Directions for the Development of Agro-Engineering Education in Russia After the Pandemic

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There is a decrease in general intellectual development level and mastery of a certain range of logical operations when learning. The decrease is compensated with the help of increased motivation and efficiency. When managing students' cognitive processes and learning motives, it is important to consider the formation stages of logical and theoretical thinking. The authors found that insufficient professional orientation and low level of academic motivation hold a second position among the student dropout reasons, after the lack of desire to study and work in the chosen direction. If we consider the state of a graduate student at an agricultural university from the point of preparedness for the production process, then the professional education and competencies that the future specialist has mastered largely determine their competitiveness on the labor market. Since the current education system has never experienced the problems that the pandemic caused, it is necessary to reconsider the further development of the education system on an innovative base using not only distance (remote) education but also digital technologies.

Keywords: professional education, teaching forms, teaching methods, innovation, professional competence

INTRODUCTION

For the high-quality preparation of future masters, specialists, and bachelors of various majors, considering the stages of continuous professional education and current multilevel training of engineering and technical personnel for the machine-technological system of agriculture and agro-industrial complex (Lachuga & Chekha, 2006, pp. 252-257; Lachuga, Gorbachev & Chekha, 2009), it is necessary to highlight the development vectors of agro-engineering education in Russia after the pandemic. If we consider the state of an agricultural university graduate from the point of preparedness for the production process, then the professional education and competencies that the future specialist has mastered largely determine their competitiveness on the labor market. During the time that the students spent at the university, they develop all levels of mentality and, under favorable conditions, form a professional orientation. As everyone is facing the realities of a pandemic and distance (remote) learning, it is relevant to keep the overall intellectual, professional development of future specialists at a sufficiently high level.

Professional competencies are determined by the requirements of scientific and technological progress in the global engineering sphere and the agro-industrial complex of Russia, as well as by the ratio of labor activity to the level of preparedness and development of a graduate of a certain major. Successful mastering of professional competencies is accompanied by the skill of independent work (Chekha, 2004; 2006a; 2006b; 2014), the author's teaching methods (Popov & Chekha, 2017), the agro-engineering education consistency (Silaichev & Chekha, 2009), and continuity (Chekha, 2010). The authors believe that according to the specifics of the agricultural university and the list of majors, the acquisition of professional competencies is accompanied by students' insufficient motivation. The paper aims to substantiate the development vectors of agro-engineering education in Russia after the pandemic. The research object is agro-engineering education at the Timiryazev Agricultural Academy. The research subject is cognitive processes, educational motives of students, forms, and methods of teaching technical disciplines.

MATERIALS AND METHODS

The methodological base of the study is general scientific and special methods: synthesis, analysis, induction, deduction, abstraction, monographic, systemic, and critical presentation of theoretical and practical aspects of agricultural education based on a competency approach. Concerning agro-engineering education, the authors draw the following conclusions:

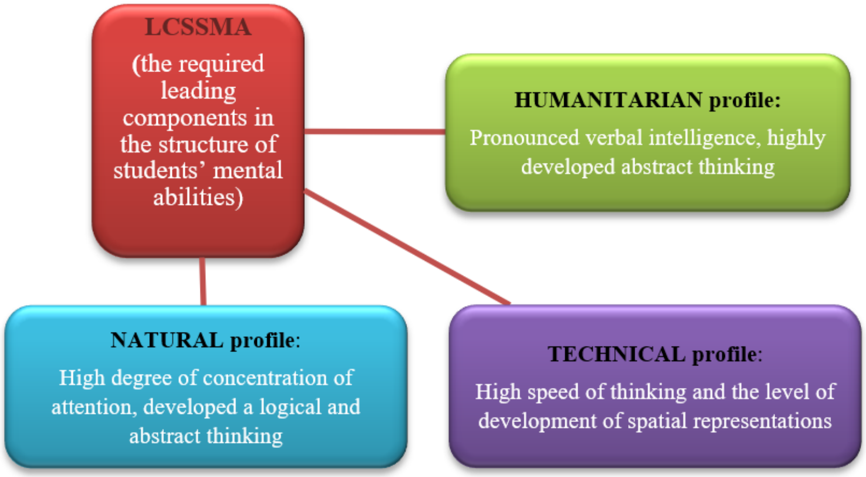
- Agro-engineering education should be multileveled (Chekha, 2006b, pp. 96-99);
- Self-education is considered lifelong learning (Lachuga et al., 2009);
- Education should be carried out considering the integration of traditional and innovative approaches when teaching technical disciplines.

The research aims to determine the development vectors of agricultural education in current universities. The research object is agricultural universities. The subject is the tendencies, patterns, and factors of the formation of agricultural education based on the study of cognitive processes, educational motives of students, forms, and teaching technical discipline methods. The theoretical basis of the research is the aspect of traditional and innovative approaches to teaching technical disciplines using not only distance (remote) education but also digital technologies. There is a dissonance between the qualitative changes in agro-engineering education during the pandemic and traditional teaching approaches. The development of agro-engineering education in Russia is determined by the content and technologies of training future personnel and teaching technical disciplines in a pandemic and distance (remote) education in particular. An appropriate assessment of the quality of innovative approaches in teaching technical disciplines after the pandemic is the development vectors of agro-engineering education in Russia formulated by the authors.

RESULTS

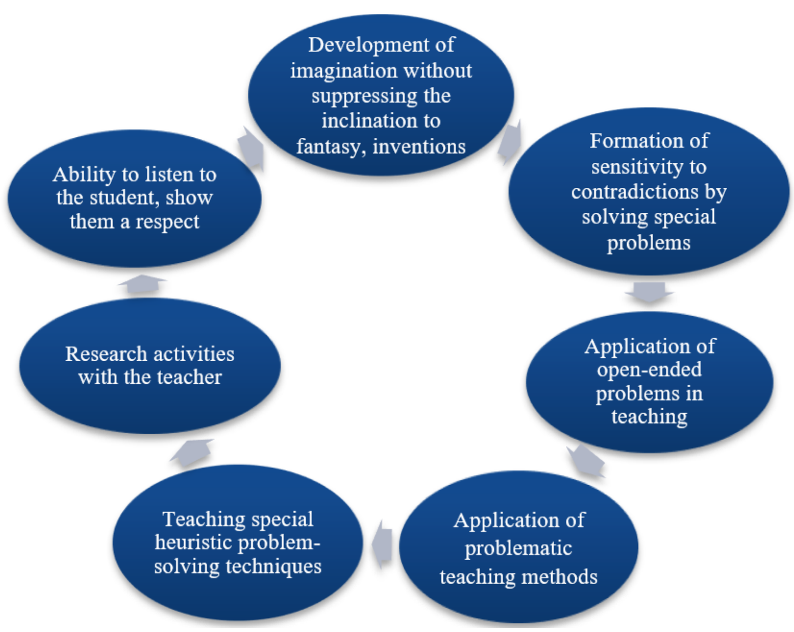
According to the authors, the high-quality preparation of future masters, specialists, and bachelors of various majors requires a sufficiently high level of general intellectual development and mastery of a specific range of logical operations. These levels decrease compensated with the help of increased motivation and efficiency. The authors reveal that the levels are slightly different in universities (depends on students' priority contingent). In this regard, they compiled a diagram of the required leading components in the structure of students' mental abilities [LCSSMA], depending on the training fields in an agricultural university (Fig. 1).

FIGURE 1
THE MAIN COMPONENTS IN THE STRUCTURE OF STUDENTS' MENTAL ABILITIES, DEPENDING ON THE TRAINING AREAS



When managing students' cognitive processes and learning motives, it is important to consider the levels of logical and theoretical thinking (Fig. 2) and internal learning motivation. The motive is what the student's activity is for. The main component in the high-quality education process is the organization of students' activities considering the development priorities of agro-engineering education in Russia after the pandemic. Students purposefully form theoretical thinking and professional preparedness to work in current production conditions and remotely.

FIGURE 2
STAGES OF CREATIVE THINKING DEVELOPMENT

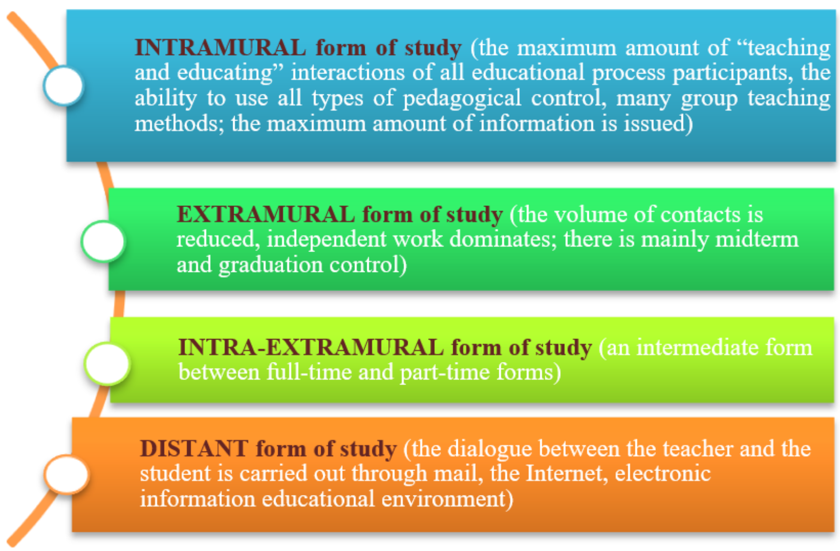


The authors found that insufficient professional orientation and low level of academic motivation hold a second position among the student dropout reasons, after the lack of desire to study and work in the chosen direction (major). All motives are combined into four groups according to the intensity of influence on the educational work of students:

- Group 1 – Professional (students strive to become highly qualified specialists);
- Group 2 – Cognitive (students receive intellectual satisfaction from the learning process);
- Group 3 – Pragmatic (students desire to receive a scholarship);
- Group 4 – Social (students strive to study well to receive approval from teachers, parents, and friends).

The authors found that learning outcomes (both based on traditional and innovative approaches in teaching using not only distance (remote) education but also digital technologies) are formed not only from high mental development indicators or phenomenal characteristics of students but also from learning forms and methods. During the pandemic and distance learning, many higher education teachers began to actively and independently apply a synthesis of traditional and innovative approaches in teaching technical disciplines based on an activity-based approach to teaching (Fig. 3).

FIGURE 3
FORMS OF TEACHING TECHNICAL DISCIPLINES



The main methods of continuous and constant cognitive activity management are organizational forms of training, namely: lecture, practical lesson, colloquium, laboratory work, research work, workshop, production, pedagogical, technological, and diploma practice. These activities are relevant to agricultural engineering education. They are also the teaching methods that need to be adjusted in current conditions and after the pandemic, considering the technical, psychological, and pedagogical capabilities of each student and teacher. Current agricultural enterprises are turning into complex, intelligent systems that require highly qualified specialists. Their professional competencies are already determined by the requirements of scientific and technological progress in the global engineering sphere and the agro-industrial complex of Russia and the ratio of labor activity to the preparedness and development of agricultural engineering graduates. The development of agro-engineering education in Russia is determined by the content and technologies of training future personnel and teaching technical disciplines in a pandemic and distance (remote) education in particular. In this regard, the authors have identified five vectors for the development of agro-engineering education in Russia after the pandemic:

- Vector 1 – Digitalization of educational processes and the creation of digital educational content;

- Vector 2 – Teaching technical disciplines in a balanced synthesis of the traditional activity-based approach and innovative teaching technologies in an agricultural university;
- Vector 3 – High-quality support and training tools according to professional competencies, current requirements of the world market, and the agro-industrial complex of Russia;
- Vector 4 – Development of agricultural universities as innovation centers with the introduction of new educational technologies;
- Vector 5 – Improvement of additional professional education programs in agricultural universities with the possibility to obtain a certificate both in person and remotely.

The digitalization of educational processes with the digital educational content formation is creating online courses using Internet technologies, simulators, virtual laboratories, and the development of their own digital education projects by universities. This improves the quality of education and increases the students' motivation. An analysis of cognitive processes, forms, and methods of teaching during distance (remote) education showed that future masters, specialists, and bachelors of various majors could significantly increase their interest in studying technical disciplines through educational motivation. After the pandemic, the vectors of agro-engineering education development in Russia identified by the authors will intensively affect the learning process in agricultural universities.

DISCUSSION

The agro-engineering education system is inert and slowly adapting to the new realities of the pandemic and distance learning. The educational process is based on full-time attendance at universities, students' presence in classrooms with a teacher, the use of traditional, "analog" teaching aids – text and workbooks. Distance learning in technical disciplines has main positive and negative sides for students. On the positive side, (1) it promotes active participation in the educational electronic environment of the university; (2) in the visualization of educational information; (3) in the education time shortening; and (4) saving time resources of moving around (Lachuga & Chekha, 2007). Among the negative ones are: (1) a real shortage of high-quality educational content; (2) disorganization of students' independent work; and (3) lack of motivation for learning activities.

CONCLUSION

The current education system has never experienced the problems caused by the pandemic. In this regard, it is necessary to reconsider the further development of the education system on an innovative basis using not only distance (remote) education but also digital technologies. They should be able to solve the following problems:

- Assess the level of equipment and readiness of universities to digitalize educational processes;
- Improve the system of financing and salaries of the teaching staff;
- Strengthen and modernize the material and technical base of agricultural universities, considering safety requirements after a pandemic;
- Improve the programs of the practice-oriented block of training for agricultural engineers.

The key strategy for the development of agro-engineering education and a modern agricultural university should be the ability to reduce the time between the emergence of innovation in the external objective environment and its study in the internal educational space. The digitalization of education will solve urgent problems in the education system, change the training structure, and organize the educational process using a new competence-based approach.

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