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Cooperation of the Students of Nature-Oriented Professions and of an Agrarian Enterprise at Solving Specific Production Tasks

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***Abstract* — A unique experience in cooperating of the nature-directed professions different universities students within the framework of mutual (collective) work experience (educational practice) is under consideration in the paper; of the students training interaction algorithm at two different directions, that is, at "Cartography and Geo-Informatics" and at "Agro-Chemistry and Agro-Soil Science" in the conditions of the real production process of the definite agrarian enterprise, namely, the functions of each working group (professor, scientific adviser and students), the methods and the stages of research work from collecting and analyzing primary spatial data to issuing of the completed cartographic product are prescribed. As a result of a three-sided joint activity "University-University-Enterprise" a positive effect was revealed for each of the sides: for a producer – a customer of a final product - the recommendations for optimizing the production process are formulated; the students gained practical experience in solving production problems and they got to know the specifics of another profession – which is close to their training direction, but the profession that is not adjoining to their one; the professors expanded a range of relevant scientific areas for further research and for the prospects for cooperation.**

Keywords—integration; partnership; professional training; agricultural production; mentoring; educational practice; geo-information mapping; soil fertility.

I. INTRODUCTION

The period of early XXI century is defined by the researchers as a period of impetuous reforming of all the life spheres. Restructuring of political and economic public domain: weakening of management centralization, changing and expanding the property forms and separating both industrial enterprises and educational institutions according to levels of jurisdiction was that "the system of vocational education as an integral part of country's economy appeared to be isolated from economy, from labor market." [1]. While "social service procurement, market demands aggravated a problem of vocational training organizing the on-the-job training." [2].

Currently a demand of combining objectives and activities of professional educational institutions and their employers, forming of coordinated goal-directed measures to improve quality of training is increasingly made public; so is an establishment of permanent direct and feedback links between them [3]. The main concept which is a constitutive one today and was repeatedly positioned by the Ministry of Education and the Head of State Vladimir Putin in person: "it is necessary to bring a professional education maximum closer to real production." In the opinion of the First deputy Chairman of the Committee on Education and Science Onishchenko G.G., one of the fundamental points contributing to solution of this problem is multiplicativity in education (a process of attracting qualified professionals to train specialists, who in turn become mentors for an increasing amount of people) and upbringing an ability to adapt quickly to the requirements of time and to the economy conditions in the students as well.

The Decree signed by the President on May, 7, 2018 " On national goals and strategic objectives of Russian Federation development for the period up to 2024", concerning vocational education, identifies the following tasks, the solution of which is of a priority:

- modernization of vocational education including that made by means of adaptive, practice-oriented and versatile educational programs introduction;
- creating the conditions for development of mentoring.

The search for a practical solution to reveal the contradictions and the tasks designated in the Decree determine relevance of active introduction of various forms of integration and interaction of vocational education and of production in the educational process.

II. LITERATURE REVIEW

Problems of science and production professional education integration are reflected in the publications of

N.S. Gedulyanova, M.T. Gedulyanov, A.M. Sagdatullin, V.S. Sheinbaum, O.V. Budzinskaya, I.M. Aytuganov, E.A. Korchagin, E.L. Matuhin, E.P. Mitrofanova, R.S. Safin [4-7]. In scientific research an integration of vocational education and production is considered as a joint use of educational organizations potential and of production ones in mutual interests. Primarily this occurs in the spheres of training, of professional advancement and of re-training and also in those of joint scientific research, of implementation of the results of scientific research, etc. The data of integration processes cover a wide range of different activity directions and are revealed in miscellaneous forms.

The issues of classification forms, types and levels of educational institutions and enterprises interaction – potential customers of staff- get special consideration in the works of I.V. Filipova, N.A. Novokreshchenova, O.A. Novokreshchenova, E.Ya. Kogan, N.Yu. Postalyuk, T.G. Kuteinitsyna, I.M. Aytuganov, U.A. Djachkov, E.A. Korchagin, E.L. Matuhin, R.S. Safin, A.R. Shaidullina, G.Kh. Valeyeva and others [8-11].

Pedagogical and professional maintenance in a form of mentoring was studied by V.I. Blinov, E.Yu. Esenina, P. Osipov, I. Irismetova and by other researchers, in whose works mentoring is viewed as a method and means of development, of upbringing and adapting of a young specialist to an education-professional activity and in a vocational one [12,13].

All-source information analyses permits to make a conclusion that in a modern scientific community there is formed a certain understanding of a necessity for organizing of vocational training in a close cooperation with practical enterprises and along with professors an active and equal participation should be taken by specialists as mentors for future professionals. Such interaction of education and industrial production in the person of their representatives – those of Universities and of enterprises – will contribute to transforming of an educational process into an education-production process, at which knowledge, abilities, skills, competences are developed in the context of forming compound and dynamic system of professional activity and specialist's thinking [7,10].

However, from our point of view, some methodological and technological aspects of using theoretical provisions at practical activity of labor subjects on organizing and improving of education-professional interaction process remain uncovered.

One of such aspects is inter-University interaction with an enterprise at solution of specific problems of production, use of the resource of educational practice in full.

The State Standard of Higher Education for training bachelors in all the directions conducts an educational practice aimed at obtaining primary professional skills for students and that includes primary skills and research ones [14]. Conducting training practice can be organized both by stationary method and by on-site one. This is an integral part of higher education program, one of executive type educational activities forms, by which students consolidate theoretical knowledge obtained during a process of theoretical training. As a rule this kind of practice at field faculties is carried on territories of education-scientific bases, of experimental and training farms, of stationaries where there are etalon, natural and man-made elements, basic and advanced technologies are used [15,16]. For this students as a part of a working group headed by practice leaders make visits and conduct certain and pre-coordinated in program of educational practice cycle of activities. On the basis of obtained information a report is written by the students and subsequently it passes final defense.

The purpose of the article is a description of an experience of organizing and mutual conducting of a part of summer training practice by the students of the directions "Cartography and Geo-Informatics" and "Agro-Chemistry and Soil Science" within the framework of inter-University cooperation of Perm State National Research University and Perm State Agrarian and Technological University on the basis of one of the leading agricultural enterprises of Perm Region in solving its actual industrial problems. size.

III. Research Methodology

Based on wishes of a customer and technical capabilities of both Universities departments fulfilling bachelors' training, an algorithm of interaction at a level of "University-University-Enterprise" was determined and a basic concept was formulated.

The main purpose of training practice was a maximum convergence of vocational education and real production; an involvement of students in a full cycle of production activity – from collecting and analyzing primary special data to presenting a final cartographic product.

Within the framework of cooperation the leaders of practice set up following tasks:

- to develop algorithms for collecting primary spatial data;
- to plan and to carry out field and office work by students themselves;
- to integrate an existing system of agrochemical inspection with GIS-technologies;
- to create a modern cartographic product, demanded by leading producers of the region agricultural products;
- to form an ability to work in team, to distribute responsibilities, to plan time.

Cartographers (students of the direction "Cartography and Geo-Informatics", PSNRU) got a task to collect primary data and process them in field conditions of a particular farm on the basis of which preparing of cartographic works is implemented.

Students-agrochemicals (direction "Agro-Chemistry and Soil Science", PSATU) were to digitize and prepare an electronic cartographic basis and a subsequent interpretation of laboratory research data.

The leading farm of one of Perm Region municipal districts (agricultural production cooperative "collective farm Zarya Budushchego") was chosen as an object of research and a place for practice.

An entire scope of a planned research was divided into several successive stages within which a distributionof responsibilities was made. An introductory lecture was a certain transition to practice, it included an explanation of an entire cycle of work with simultaneous distribution of responsibilities between directions of training.

At the first stage a working group of PSNRU obtained cartographic archival material that needed correcting and updating. The maps were subsequently scanned, mapped to GIS and reduced to a known coordinate system. At the same stage the ROSREESTRE downloaded cadastral maps according to which borders of settlements were specified. A working group of PSATU together with an agronomist of a farm using space images refined dimensions and location of an enterprise agricultural land. An entire amount ofagricultural land was divided into separate elementary sites in accordance with configuration and size of which construction of field routes was carried out.On the basis of the stage the leaders of the working groups implemented a verification of information obtained, after this the data was uploaded to GPS-navigators.

Second stage included an actual field work: a departure to the place of practice, accommodation at a farm, introduction to handling and safety advice when performing field work, territory reconnaissance, selection of soil samples using reed bores from depth of arable horizon.

For more rapid solution of emerging issues and an effective interaction among working groups of students mixed links consisting of both universities students were formed. This approach permitted to make selection of about 543 soil samples from a total area of 4867.6 hectares only in a few days.

Next stage is a cameral processing of field work results: the students of agricultural profile were engaged in laboratory analysis of soil samples, the students of classical University – in a processing of digital data. As a part of this stage joint laboratory classes and joint lectures were organized at which students learned individual elements of their colleagues' work and "plunged" into thespecifics of a non-related specialty. Cartographers tried on robes and personal protective equipment of analytical laboratory employees, agro-chemists were given an opportunity to attend the GIS center and work with the newly obtained satellite imagery of surveyed area.

The final fourth stage of mutual work was an interpretation of the data obtained. The students as a part of working group of PSATU made a grouping of indicators that determine a level of soil fertility, its degree of cultivation and of a suitability for cultivating certain groups of agricultural crops. Systematization of data permitted to form a passport statement which reflects the results for each elementary site. The information obtained was used by students of PSSRU working group for mapping, creating mathematical-cartographical models of an area and designing an explanatory note.

A conclusive moment of this stage was a designing of a statement and recommendations for the farm. A level of fertility and supply of agricultural lands soil with main elements of mineral nutrition is established. Calculating of amount of lime meliorants (that is, agrochemicals for optimization of physical-chemical properties of soil) for optimization of certain land environment response use areas in the conditions of this farm are shown.

IV. Results

The conclusions drawn from this work include the following:

The use of training environmental directions educational programs integration implemented in different institutions provided the learners with a detailed understanding of all stages of work (displaying in a GIS archival cartographic materials, collecting primary spatial data, cameral processing and conducting laboratory research, interpreting the laboratory research data and working out cartographic materials) related to establishing the level of agricultural land soil fertility. Interdisciplinary research has contributed to manifesting of high interest of the students throughout all the period of mutual work.

For professors who initiated this cooperation and the subsequent work, a built-up interaction allowed to get acquainted with more detailed whole range of mutual opportunities and the technologies used by the departments, to identify the potential for interpretation of the spatial data.

The usage of digital agrochemical cartograms permitted agricultural product producers to optimize nature of land use; gave immediate information on a level of individual agricultural land fertility for agronomists; permitted them to update an approach for calculating doses of meliorants and fertilizers; to reduce production costs associated with purchasing, transporting and applying agrochemicals.

V. Conclusion

In the context of scientific interaction, interdisciplinary research is the most compound component. On the other hand, the high informativity, novelty and actuality of the data allows us to reveal a number of directions for joint and unilateral research which have a certain scientific and technical interest from a part of particular production. An involvement of representatives from industrial sector of economy in this interaction is a significant factor and sometimes the most important one. The wishes of agricultural goods producer acted as a guide that determines a vector of development and corrects a direction of practice.

An idea for such interaction was actively accepted not only by the leader and by the specialists of the farm, but it also found an appropriate response and the support of the district agricultural administration representatives. An integration of the director and the specialists of the municipal district agricultural department into the process of training practice as participants expanded the opportunities for organizing the practice and increased the degree of the process participants responsibility.

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