field of education is of particular interest for the purposes of our research. It is generally accepted that education is a conservative area of social life; however, the development of information and communication technologies is changing the trajectory of knowledge acquisition and sets the task of a comprehensive rethinking of the usual approaches to the organization of the educational process. Here we consider it important to note two aspects: the integration of information and communication technologies in education and the individualization of educational trajectories.

The first aspect provides new opportunities, namely:

- (a) The possibility of transforming the model of the educational process “one education for life” into the model “continuous education throughout life (lifelong learning)” [5,15].
- (b) Changing the role of the teacher. The use of information and communication technologies in the educational process provides an opportunity for the teacher to change from the role of a lecturer, who mostly just provides information, to a consultant or leader [1,3,8], operating project work and helping students to independently obtain the necessary knowledge.
- (c) Increasing motivation and, hence, increasing activity due to the greater attractiveness of information and communication technologies for students than traditional exercises in traditional printed textbooks. Most teachers who use ICT emphasize their motivating function [6,9,13]. It should be considered that modern students are a new generation that has grown up in the conditions of widespread informatization.

The second aspect allows us to give the educational process flexibility. Classes at a convenient time, at a convenient pace, outside the limits and restrictions of a traditional offline classroom learning, as well as constant interaction, regardless of the location of the educational process’ participants. Individualization of educational trajectories provides

opportunities such as: the ability to meet the needs of various categories of students, including students with special needs; the ability to choose the format of studying and its pace; the possibility of narrow specialization or, on the contrary, generalization within the framework of professional training at a university.

The authors of the Atlas argue that the world around us is changing so rapidly that students can no longer afford to study theoretical disciplines for five years of study at a university, and then master the practical aspects of their chosen profession at the expense of the employer. Therefore, education, especially within the framework of higher education, is becoming more and more subject-oriented and practice-oriented, and the emphasis is shifting from theory to real projects of students, including their start-ups. In addition, forms are being developed in which a student can study and work at the same time [14].

In connection with the listed prerequisites for changes in the field of education, the “Atlas of New Professions 3.0” proposes the profession “Developer of educational trajectories”. As conceived by the authors, this is a professional who creates a route for training new specialists from courses offered by educational institutions, including those available online, as well as simulators, internships, etc., and develops an educational track based on them, considering the psychotype, abilities and goals of an individual.

### 3. Results

We believe that the concept of the profession of a developer of educational trajectories, described in the Atlas, is quite a promising one, but requires further development, especially in terms of its content. Peter the Great St. Petersburg Polytechnic University is a multidisciplinary university that implements dozens of different areas of training specialists. It is possible to organize professional training for such interdisciplinary specialists as a developer of educational trajectories on the basis of SPbPU.

The “Atlas of New Professions 3.0”, in its description of the profession of a developer of educational trajectories, notes the importance of developing such a specialist in cross-professional skills and abilities, namely: systemic thinking; intersectoral communication skills; ability to manage projects and processes; programming IT solutions; control of complex automated complexes; work with artificial intelligence; customer focus, the ability to work with consumer requests; the ability to work with teams, groups and individuals; and artistic creativity and the development of aesthetic taste [14].

The listed skills and abilities are certainly important for most modern specialists striving for competitiveness; however, they do not give a sufficient idea of the content specifics of the considered profession of the developer of educational trajectories. We would like to dwell in more detail on the substantive aspects of the formation of the ability to build and maintain constructors of individual educational trajectories.

It should be noted that the constructor of individual educational trajectories is a software that allows you to perform the following actions:

- (a) the ability to implement interfaces for describing different types of content;
- (b) the possibility of correcting the description of knowledge, skills and abilities;
- (c) the ability to remove obsolete knowledge, skills and abilities;
- (d) the possibility of correcting the description of digital competencies;
- (e) the ability to remove outdated digital competencies;
- (f) the possibility of implementing linear and non-linear scenarios for the assembly of educational programs;
- (g) the possibility of approbation of the project on educational trajectories that develop digital competencies;
- (h) the possibility of forming (collecting) a digital trace of the student.

As part of an individual educational trajectory, the developer identifies five levels of mastering competencies within a specific course: initial, basic, advanced, professional and expert. Professional and expert levels of mastering competencies are not necessarily expected. According to the needs of the students, the developer provides them with the

opportunity to master the course program at the level that they need to achieve their individual learning goals.

On the example of the development of digital competencies, we will consider the methodological basis of the constructor of individual educational trajectories. Digital competencies, the formation of which is integrated into all educational programs of SPbPU, are: digital literacy, digital culture and digital technologies in professional activity [15]. The formation and development of digital competencies are implemented on the following principles, which are reflected in the constructor of individual educational trajectories:

- (a) Leveling. The formation of digital competencies has a tiered character. The levels of mastery of digital competencies are arranged vertically, in order of increasing complexity;
- (b) Customization in relation to educational programs. The complex formation and development of digital competencies is carried out considering the peculiarities of educational programs;
- (c) Individualization of educational trajectories. Mastering the minimum required level of digital competencies by students is provided by compulsory disciplines. At the same time, students have the opportunity to build their individual educational trajectory.

There are five levels of digital competencies mastering: initial, basic, advanced, professional and expert. The professional and expert levels of mastering digital competencies are not necessarily expected; therefore, they are not fixed as the minimum required and are achieved within the framework of individual specializations or an individual educational trajectory.

As part of the development and maintenance of individual educational trajectories, the developer operates with two basic concepts: the minimum didactic unit (MDU) and the result basket product (RBP). Each of the products is described by its own set of parameters; there is also a set of additional services for comparing them with each other.

Depending on the goals and objectives of training, the developer of individual educational trajectories chooses one of the development scenarios:

1. The ability to select a product from the basket of results and automatically select a set of minimum didactic units for this product as shown in Figure 1. The linear trajectory with one block provides an entrance test for each minimum didactic unit. For the initial minimum didactic unit, input testing allows you to determine the initial values of the student's competencies. This does not preclude students from self-assessment of their competencies.

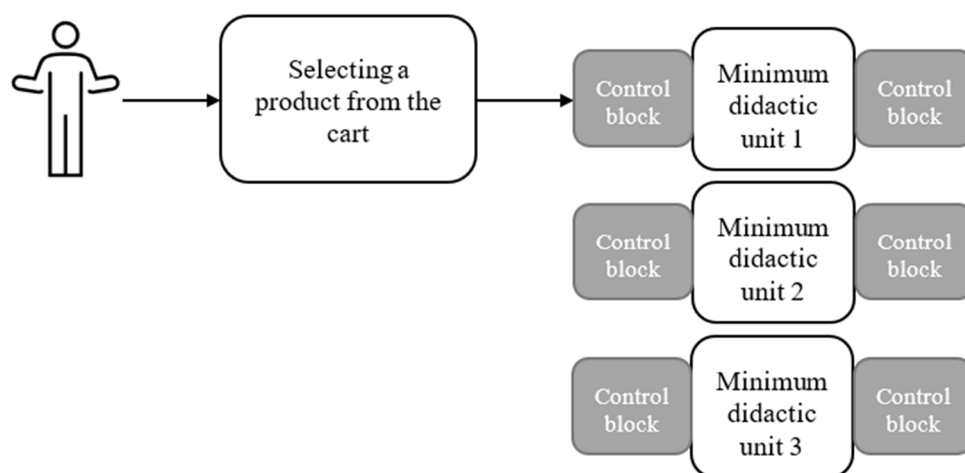
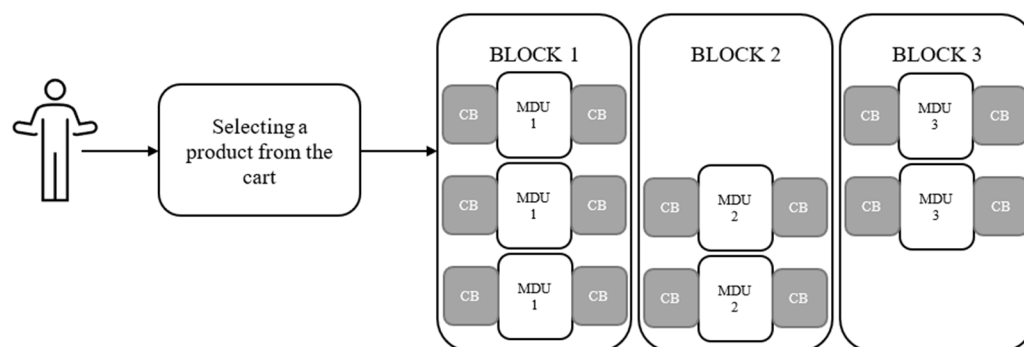


Figure 1. Linear trajectory with one block.

2. When choosing a product, different sets of minimum didactic units are offered at different stages as seen in Figure 2. The linear trajectory with multiple blocks is similar to the previous one, but the student's choice at each step implies the presence of not

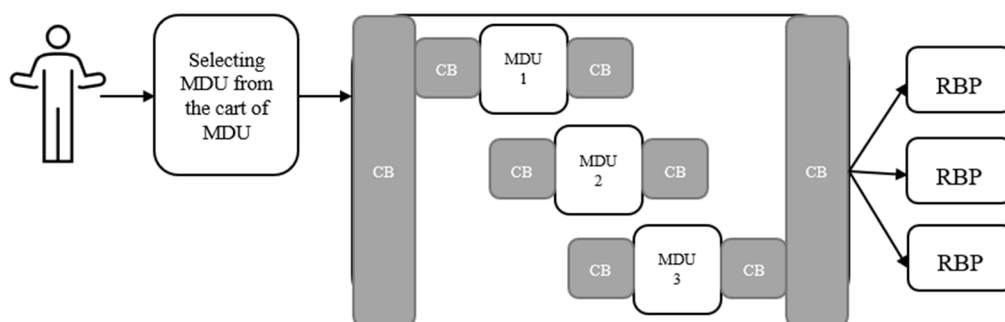
one minimum didactic unit, but a block of minimum didactic units, which ensures the variability of choice.



**Figure 2.** Linear trajectory with multiple blocks.

In the case of this scenario, the input testing includes blocks of input tasks from different MDUs of Block 1, after which the initial block is determined (automatically) or recommendations are given for mastering another MDU.

3. The possibility of a set of MDUs, with automatic splicing and with variable execution and the determination of which product is the most consistent, as seen in Figure 3. Scenario: the user types MDUs from the basket, they line up in accordance with certain splicing rules—there may be several MDUs from the selected ones, which will be located separately—then a recommendation is given to either collect something new or exclude them.



**Figure 3.** Variable trajectory.

If the product from the basket of results is not assembled, then the student can be given a recommendation to which product the collected trajectory is closest and the corresponding MDUs are recommended.

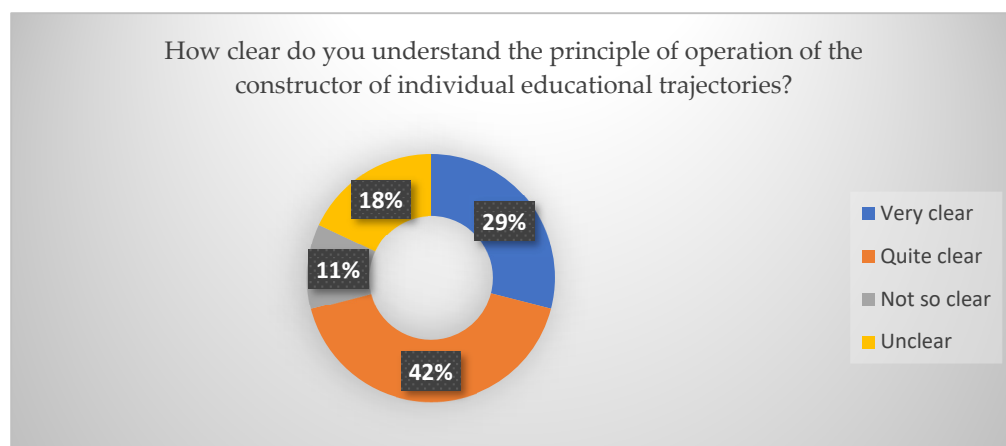
4. Cultivation of the knowledge, skills and abilities component; access to the MDU basket (there can be an absolute mixing of all trajectories and an increment of only, for example, one component). Scenario: The user selects blocks that do not stack into a basket of results product. However, the collection of these blocks in a chain makes it possible to develop a separate competence. The result in the profile (as an example) is a 60% increase in competence in the field of compiling mathematical algorithms and 2–5% increase in other competencies that are declared in the MDU.

#### 4. Discussion

We agree with the authors of the “Atlas of New Professions 3.0” on the matter of importance and prospects of the developer of individual educational trajectories profession. The learning content overview in preparing a developer of educational trajectories provided in this article allows us to consider the process of professional training such a specialist requires from the point of view of what professional tasks they actually need to be prepared for.

The graduate should be ready to implement interfaces to describe different types of content; should be able to describe knowledge, skills and abilities, as well as adjust, add and remove them in the educational trajectory; should be able to describe digital competencies, as well as adjust, add and remove them; must be able to implement linear and non-linear scenarios for the assembly of educational programs; and must also be able to collect the student's digital footprint.

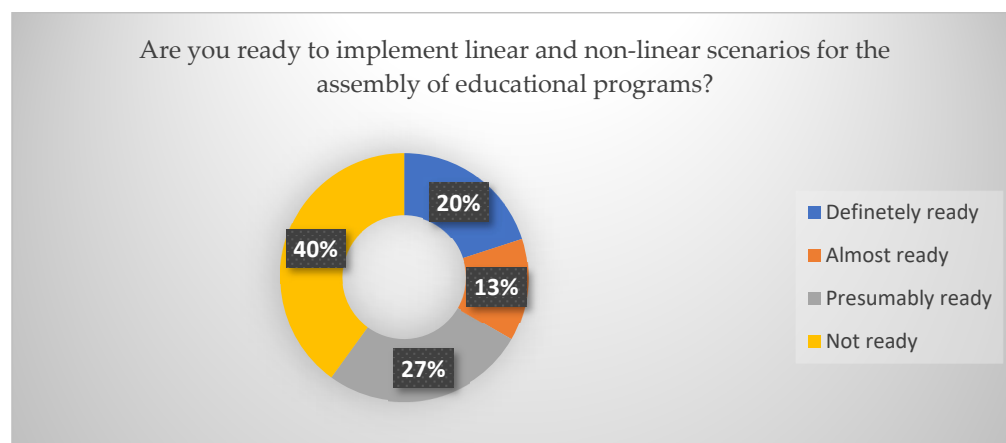
We have consulted the educators' community of Peter the Great St. Petersburg Polytechnic University through an online survey in order to collect relevant data regarding their readiness for interaction with individual educational trajectories (Figure 4). A total of 335 participants have completed the survey; all were professional educators, with precisely 34% information sciences specialists, 28% pedagogical sciences specialists, and the remaining percentage natural, social and physical sciences specialists.



**Figure 4.** The understanding of the constructor of individual educational trajectories.

They were asked to express their understanding of the principle of operation of the constructor of individual educational trajectories. The majority of them found the description of the software quite clear (42%) or very clear (29%), and they gave valuable remarks which were considered by the authors.

Recipients were also asked to self-assess their competence in developing individual educational trajectories. As shown in the graph below, the majority of them (40%) are not ready or just presumably ready (27%) to implement linear and non-linear development scenarios (Figure 5).



**Figure 5.** Implementing linear and non-linear scenarios for the assembly of educational programs self-assessment.



## 5. Conclusions

As was mentioned earlier, the modern economy requires new personnel who are well versed in the digital environment, and the new educational reality requires educators to be able and willing to build new network forms of educational interaction. Therefore, one of the most important tasks is the organization of systematic training and retraining of educators capable of developing the educational process with purposeful and methodologically sound use of innovative software. One of the most interesting outcomes of the research seems to be the fact that the majority of the community of educators demonstrates understanding the principle of operation of the constructor of individual educational trajectories developed at SPbPU. Nevertheless, recipients are not ready to implement linear and non-linear development scenarios yet because they lack practical skills. Therefore, we can state the request for the emergence of new interdisciplinary professions at the intersection of pedagogy, information and communication technologies.

It is interesting to highlight how the request of society for changes in the educational system meets the readiness of educators' community to develop and implement those changes. We are convinced that the emergence of the new promising profession of a developer of individual educational trajectories can become a way to meet the needs of all the parties concerned.

We believe that this research can be useful for educators and educational institutions that are interested in developing various ways of constructing individual educational trajectories and the transformation of educational process in higher education. The next step of research is to develop an algorithm to adapt learning content for the SPbPU constructor of individual educational trajectories.

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