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The Latest Trends in The Professional Training of Masters in the Field of Engineering and Technology

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Abstract: The article talks about the latest trends in the professional training of masters in the field of engineering and technology. Its goal is to highlight and summarize these trends, to find out the general and the excellent, which can be used for the further development of multistage of higher education. Mostly, we used theoretical methods - selection, analysis, generalization of the latest trends in modern scientific and methodological literature, as well as elements of a comparative typological analysis of educational systems. In the course of the study, the authors found out: a characteristic feature of master's programs in Western European countries and the United States is the profile specialization and duration of study, which is determined by the requirements of the state and the system of organizing training in a particular university. Education at this stage is created according to individual programs, where the student and the scientific adviser participate jointly. An analysis of the training of masters in the field of engineering and technology in foreign countries indicates that the master's level in differentiation is preliminarily acquired on the basis of the obtained bachelor's level: master-practitioner and master-scientist. When preparing masters, national traditions of countries are taken into account and special attention is paid to practice. International significance of the article: the article summarizes the latest changes in the professional training of masters in the field of engineering and technology, which can be used in reforming the educational systems of developing countries. Also, the article is of interest to historians of education and specialists in comparative typological education.

Keywords: *master's programs, bachelor's level, master-practitioner, master-scientist, Smith-Hughes law of variance, educational technology environment.*

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1. Introduction

Training specialists to work in new conditions requires restructuring and updating the system of higher education and reforming the process of training and professional development of higher education teachers, the growth of their professional competencies. Reforming the education system of Ukraine (Bakhmat et al., 2019; Gerasymova et al., 2019; Nerubasska & Maksymchuk, 2020; Nerubasska et al., 2020; Maksymchuk et al., 2018; Onishchuk et al., 2020; Palamarchuk, 2020; Sheremet et al., 2019), its improvement and improvement of the quality level is the most important socio-cultural problem, in is largely due to the processes of globalization and the needs of the formation of positive conditions for the individual development of a person, its socialization and self-realization in this world and cannot occur without taking into account the experience of training specialists in other countries of the world (Melnyk et al., 2019).

The Sorbonne Declaration (1998) provided for the organization of a higher education system for students and society (Galeş & Florea, 2016), which provided better opportunities for the implementation of their skills, and the two-level higher education system (two-level and postgraduate) would be equivalent at the international level.

The two-level system provides for the training of specialists at the educational and qualification levels of "bachelor" and "magister". Postgraduate training provides training in which students will be able to choose between short-term training for a master's degree and long-term training for a doctorate with the possibility of moving from one level to another. At both levels of preparation after receiving the first diploma, appropriate attention is paid to research and independent activities of applicants.

For our research, an important aspect is the content and methods of preparing the educational qualification level "Magister" in foreign countries.

In 1999, when the Bologna Convention was signed, according to which access to postgraduate education provides for the mandatory successful completion of two-level education, which lasts at least three years. The bachelor's degree, which is awarded after completing the course of study and successful completion of state certification, will be perceived in the European labor market as an appropriate level of qualification. Upon completion of the second academic cycle, a master's degree is awarded.

According to the documents of the European countries participating in the Bologna process, the two-level education system is unified at the same time as preserving its national features.

The duration of training in the postgraduate education system in most countries is from one to six years, when much attention is paid to practical activities and internships. A characteristic feature of master's programs is their profile specialization and duration of study, which is determined by the requirements of the state and the system of organization of training in a particular university. Training at this stage is based on individual programs, in the preparation of which the student and supervisor take an active part (Vitvytska, 2004).

Master's degree is an academic degree awarded to individuals who have completed their studies, characterized by the skill of the graduate in a specialized specific field of knowledge or field of professional practice. Within a specific field, graduates have a thorough knowledge of theoretical and applied topics; skills of maximum analysis of phenomena and processes, critical assessment or professional application; the ability to solve complex problems and think out of the ordinary, to perform certain activities. Master's degree gives the right to engage in further research, to continue doctoral studies (Yashchuk, 2015, p. 100).

Relevance of the article. According to the documents of the European countries, which were the participants in the Bologna process, the two-stage education system is being unified simultaneously with the preservation of its national characteristics. However, in many post-socialist countries a number of problems arise: a) the presence of an intermediate degree "specialist"; b) sustainability of state traditions of higher education; c) the problem of choosing a recipient country, the model of master's education which could be borrowed. The authors of the article, who are from Ukraine, have made sure from their own experience that borrowing foreign experience in reforming education is often carried out mechanically, there is no transitional phase for changing educational consciousness, and a number of other compelling reasons can be named that make the topic of the article relevant.

Therefore, **the purpose of the article** is to analyze and highlight the latest trends in the professional training of masters in the field of engineering and technology, which have appeared in recent decades against the background of the general principles of training a master as a classical educational level with a centuries-old tradition.

We used **methods** of thematic selection of relevant literature and its analysis to achieve this goal; used methods of generalization, classification according to selected parameters, a comparative method to determine the latest trends.

The accumulation of data took place by summarizing the main ideas of the above literature, analyzing master's programs in leading countries, comprehending the experience of personal internships of the authors of the article in these countries.

Ethics of the article. The administrations of educational institutions agreed to analyze and use fragments of their software and methodological support. The theoretical generalizations given in the article were obtained by the authors personally or taken from the sources to which the vocation was made.

2. General trends of changes in the education of masters in the field of engineering and technology

At the turn of the second and third millennia, scientists noticed an ever-growing divergence between the rapidly developing and pedagogical technological sphere, which was acquiring more and more humanitarian features. (McCaslin, 2002) It is clear that the Hi-Tech technologies that were studied at universities could not be methodically provided within the framework of the humanitarian paradigm, since they were different sciences. First of all, this gave rise to an existential and professional problem for university teachers. As R. Hansen notes, based on research on the psychology of teachers at the University of Western Ontario (UWO), a modern young teacher must go through specific stages of socialization: overcome pedagogical stereotypes and acquire a culture of technology-based international education (Hansen, 1995). Therefore, first of all, the teacher should be an engineer, technologist, and then - a teacher.

A conflict has arisen between the artificial technological and natural environment in a similar context, which in the teaching and activities of the Master in Engineering and Technology must be coordinated and interpreted as equivalent and complementary systems. When solving this issue, the term "educational technological environment" or "educational technological space" arose, and these phenomena cannot be equivalent to natural or social space. Therefore, P. Dillon suggested using the concept of "environment" as a common one, and technological space as its component (Dillon, 1993). The hybrid term "Educational technological environment" "is defined by information, management, consumer and other technologies that modify the content and forms (technologies) of education" (Dillon, 1993).

To solve these pressing issues, so-called Advanced Technology Education (ATE) programs are being implemented to develop educational programs for technology education by deepening cooperation between

manufacturing, business, education and political governance. This is done not only through the involvement of specialists, but through widespread public debate and debate (Zinser & Lawrenz, 2004).

Thus, the reform of the education system, its improvement and improvement of the level of quality is the most important socio-cultural problem, which is largely due to the processes of globalization and the need for the formation of positive conditions for the individual development of a person, his socialization and self-realization in this world and cannot take place without taking into account the experience of training of specialists in other countries.

In the newly standardized European higher education system (Bologna Process), a master's degree usually carries 90 to 120 ECTS credits, with a minimum requirement of at least 60 ECTS credits at the master's level (one or two full years of graduation program) carried out after the student's three years of study in bachelor's degree (Yashchuk, 2015, p. 100).

This provides a higher qualification for employment or preparation for doctoral studies. One ECTS credit is equivalent to 25 hours of study. This means that the master's degree program must include 2,250 hours of study. Current UK master's degree programs typically include 1,800 hours of study or 180 UK credits (Belmaz, 2010, p. 144).

Today, successful professional training of masters involves mastering such areas of training:

1. Scientific research, including the development of scientific research, the organization of their implementation; search, collection, analysis of information on the research topic; development of methods and tools, research and analysis of their results; preparation of reports, reviews, scientific publications.

2. Organizational and managerial, which involves the formation of management skills of organizations, projects, teams; development of strategies for the development of organizations and their departments.

3. Pedagogical, which includes teaching management disciplines, development of educational programs and teaching materials.

4. Calculation and design, which sets the main goal of forming the goals and objectives of the project; development of options for solving the problem; development of development plans; the use of innovative developments in the preparation of projects.

5. Experimental research, which involves participation in basic and applied research; drawing-up of plans, programs and methods of research of objects; technical, organizational support and implementation of research; analysis of research results.

6. Production and technological - the implementation of measures to improve the processes of the enterprise, taking into account market conditions and modern scientific advances; efficient use of material, financial and human resources (Mayboroda, 2010, pp. 108-112).

In most European countries there is a standard system for obtaining a master's degree in most disciplines.

According to the regulations, the following types of master's degrees are distinguished:

- *magister of specific field of activity*: can be obtained on the basis of a bachelor's degree;

- *magister of administration*: used in business and management, usually there are some misunderstandings with this level: on the one hand, it is masters of sciences, magisters of arts, magisters of trade, training programs which do not require experienced professionals, on the other - magisters of business administration, training which requires a minimum of two to three years of professional experience and is open to people with academic knowledge in any field. The difference between these areas is their reputation, the student's career goal and tuition fees;

- *executive master's degree* - a degree created specifically for professionals in administration. It is assumed that the requirements for the graduate and the structure of the master's degree differs from the full-time program (Vitvytska, 2004, p. 70).

It should be noted that an important trend in technological education in recent times is the rapid and permanent renewal of a significant part of its content. Previously, a specialist technologist or technician could use the knowledge acquired at the university for a long time, now this is impossible. Modern scientists call the main task of technology education not established competencies, but "methods of acquiring knowledge and operating rules" (Shishov & Kalnei, 2017). The point is not only in the frantic pace of technologization and development of high-tech, but in the change in the functions of technological education, and, consequently, the activities of the master in the field of engineering and technology. If a bachelor-technologist can perform relatively specific functions, then a master in engineering and technology should perform broader functions due to the specifics of this educational level:

1. Reflect and analyze the information technology context within the framework of production and society as a whole.

2. Be a guide, interpreter of relevant information.

3. Test attractors of progressive changes, rationalize systems and communications

4. Promote access, openness to new technologies, perform an educational function.

This list can be continued, but the main thing is the specialist's understanding of the relative sustainability of technological innovations. This relative stability, according to F. Lawrence and F. Kaiser, and B. Lavoie is supported by constant inter- and intraprofessional communication, interaction with authorities and partnerships, participation in the development and implementation of flexible technological development programs (2003).

Let's dwell on the features of master's programs in European countries and the USA.

3. Features of master's programs in European countries and the USA

3.1. The United Kingdom

Master's degree programs in the UK have been created as one of the options for continuing professional development (Continuing Professional Development) of teachers. They promote the postgraduate education of teachers in order to improve professionalism in teaching and research. The courses are directly related to teaching and learning in higher education. In the abstracts to all such courses, it is noted that they are provided for both teachers and students. As you know, teaching in general, and especially in the field of higher education, is a scientific, professional and complex activity. Therefore, to be an expert in this field, to get the effectiveness of student learning, teachers need to be able to use appropriate optimal methods and forms of learning, including the latest technologies, develop an independent, creative approach to teaching, find links between pedagogical theory, research and own pedagogical experience, to conduct own researches and to put them into practice. It is for such activities that master's training programs for high school teachers in the UK are prepared (Yashchuk, 2015, p. 101).

A feature of the teacher training system in the field of "Technology" is the presence of a large number of educational directions for obtaining a profession. The main ones are:

1. One-year course for obtaining a special certificate (Rostgraduate Certificate in Education - PGCE) in higher education institutions of the university sector (mainly universities) on the basis of a bachelor's degree;

2. Three- or four-year educational programs to obtain a bachelor's degree in education (Bachelor of Education) or another degree sufficient to obtain a teacher's qualification (Yashchuk, 2015, p. 101).

In addition, since the 1990s, in order to expand access to teacher education and overcome the shortage of teachers in the labor market, alternative educational programs have been developed and implemented to obtain the status of a qualified teacher:

1. School-based teacher training programs (School Central Initiative Teacher Training - SCITT), implemented since 1994 by school consortia for the training of teachers (schol-based teacher educational consortiums) and reflect the trend of widespread involvement of secondary educational institutions;

2. The Fast Direction Programs, which have been in existence since 2000, are designed for university degree students and qualified teachers;

3. In-service teacher training programs (Employement-Based Directions) have been developed for adults (over 24 years of age) who have good basic training in the subject area (Orekhova & Polunina, 2007, p. 112).

3.2. Denmark

In **Denmark,** the name "candidatus or candidata" (for women), i.e. candidate, is used as the equivalent of "master's degree". After completing engineering specialties, the graduate becomes a Candidate of Polytechnic Sciences. Similar degrees are used for a large number of areas, such as sociology (cand.scient.soc), economics (cand.merc., Cand.polit. or cand.occon), jurisprudence (cand.jur), humanities (cand.mag) etc., (Rolyak, 2010, p. 23).

3.3. France

In **France**, the previous equivalents of the DEA and DESS masters were replaced after the Bologna process by M1 and M2. The first option of training was to later obtain the degree of Doctor of Philosophy, and the second - for professional life. They become a master researcher or master professional after 2 years of postgraduate training, which is usually carried out after 3 years of study and obtaining a license. The first year of training "master" is called "Master 1" (M1), the second year - "Master 2" (M2) (Lashchykhina, 2007).

The solution to the problem of training teachers who carry out professional activities in the field of formation of labor technological competencies in students of the French school depends primarily on several components: the level of training of future teachers after secondary education, special certification.

If we do not go into the details of the complex mechanism of teacher training in France, the ideal scheme of teacher training in technology is:

1) technological bachelor as a basis for obtaining higher professional education;

2) two years of study in a higher educational institution with the receipt of the relevant diploma;

3) training at the Institute of Teacher Training (ITT) for two years, where the first year is devoted to fundamental theoretical training in the chosen specialty and three weeks of pedagogical practice under the guidance of a teacher of the institute, and the second year is devoted to vocational training;

4) passing the competition for a diploma, which indicates the preparation for teaching in the lyceum, in particular in technological or professional (CARES: CAREP-CARET; CARLP).

3.4. Germany

In **German universities** today, there are two parallel learning structures: a new two-level system of "bachelor-master" and a curriculum that culminates in a specialist or master's degree.

The German Higher Education Act was amended to lay down the minimum requirements for the implementation of the Bologna Declaration, giving them the status of complementary to the national education system. This gave German higher education institutions the right to choose the system of student training, both for the classic German and the new European version of the training of bachelors and masters (Makhynya, 2008, p. 12).

Bachelor's and master's programs are divided into modules consisting of lectures, seminars, practical work and provide an academic load of 6 to 10 hours per week. ETCS credit points are charged for each module. To complete the training you need to type a certain number of credit units.

In Germany, masters are trained in accordance with curricula developed by individual higher education institutions (Terhart, 2003). Master's degree programs generally involve two stages of study. The first stage of the educational process contains general disciplines. On the second there is a specialization of disciplines depending on the chosen direction of preparation. The organization of practice is one of the necessary elements of professional development of the future specialist.

Upon completion of the Master's program, the following degrees are awarded: Magister, Magister of Science, Magister of Engineering and Magister of Law (Makhynya, 2008, p. 13).

The training of specialists, teachers of labor and technology in Germany is carried out at universities. It has two phases - study at a university or an equivalent higher educational institution (nine semesters) and professional practice lasted from one to two years (Vorberitungsdienst), taking place in educational institutions of the non-university sector (Ausbildungs und Studenseminar), which are attached to them. Each phase ends with the compilation of a state examination (die erste und die zweite Staatsprufung), which is conducted by state examination bodies located in the structure of the ministries of education of regional subjects.

The general structure of curricula for teacher training and technology is as follows:

50% - in-depth study of the professional field;

25% - psychological and pedagogical disciplines and methods of teaching the subject;

25% - general education subject or second professional direction (as an additional specialization) depending on the region and educational institution.

The peculiarity of vocational training in Germany is the focus of curricula not on a specific discipline (as for teachers of general education subjects), but on the professional field, which is considered as a cluster (set) of specialties within the general professional field. In 1995, three priority areas were identified at the federal level for the training of labor and technology teachers: technology, commercial activities and social security/health, which are divided into 16 professional areas: metalworking; electrical engineering; construction; woodworking; textile production and manufacture of clothes chemistry/physics/biology in production processes; polygraphy; color and interior design; designing; economics and hygiene management; fitness; cooking and home economics; agriculture; social pedagogy and nursing.

The main models of teacher training and technology that developed in Germany in the 1920s still exist today. It can be conditionally designated as "specialist", "teacher" and "teacher of professional training".

The *"specialist" model* is dominated by the scientific and technical aspect of training, based on the concept of engineering knowledge and the logic of studying technical disciplines. Such educational programs are implemented mainly in technical higher education institutions - Technical Hochschulen, Technical University (for example, in such regions as Saxony, Baden-Württemberg, etc.).

In the *"teacher" model,* the training of specialists in the field of technology corresponds to the basic principles of didactics, focusing on the study of

psychological and pedagogical disciplines and methods of teaching the subject. This model underlies the educational programs of most pedagogical faculties of universities (for example, in Hamburg and other states).

The third model *"teacher of vocational training"* integrates the main features inherent in the two previous models. It combines the professional orientation of teacher training in a particular field of production with the study of the basic principles of organization of the educational process, socialization of students and their education. Teacher training programs based on this model are implemented, first of all, in educational institutions of the non-university sector - Berufredagogische Institut, Berufredagogische Akademien (for example, in Bavaria and other states) (Nielsen, 2002).

Problems of training teachers of labor and technology are actively discussed by the pedagogical community in Germany. According to many researchers, the academicization of teacher education has negative consequences for the field of vocational training. Thus, the professor of the University of Bremen, F. Rauner & R. Maclean (2008) in this regard points to the following unfavorable trends: the lack of graduates of integrated practical skills; lack of real production experience, which they can get only in the process of working in enterprises; low level of competence in the field of technological processes; inconsistency of applied knowledge received in the educational institution with the current level of development of basic science in the relevant fields; low prestige of the profession as a whole. Moreover, none of the models of teacher training has escaped criticism, including the "centrist" model of "teacher training". According to F. Rauner & R. Maclean (2008), teachers trained within this model, on the one hand, have very little technical knowledge compared to engineers, and on the other hand, they lose to teachers of general education disciplines in terms of mastering pedagogical knowledge (***, 2005).

Now the country is updating the approaches to organizing the training of labor and technology teachers. The “specialist” model has not lost its relevance either, which propose to modernize, strengthening its pedagogical component and preserving the expressed scientific and technical orientation of education, since a modern teacher in the context of the intensive development of science-intensive technologies must have a high level of knowledge in a certain professional field. The main argument of the opponents of this model is the lack of convergence between abstract engineering disciplines and real production practice. From their point of view, the model based on the concept of "professional fields", which integrates the study of theoretical disciplines in their applied aspects with practical activities in a particular workplace, is deprived of this shortcoming.

The basic idea of this model is the formation and development of technological competencies through the creation of a learning environment.

Proponents of the interdisciplinary modular approach consider the disadvantage of this model to be that the boundaries of "professional fields" are constantly changing due to the influence of four megatrends: globalization, individualization of learning, integration of information and communication technologies with different fields of knowledge and intensive development of modern science. Within the framework of the modular approach, it is proposed to replace the fixed list of disciplines in additional specialization in the curricula for training teachers of labor and technology with several modules that students can choose independently. This will make it possible, without changing educational programs as a whole, to make them more flexible and innovative, to combine a greater number of professional areas, as well as to train specialists who meet modern requirements.

It should also be borne in mind that the transition to a two-level model of teacher training in accordance with the Bologna recommendations leads to a redistribution of powers between the university and non-university sectors of higher education. The Council for Science in 2002, by its decision, recommended that higher professional schools develop and implement two levels of training of specialists. As a result of the implementation of this project, experts believe, graduates of educational institutions of the non-university sector, with equal qualifications, will have an advantage over university graduates in employment in the field of education. This is due to the diversity, flexibility and much greater professional orientation of teacher training programs offered by higher vocational schools (Terhart, 2003).

3.5. Austria

A wide network of vocational schools in **Austria** has led to high requirements for teacher training for this level of education. Due to the variety of professional areas included in the curricula of educational institutions, the training of vocational teachers in Austria is highly differentiated. There are three main qualifications of teachers working in the system of vocational education:

1. Teacher of general education subjects. The qualification requires a university education and a teacher's diploma. In addition, to work at the school, the graduate must undergo a one-year professional internship at an educational institution of the appropriate level of education;

2. Teacher of theoretical foundations of the profession. Applicants for the position of teacher must have a special university education and four years

of experience in the relevant field. Depending on the specifics of the disciplines (electrical engineering, electronics, mechanical engineering, etc.), teachers of this category are trained in technical and classical universities. In order to have the right to teach in vocational education institutions, university graduates receive additional training in pedagogical disciplines by attending special seminars at pedagogical institutes.

3. Teacher/master of industrial training. The qualification presupposes appropriate professional education and six years of practical experience in production. Teachers of vocational training for secondary schools and masters of industrial training for vocational schools and technical schools are trained mainly by vocational schools (Berufredagogische Akademie), for employment it is necessary to have professional qualifications and work experience (six years or more) or to have a certificate of full secondary education practical activities in the relevant economic sector. Teacher training takes place in two stages: introductory in-service courses at the Pedagogical Institute (Berufredagogisches Institute), and then training at a vocational school. The duration of educational programs is three years, after graduation the graduates are awarded the qualification of teacher/master of industrial training (for the 1st and 2nd levels of secondary education) (CEDEFOP, 1999).

Obviously, the connection with practice is traditionally particularly important in the training of vocational teachers in Austria. However, this is due not only to traditions, but also to current trends in school and vocational education. The new educational standards, which have been developed in the country since 2005, are based on the competency model, which provides for the formation of special professional competencies in future professionals related to their future practice.

In addition, the system of pedagogical educational institutions is used in Austria to fill a certain "gap" in the training of vocational teachers. We are talking about pedagogical institutes that exist in each region and implement various teacher training programs, in particular correspondence and distance learning, as well as advanced training programs. Pedagogical schools play an equally important role here; they also carry out pedagogical training of teachers.

Curricula of vocational schools include compulsory subjects (pedagogy, teaching methods, special disciplines), elective courses, electives, school and industrial practice.

The basis of practically oriented training of a teacher of vocational training in Austria is the formation of technological competencies as an

important component of his professional competencies, which allow him to successfully develop labor, pragmatic competencies in young people.

3.6. The United States

It is necessary to say about the specifics of master's training in the **United States.** The training of specialists and teachers in the field of engineering and technology in the United States traditionally has an expressive praxeological orientation through the mental nature and traditions of Americans who have mastered new resources. According to the researchers, it was the competence-based rather than the knowledge-based approach that originated in the United States. One of the first publications that "opened" this issue was the article by D. Mc. Clelland "Test competence, not intelligence." However, not in America, but in Great Britain, the concept of competence-based education since 1986 has been taken as the basis of the national system of qualifications standards and received official support from the leadership.

The experience of master's training in the field of higher education at the Pedagogical School of the University of Michigan is interesting. The master's program in higher and postgraduate education is structured to, on the one hand, provide students with a general understanding of higher education as a place of their activity, and on the other - to provide opportunities for everyone to realize themselves in those areas in which the individual is interested. A distinctive feature of the program is the interaction of students with different training and future career goals. Students also have the opportunity to work with doctoral students by choosing one or another elective course. This approach gives them the opportunity to evaluate and understand the various approaches to addressing issues affecting higher education (Yashchuk, 2015, p.100).

The experience of master's training in higher education at the School of Education at the University of Michigan is interesting. The Master's program in higher and postgraduate education is structured so as, on the one hand, to provide students with a general understanding of higher education as a place of their activity, and on the other hand, to provide an opportunity for everyone to realize themselves in those areas in which the individual is interested. A distinctive feature of the program is the interaction of students with different professional backgrounds and future career goals. Students have the opportunity to work together with doctoral students by choosing one or another elective course. This approach enables them to evaluate and understand various approaches to solving issues affecting higher education (Yashchuk, 2014, p. 100).

This master's program is training graduates for a wide range of positions in higher education, including administrators and teachers of colleges and universities, officials of national and state agencies, professional associations, consortia, regional coordinating councils, accreditation agencies.

4. Conclusions

Educational reforms of the late XX - early XXI century have significantly influenced the formation of training programs for teachers of vocational training. The main objectives of the updated programs are to increase the level of academic and technical knowledge, increase the criteria for assessing the quality of training, develop rational curricula that take into account the realities of modern life, expand the use of new technologies, develop teamwork skills, leadership, McCaslin N. L. (2002).

The training of vocational teachers is carried out in universities funded by the state, religious organizations, as well as in private educational institutions. Most of the teacher training programs for vocational training are focused on the corresponding faculties of pedagogical colleges, however, specialists in this area also receive education at the university departments of the corresponding professional direction: agricultural, engineering, technological, etc. Faculties prepare specialists in eye and on-the-job programs, M. (2015, p. 103).

In addition, many universities in Europe and the United States offer master's degree programs in Higher Education Pedagogy. The programs differ in content, but each of the analyzed programs is aimed at developing theoretical knowledge and practical professional skills for effective activities in the field of higher and postgraduate education.

In Europe and the United States, a Ph.D. is a prerequisite for a career as a high school teacher. Until recently, European and American doctoral programs have been more exploratory. However, in-depth doctoral courses are now included in doctoral programs. Moreover, doctoral students have access to consultants not only for scientific activities, but also for other activities, such as teaching, social work, etc., Yashchuk S.M. (2015, p.103).

Thus, the training of masters in the field of engineering and technology abroad retains the requirement of two years of study on the basis of a previously obtained bachelor's degree, during which much attention is paid to the practice of masters. There is also a differentiation between masters-practitioners and masters-scientists. Master's training is in line with national traditions, but there is also a difference in master's training at different universities in the same country.

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