Methodology for the formation of an individual approach in the training of targeted highly qualified specialists at the request of the aviation industry

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Abstract. Modern higher education is a rather complex process that requires a special methodology for building the process of obtaining education by future specialists. In the aerospace industry, to simplify the process of searching for future employees of enterprises among applicants/students, a tool such as targeted training is used. At the same time, it does not guarantee the effectiveness of training a student, due to the linearity of the process of targeted learning. In addition, inertia is another important problem in targeted training. This paper presents a methodology for implementing individualization of the training of target students, which will solve the problems described above. Enterprises classify targeted queries into three vectors. The first vector covers further vocational education (FVE). It is associated with specific qualifications required by the employer and industry. The second vector is the classical scheme for preparing students. According to this scheme, training takes place according to the list of educational programs implemented by the university. But at the same time, this vector has the largest number of problems. The third vector is full-cycle training. The main aspect is the application of individualization of the learning process and individual tutoring.

1 Introduction

The modern aircraft and space industry needs a constant supply of new personnel. As part of the growing competition in the market of military-industrial products, enterprises are forced to equip their design and production units with personnel capable of modernizing existing and creating new models of military equipment.

Due to the increase in the working capacity of the industry and the long-term stagnation of personnel, a significant issue arises related to the shortage of qualified personnel. Selection and training of future employees is a reasonable measure of the employer to ensure its production. One way or another, the functioning of authorities and organizations always depends on people: even automated production requires human management and coordination. In this regard, the urgent need of employers for personnel entails an interest in their independent training and "booking" of highly qualified specialists at the formative stage.

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2 Solving personnel problems

Most enterprises solve the issue of new employees with the help of targeted programs. The classical target program has the following model: an applicant enters into an agreement with an enterprise before entering the institute, enters the institute and after training goes to work for this enterprise. This model is not always beneficial for both the enterprise and the student. Let's consider the problems that may be associated with such a model of targeted training of personnel for industry.

The main problem is the linearity of the process of working with a young frame. The industry pays for an applicant, and receives an employee in 4–5.5 years. In this linear process, there are no stages of a rapid learning process and rapid introduction of new personnel in the industry [1]. In this case, quite a large part of the time is spent on mastering the missing professional competencies, general cultural and universal competencies by the listener. As a result, the industry has to wait until the student fully masters professional competencies, graduates from the institute and comes to work.

Another important problem is a certain conservatism inherent in the classical model of higher education. Conservatism, of course, allows us to preserve the traditions of scientific and educational schools, contributing to the preservation of the best practices of fundamental training of students. This by no means indicates stagnation in higher education: the world's leading and Russian universities are constantly testing new methods and educational technologies, introducing only time-tested and experienced innovations into the main educational programs. Such an approach slows down the process of preparing the target student.

Let's assume a request comes to an educational organization from 5 different enterprises, which on average need no more than 8–10 people per year, who need special knowledge of software. However, the enterprise is not ready to additionally finance and unify its requirements. There is a certain problem in the requirements from enterprises due to the fact that different enterprises need different software products. It is not profitable for the Institute to open a new program/discipline for such a small number of students as part of the usual training of students, so often such industry requests remain fully unsatisfied.

For coping with some of the main problems of the industry in training targeted personnel there are certain solutions that can be used as part of the educational process. These solutions are used in the Moscow Aviation Institute (National Research University) (MAI), in particular, at the Institute No. 1 "Aviation Technology". In this article, we will consider the methodology for implementing individualization to target students' training.

3 Implementation of the target contract

The targeted training of students is significant for all three participants in the process: industry, institute and student. All three participants should be interested in this process. If one of the participants has no interest, then this linked chain is lost, and we return to the problems described above.

The requirement for a specialist, first of all, should come from an enterprise. This requirement for targeted training should take into account the strategic development of the enterprise and the industry as a whole. Based on its strategic path, the organization forms a list of competencies that they want to see in their potential employees. It is noteworthy that the list may not include oly professional competencies but also requirements for Soft Skill, IT, etc. competencies. But the company selects its requirements for competencies for jobs where graduates of targeted programs will be arranged in the future. It is important to understand the following: the ratio of competencies of the target student should be correlated with their salary. Also, the company must declare the required number of applicants for targeted training.

After the formulated requirements from the enterprise have been received by the institute, the educational organization conducts analytical work on the declared competencies. Generally such target requests of an enterprise are classified according to three vectors.

The first vector is the training of students/employees within the framework of program of additional professional education (PAPE). Training under the programs of additional professional education is to a greater extent related to specific qualification requirements required by the employer and industry. This vector can be considered the fastest in the stage of employee training. Professional retraining can take from several months to several years, depending on the complexity of the program. Another advantage of PAPE is that it can be carried out according to any competencies necessary for the future job [2]. But there are also significant drawbacks, for example, this education is ordered from the institute for separate financing from the enterprise.

The systematic approach to PAPE requires ensuring quality guarantees of additional professional education, the formation of a regulatory framework of methodological materials, a certification system and qualifications based on qualification frameworks, professional standards and other qualification requirements. At the same time, it is desirable to organize a system of advanced training and retraining of engineering and technical workers without interrupting them from production processes. This problem can be solved by using distance learning technologies as part of the educational process [3, 4]. But it is notable that the elements of the teacher's contact work with the listener are an obligatory component of the learning process.

There are a number of necessary steps that need to be taken to implement this training of targeted industry personnel. After receiving the list of required competencies, it is necessary to agree on the content of the program, approve the educational plan and enroll students in the course. After the course is listened to, it is necessary to prove the competencies mastered in the course, usually it is done through an exam, an interview, or a practical test.

The second vector is the classical scheme of student training. The university has a list of implemented educational programs. As described above, the program has the main disadvantages: the time of preparation of students and the lack of variability in preparation. The applicant enters into a contract with the target company for a specific specialty and chooses the institute in which such a specialty is implemented. After entering the institute, the target student learns competencies on an equal basis with all students. The only difference between the target students and ordinary students is that target students from the first to the last year undergo practical training at the enterprise and write diplomas on topics that will be of interest to the enterprise. Sometimes, after the 3rd year, an enterprise hires their students, but this method does not guarantee the most important thing: the provision of the employer with the specialist he needs. A specialist noticed by the employer, even with whom a contract has been concluded, may be lured away by competitors, or may not fully master professional competencies and be expelled.

The above problems can be solved with the help of the third vector—full-cycle training, in which the future specialist is actually assigned to the employer. MAI has been implementing one of the largest targeted training projects for a state corporation since 2020. The main idea of full-cycle training is as follows: the immersion of students into the working atmosphere of industry from the 1st year, the use of individualization in the learning process, the presence of individual tutoring and the training of highly qualified personnel. Let's look at these possibilities of preparation and ways to formalize such targeted contracts in more detail.

4 Essence of the target contract

By virtue of a target contract, a state or municipal body, organization, enterprise and educational institution are obliged to provide social support measures to a citizen, organize

educational, industrial and pre-graduate practice, as well as provide employment for a citizen, and a citizen, in turn, is obliged to master the curriculum, undergo educational, industrial and pre-graduate practice, and after graduation work in the organization for a certain period of time. The responsibility of the parties for the violation of the contract is manifested in the fact that the citizen reimburses the body or organization for the costs of providing social support measures, as well as a two-fold fine in relation to such expenses. In case of violation of the contract by the body or organization, a citizen is paid a double fine in relation to the social support measures provided.

The link between the student contract and the contract on target training is that the contract on target training can be regarded as a type of student contract due to their similarity. Such systematization is necessary to introduce certainty on some issues. A distinctive feature of the contract on targeted training from the traditional student contract is that the employer, in addition to the obligation to employ, also has the obligation to provide social support to the student (in the form of a "scholarship", the nature of which differs from the state scholarship, or other social support measures). The differences can be traced in two aspects: in the parties to the contract and liability. On the part of the employer, any organization can be a party to the student contract, except for state organizations that can act as a party to the contract on targeted training (since there is a special regulatory regime for them).

Responsibility under the contract on targeted training has been increased: a citizen who has not fulfilled his/her obligations actually reimburses three times the amount of social support measures provided to him, and under the student contract—in a single amount. At the same time, if the employer—party to the contract on targeted training fails to fulfill his/her duties, he is obliged to pay a fine to the citizen, twice in relation to the social support measures paid [5]. In case of violation of the contract, there is equal mutual responsibility—eventually one of the parties will receive three-fold measures of social support. Responsibility under the apprenticeship contract, as previously written, performs a compensatory function and is associated only with reimbursing the employer for his/her expenses.

As soon as the applicant enters the institute, a lot of work begins with him. First of all, each student has his/her own supervisor attached to him, who explains the whole system in detail. Right from the first semester, these students' education is built up several levels higher [6]. In the educational process, they are taught English at a high level with the number of hours 2 times more than ordinary students. One part is implemented as part of the curriculum, the second as part of additional classes, for which the customer pays. In addition, students participate in international conferences in English, first as listeners, and then as participants.

Also, from the first semester, students have a whole day in the middle of the week, during which they get acquainted with the company, and after some time they are officially employed and start working there [7]. In the first semester, students begin to study work with specialized IT products, as well as in-depth acquaintance with modern technologies in the field of robotics, composite materials, 3D printing, etc. Students undergo in-depth training that stretches over several semesters in programming in C++, Java or Python. In addition, they master computer-aided design systems (CAD), engineering analysis (CAE), technological preparation of production (CAPP), life cycle management systems (PLM) at a professional level. This training is also well suited for distance learning. The process of distance learning has already been sufficiently developed and there are many software products used in conducting such classes.

After the first year of study, the student not only passes an internship, but is also enrolled in a working profession, such as an aircraft mechanic, a CNC machine operator, etc. These additional skills allow the target student to participate in the work process in the specialty field. At the same time, the tutor suggests where you can apply your knowledge and addi-

tionally learn something new. Such additional courses, the development of individual training for students and tutoring allows to build a trajectory of a highly qualified specialist for industry, who from the first months of study will immerse himself in the working structure and improve his/her knowledge under the employer's order.

In subsequent courses, the student also builds an individual structure. Depending on the specific requirements of the customer, academic mobility from 6 to 12 months to universities in other countries is available for students. For academic mobility, the company can send students together with the institute to universities such as: Mendoza University, Buenos Aires Civil Institute of Space Technology, Bandung Institute of Technology (ITB), Shanghai Transport University, Beihan University, Beijing Polytechnic Institute, Technical University of Vienna, Technical University of Munich, University of Applied Sciences Ingolstadt, University of Applied Sciences Heilbronn, University of Stuttgart, Polytechnic University of Madrid. Graduate School of Aeronautics and Space Research, Polytechnic University of Turin, ECAM LYON, ISAE–SUPAERO, IPSA, ENAC.

5 Advanced MAI programs

It is important for the company to prepare not only a good specialist with a high knowledge of professional competencies, but also a potential manager. Therefore, the Institute offers these students to undergo professional retraining within the framework of the "School of Service" and "School of Management".

The School of Service is the first aviation service program in Russia. After-sales service of aviation equipment is one of the promising areas in the industry, located at the intersection of aircraft construction, economics and management. The Service School is attended by organizers from Moscow, experts from Italy, France, Japan and participants from all over Russia. There are 5 thematic blocks in this school: the current state of MRO in Russian aviation, the business model of the service and the contracting system, the design of the aircraft in the logic of the cost of ownership, the operational infrastructure: MTO and MRO operational infrastructure.

The MAI School of Management creates an environment for the development of talents and provides successful engineers with managerial competencies as well. The School of Management was created for the personnel reserve of high-tech corporations, talented students and employees of MAI, who are ready to develop their native institute and implement promising projects. The project was launched jointly with the largest corporations—the United Aircraft Corporation (UAC), the United Engine Corporation (UEC) and the United Shipbuilding Corporation (USC).

At the Moscow Aviation Institute, there is another stage of training highly qualified specialists for the requirements of industry—a targeted master's degree. The Master's degree program has a certain flexibility in implementation and, as a result, is in demand in a competitive market. Enterprises can send students to study under existing programs or sign a contract for the development of a completely new program. As a rule, to such programs companies send employees who already have experience working at this enterprise. Also, under the requirements of the customer, it is possible to obtain a specialist with a double diploma within the framework of the master's degree, while he will receive one diploma at MAI, and another at Shanghai Transport University (Shanghai Jiao Tong University). The MAI—SJTU Joint Institute is a unique educational and scientific environment in which students of the two countries study in joint groups throughout the entire period of study, which allows them to achieve high quality results in education and exchange their experience [8]. These programs are a direct example of the theory of global education and have no analogues in Russia and abroad.

6 Conclusion

The purpose of full-cycle training is to educate a new generation of engineers with a set of "digital" competencies, fully ready to work in modern aircraft construction. The training program is designed taking into account the real demands of the industry and helps to build a professional trajectory of future specialists from the first year. Students will be maximally involved in the current production processes of aviation cluster companies. The development of such programs is a condition for the competitiveness of Russian industry in the future. To continue studying under the program, students must annually confirm the achievement of targets. Upon graduation, enterprises guarantee employment of graduates who have achieved the goals set by the employer.

The ways of introducing individual training of highly qualified specialists for the needs of industry were proposed above. The requirements for a student and a future employee of the industry are put forward by the industry itself together with the institute, thereby forming new highly qualified personnel.

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