Features of practical training of IT - specialists for the agro-industrial complex

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Abstract. The article is devoted to the methodology of conducting for future specialists in the field of applied informatics at the Krasnoyarsk State Agrarian University. Its relevance is due to the fact that the training of such specialists should be accompanied by the preparation of a number of course projects and complex course work for agricultural enterprise. In our opinion, when completing course projects, students should rely on real data on the object of study. According to the method of organization, the practice should be of a mixed nature, both stationary and in the form of excursions. In the stationary phase of the practice, students, together with the teacher, analyze theoretical issues on building databases and computer networks, on presenting an enterprise on the Internet, on developing websites and general issues related to the information security of an agro-industrial enterprise. At the visiting stage of the practice, students collect real data about the enterprise, which will then be used in course projects. This approach greatly increases students' understanding of the essence and specifics of their future specialty and understanding of the development of information systems for a particular agricultural enterprise.

1 Introduction

Practical training is an essential component of preparing future IT specialists for the agro-industrial complex. In the context of digital transformation and the transition to a digital economy, the training of such specialists in agricultural universities is undergoing significant changes.

In normative guidance, much attention is paid to the practical training of students, which is recorded in the government documents [1 - 4].

These documents indicate the basic requirements for the content and organization of practice for IT specialists for the agro-industrial complex.

It should be noted that there is no single program for conducting practices; The University relies on the so-called exemplary practice programs, its own developments, practical experience and curriculum [5-7].

In the internal local regulatory act "Regulations on the practical training of students in the form of practice of the Krasnoyarsk State Agrarian University" the university establishes the types of practice and methods of its implementation (if any) in accordance with the Federal

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State Educational Standard of Higher Education. The type and volume of practice are reflected in the curriculum and ensure the implementation of the Federal State Educational Standard of Higher Education in the areas of training. Practice can be either stationary or visiting. Stationary is the practice, which is carried out in Krasnoyarsk State Agrarian University or in other specialized organization located in the Krasnoyarsk. Visiting is a practice that is carried out outside of Krasnoyarsk city and can be carried out in various forms, including field practice, if it is necessary to create special conditions for its implementation.

2 Methodology and results

The purpose of this work is to develop and analyze the methodology, organization, content and relationships with other disciplines of Technological (design and technological) practice in teaching IT - specialists of the agro-industrial complex.

The work uses the techniques and methods of practice-oriented learning, the results of student surveys, as well as methods of statistical data processing.

The curriculum for the specialty 09.03.03 Applied Informatics is designed in such a way that after the first year of study, an introductory training practice is held, the purpose of which is to form additional skills and techniques in the field of programming.

In the second year, when studying such disciplines as Operating Systems, Computer Systems, Networks and Telecommunications, Software Engineering, Information Systems and Technologies, basic knowledge is laid in the field of the future specialty, and, in particular, general initial information is given on building computer networks, databases and information security organization.

Such initial knowledge is already enough for the student to be able to cope with the next stage of practical training in the fourth semester in the summer, and, in particular, to master:

A. educational practice, called "Technological (design and technological)"
B. educational practice "Research work (obtaining primary skills of research work)".

The educational practice "Technological (design and technological) practice" consists of a number of stages:

- *The preparatory stage*, including safety training, receiving the assignment, filling out the practice diary;
- *Main stage*: research (analysis, formation of an individual task, search and processing of information) contains the following:
  - Research of activity of the agricultural enterprise and an estimation of information flows. Here we study issues related to the characteristics of the enterprise: the name of the enterprise, its address, form of ownership; list of manufactured products (services), production volumes, average number of employees, main suppliers and consumers of products, information about the organizational structure of the enterprise, etc.
  - Study of information flows of an agricultural enterprise for the production and sale of products (document flow diagram indicating the qualitative and quantitative composition of documents).
  - A study of the automation of an agricultural enterprise, where the automated areas of activity of this enterprise are examined.
  - A study of the hardware of enterprise information systems. Here students collect information about the hardware used: models and specifications of computers, peripherals, network topology (if any), models and characteristics of network equipment.
  - A study of the software of enterprise information systems. At this step, the list, capabilities, specific areas of application of software tools, the procedure for

working with them, their advantages and disadvantages, as well as the use of information security methods in an agricultural enterprise are explored.

- Development of proposals for the further development of information systems used in the enterprise.

– *The final stage,* which is the preparation of a report on the work performed.

The main goal of the Technological (design and technological) practice is to consolidate and expand theoretical knowledge and practical skills, as well as a preliminary examination of the subject area: analysis and evaluation of industrial software and hardware of information systems and business processes of agro-industrial enterprises.

This way of organizing the practice is aimed at collecting and analyzing practical material on a particular enterprise for the further implementation of course projects in such disciplines as Databases, Computer Networks, as well as complex laboratory work on the discipline of Information Security. In addition to getting acquainted with the structure of the enterprise, the main business processes, systems and means of their automated support and management, the purpose of the practice is also to create motivational guidelines for students in relation to future professional activities.

The nature of the Technological (design and technological) practice is mixed and is carried out in stationary and visiting forms. In the stationary form, the teacher works with students in computer classes, identifying and focusing students' attention on the information about the enterprise that needs to be collected and analyzed. The primary collection of information is carried out on the Internet: information is collected on the structure of commercial products manufactured by the enterprise, on the number of employees, on the form of ownership, on types of activities, on sales, etc.

At the visiting stage of the Technological (design and technological) practice, students, together with the teacher, visit a number of enterprises of the agro-industrial complex. As a result of such visits, the initially collected information is clarified, in particular, about the software and hardware of the enterprise, about the main business processes of the enterprise, about information for the development of a computer network, about information security issues, about presenting information about the enterprise on the Internet, etc.

The materials collected during the practice are a valuable source of information for the design and development of databases, computer networks, enterprise information security policy, and website development. The ability to design a database, a computer network, a website for a particular enterprise and its departments, as well as to develop a client part for working with a database is essential part of the IT specialist training process.

During the practice, students analyze the activities of the enterprise and make models of business processes implemented at the enterprise; highlight a business process for which a database, or a computer network, or an information security policy will be subsequently designed; collect a list of documents used in this business process. Based on the collected documents and a survey of potential users, they receive information that should be stored in the information environment; based on the identified list of input and output documents and a survey of potential users, requirements for the user interface (client application) are developed.

This approach to practice brings subsequent training to a qualitatively new level.

The preparation of students for the implementation of course projects and specialized tasks is improved, since they rely on real data on agricultural enterprises, and not on fictitious test data. Since the level of data digitization at the enterprises of the agro-industrial complex of the Krasnoyarsk Territory is quite low, the possibilities for further development of software and information systems that will be introduced and implemented at such enterprises are quite extensive.

When working on a course project in the discipline of Databases, the information received by students during the practice allows them to identify those business processes that will be

automated in the future. The list of participants in business processes is determined, who in the future will be users of the database; a conceptual and logical model of the database is being developed, the normalization process is being carried out; the database is implemented at the physical level and the client application is developed. Students "open their eyes", they begin to understand how information systems are designed and created for a real specific task, which undoubtedly motivates them to master the profession [8, 9].

When working on a course project in the discipline Computer Networks, the information obtained in practice is necessary for informed decisions in the design and implementation of an enterprise computer network: network topology, communication media, network equipment (switches, routers, access points, etc.), server hardware, a list of necessary network services for a particular enterprise. In the process of working on a course project, students receive and consolidate the skills of deploying and configuring servers [10].

When performing complex laboratory work on the discipline Information Security, students also have starting information. In this work, students should explore and analyze the problem of ensuring the information security of the object of study (a particular enterprise); identify the existing means of protection and their functional features; develop directions for improving the reliability of data storage; develop software tools that allow to protect the information of the object of study.

3 Discussion

In the Krasnoyarsk State Agrarian University, studies were carried out, focusing on the impact of Technological (design and technological) practice on the progress of students in special disciplines.

A questionnaire was developed (questions are presented in table 1) and a survey was conducted.

Table 1. Survey results.

Questions in the questionnaire. Score in the range from 1 to 5.	**Average score**
1. Overall rating of the practice	4.5
2. Practice guidelines	5.0
3. The quality of manuals (for practical, research activities, information, bibliographic support, including its availability in the University library)	4.8
3.1. The quality of manuals due to field events	4.95
4. Quality of safety briefing	5.0
5. Atmosphere during practice	4.8
6. Enthusiasm of the teacher (the ability to arouse interest in practice)	5.0
7. The material is presented by the teacher in a clear, accessible and understandable way.	5.0
8. The teacher is able to communicate with the group and with each student	4.95
9. Teacher's willingness to answer questions	5.0
10. The use of modern technologies by the teacher	4.8
11. Possibility of additional consultations.	4.9
12. The interest of the teacher in the level of knowledge of students	5.0
13. The use of quizzes, control tasks, questions during the final test.	5.0
14. Clarity of requirements for students (fair and objective mark).	4.75
15. Correction of mistakes, the possibility to retake in a short time (for example, the next day)	4.7
Average	4.91

The results of the survey indicate that students enjoy the practice, that its content and organization are fully consistent with their interests and needs.

Due to the use of a point-rating system, the Technological (design-technological) practice score is given as a sum of points. When analyzing the scores obtained when completing all the tasks of the practice and the scores received during the defense of the course project in the discipline of the Database, the results shown in Figure 1 were obtained.

The sample included data on 30 students who passed all the exams.

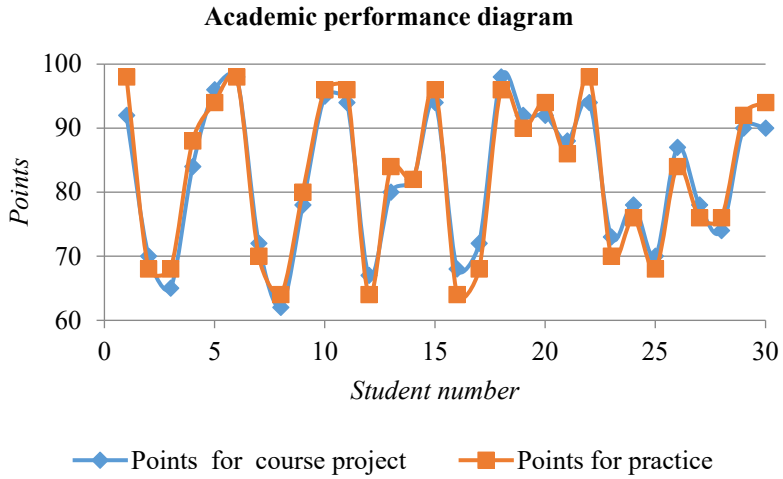

Fig. 1. Diagram of points received for a course project and points for practice.

When calculating the correlation of the given scores, a value of 0.97 was obtained, showing a high dependence of grades (points) received for the course project and points received for practice. Approximately the same dependence is observed when comparing scores and calculating the correlation for practice and the resulting scores received for a course project in the discipline Computer Networks and a complex laboratory work in the discipline Information Security.

4 Conclusion

The presented article shows that the best option for conducting a Technological (design and technological) practice is a combination of both visiting and stationary forms. This combination allows students to acquire theoretical knowledge and immediately use it in practice in the process of collecting the necessary information for the high-quality preparation of course projects and other practical tasks. This provides a good basis for mastering the material of subsequent professional and special disciplines and, in result, obtaining a diploma. Such an impact of practice on the learning process is confirmed both by the data obtained and by the satisfaction with the conducted practice of future IT specialists for the agro-industrial complex.

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