

FORMATION OF INFORMATION-COMMUNICATION COMPETENCE OF FUTURE AGRICULTURAL ENGINEERING SPECIALISTS AT AGRICULTURAL INSTITUTIONS OF HIGHER EDUCATION

Oksana Bulgakova¹, Lesya Zbaravska², Sergii Hrushetskyi², Ilmars Dukulis³

¹National University of Life and Environmental Sciences of Ukraine, Ukraine; ²Podillia State University, Ukraine; ³Latvia University of Life Sciences and Technologies, Latvia
semjons@apollo.lv, olzbaravska@gmail.com, ilmars.dukulis@lbtu.lv

Abstract. One of the components of professional competence is information-communication competence, the development of which determines the ability of the future specialists in agricultural engineering to interact efficiently in the agrarian environment with their colleagues and managers. This is especially true for the mandatory components of professional training, in particular the disciplines: “Innovative technologies for the production of agricultural products”, “Agrarian service and information support”, “Methods of scientific research”, “Analysis of technological systems”, “Modelling of technological processes and systems”, and others as the most universal basic disciplines. The aim of this investigation is to introduce into the educational process the information-communication competence of the future agricultural engineering specialists at agricultural institutions of higher education, aimed at the formation and development of professional training. Implementation of pedagogical conditions, introduction of an experimental methodology for the formation of information-communication competence of the future agricultural engineering specialists in the process of professional training made it possible to achieve significant changes in the levels of formation of the studied phenomenon in the experimental group compared to the reference group. 100 students of “Podilskyi State University” took part in the experiment. In the experimental group the results of the formation of information-communication competence of the future agricultural engineering specialists improved significantly: at the sufficient level they increased by 6.0%, at the satisfactory level – by 8.0%, but at the low level the results decreased by 14.0%. In the reference group there were also positive changes in the levels of formation of the information-communication competence of the future agricultural engineering specialists: at the sufficient level the results increased by 1.0%, at the satisfactory level – by 2.0%, but at the low level – they decreased by 3.0%. The positive dynamics of the level of knowledge, revealed as a result of experimental testing, gives reason to assert the efficiency of the proposed organizational and pedagogical conditions and methodology for the formation of information-communicative competence of the future agricultural engineering specialists in the process of professional training.

Keywords: competence, professional training, specialist, agricultural engineering.

Introduction

At the present stage of development of the information society such aspects as the globalization and democratization processes significantly increase the requirements for the qualification of teachers, their competence and competitive power in the global labour market, their ability to adapt to today’s rapidly changing socio-economic conditions and scientific and technological achievements. Application of information and communication technologies (ICT) contributes to the globalization of education, the development of international labour market, and the growth of various types of personal mobility. At the end of the 20th century there appeared a phenomenon of using the ICT tools in the educational process. It represents interaction of the teacher and the students, where all the parts of the learning process are implemented using the Internet technologies or other means of interactivity [1-7].

A necessary condition for the social and economic development of any country is investment in education of the population. In this context globalization of education contributes to the personal and professional development of specialists, involved in the development and implementation of new engineering technologies [8]. The latter is possible when they acquire a high level of professional competence. One of the components of professional competence is information-communication competence, the development of which determines the ability of the future agricultural engineering specialists to interact efficiently in the agricultural environment with their colleagues, management, as well as within the entire system of agricultural institutions, which is especially true for the agricultural engineering specialists who interact with a large number of people [9].

Eisenbart explored the essence of the concept of “social-communicative competence” in the modern scientific paradigm [10], A. Andriyanov and A. Tataki explored the formation of information-communicative competence in the process of training specialists in the document-information sphere [11]. N. Ashitok [12] dealt with the issues of the teacher’s communicative competence, and

Yu. Bystrova [13] studied innovative teaching methods in the higher education of Ukraine. N. Bibik explored in her writings the competence-based approach: a reflexive analysis of application [14]. L. Didukh and other scientists were engaged in the information-communication competence of the teacher [15]. A teacher's ability to use the tools of information and the information technology to solve professional problems becomes one of the components of professional competence. Much attention to this is paid in the works by Galustyan O.V., Gaidar K.M., Aleshina S.A., Ksenofontova A.N., Ledeneva A.V., Arrosagaray M., González-Peiteado M., Pino-Juste M., Rodríguez-López B., Pikhart M. Many foreign scientists (K. Ahmad, T. Bender, G. Corbett, M. Connel, U. Dayzard, R. Earle, J. Helbrayt, M. Kompf, M. Makklyuen, M. Porat, M. Rodgers, S. Rychen, L. Salganik, R. Sheppard, F. Stoller, J. Spector, E. Toffler, N. Wendworth, K. Whitehouse et al.) have also investigated this problem. We pay special attention to the investigation by J. Spector (competencies for online learning) and M. Kompf (temptation of knowledge and learning: information and communication technologies).

However, the existing studies of the information formation process and communicative competence of the future agricultural engineers cover only some aspects of this problem. Indeed, the content, forms and methods of forming the information-communication competence of the future agricultural engineers should be further investigated during professional training and attempts to include modern information-communication technologies into higher education.

Therefore, the purpose of this investigation is to explore the efficiency of the formation of information-communication competence of the future agricultural engineering specialists at the agricultural institutions of higher education.

Materials and methods

The following methods were used during the research: theoretical analysis of philosophical, psychological and pedagogical literature on the topic of the research in order to select and comprehend the factual material; analysis of concepts, theories and techniques in order to determine the ways how to solve the problem of the study; survey, testing, generalization of the results, methods of mathematical statistics [9]; and methodological approaches: competence-based, axiological, personal, interdisciplinary approach.

The process of training the agroengineering specialists is based on a competent approach to the study of all disciplines in all cycles of the study at the university. Traditionally, the disciplines of the general education cycle in terms of the content of the methodology of the study are almost the same for all areas and specialties. The technology of the competency-based approach requires fundamental changes in the organization, content and methodology of the educational process. This is, first of all, a shift in the emphasis from theoretical training to theoretical-applied, professionally oriented.

This especially applies to the mandatory components of professional training, in particular: "Innovative technologies for the production of agricultural products", "Agrarian service and information support", "Methods of scientific research", "Analysis of technological systems", "Modelling of technological processes and systems", and others as the most universal basic disciplines, to provide fundamental theoretical and practical training of highly qualified personnel who have acquired deep professional knowledge to perform professional tasks and duties of research and innovation nature in the field of agroengineering, training of specialists, capable of developing and using modern technologies for the creation, operation and repair of agricultural machinery, conducting theoretical and practical scientific research, causing a possibility of further reaching the third (educational and scientific) level; obtaining primary skills in the pedagogical activity, and so on. In addition, a significant part of the laboratory, practical and independent work will be of a nature, commissioned by the coordinator of the qualification work; it will have elements of professional competence and research. The main task in planning the independent activity of the applicants for higher education in the educational process is the theoretical substantiation and development of a model for the formation of information-communication competence of the future agricultural engineering specialists in professional training (Fig. 1).

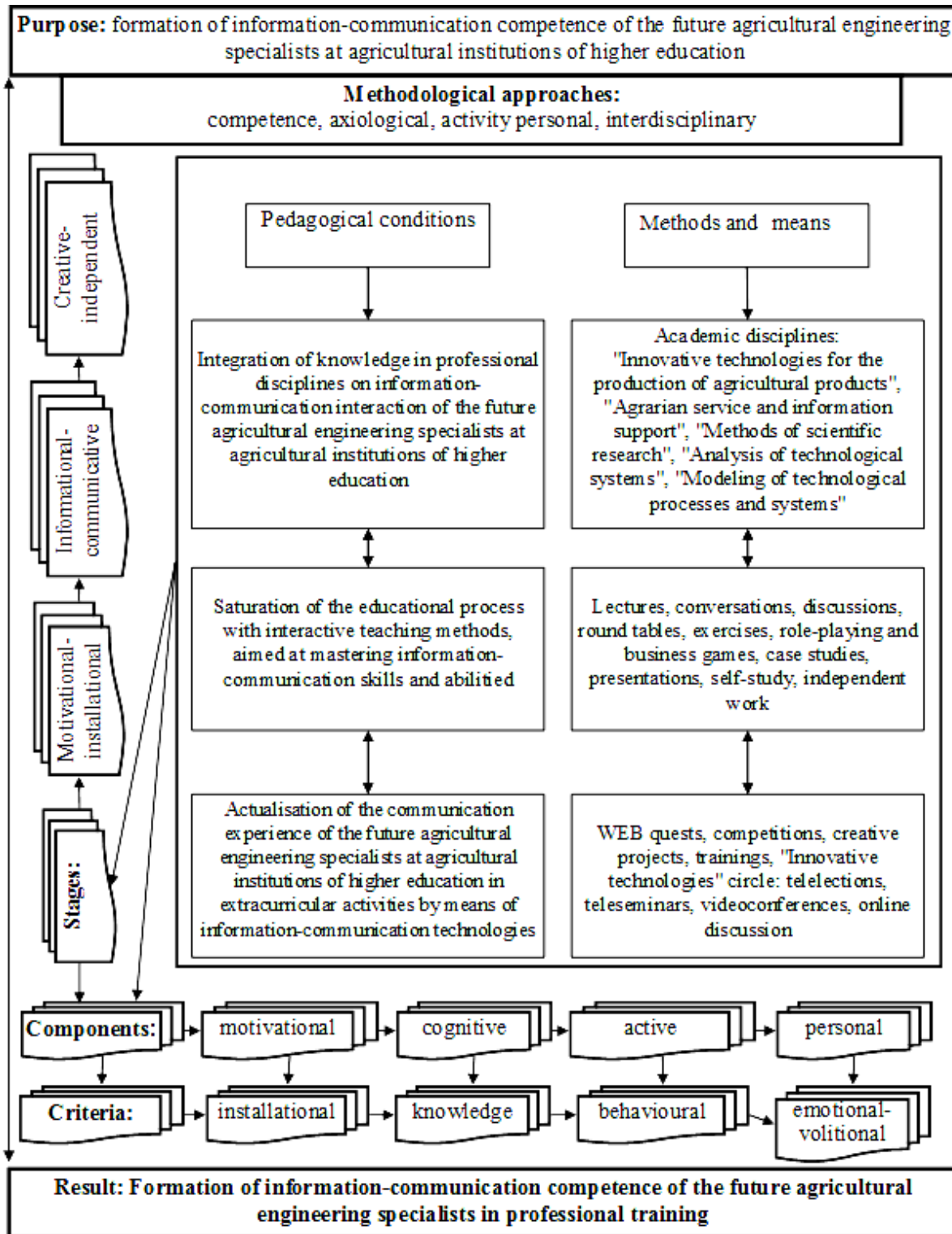


Fig. 1. Model of information-communication competence of future agricultural engineering specialists in professional training

The model includes the most complete view of the description of the knowledge, skills and abilities (combined in competencies) necessary for a modern teacher to convey current knowledge in a form convenient for students and to be not just a teacher, but a teacher-scientist who is ready to develop and develop. Consequently, the pedagogical model for the formation of information-communication competence of the future agricultural engineering specialists in professional training should include a complex of conditions, forms, methods and means, aimed at the development of the skills of the applicants for higher education to apply knowledge in various academic disciplines to a greater or less

extent in their future professional activities. Taking into account what was said above, the developed model provided for: the goal of defining pedagogical conditions (integration of knowledge in professional disciplines regarding the information and communication interaction of the future agricultural engineering specialists; saturation of the educational process with interactive teaching methods, aimed at mastering information and communication skills; agricultural engineering in extracurricular activities); components of information and communication competence of the future agricultural engineering specialists (motivational, cognitive, activity, personal). Based on the theoretical and methodological foundations of pedagogical modelling, the model for the formation of information-communication competence of the future agricultural engineering specialists in professional training was developed in compliance with the following stages: motivational-installation; informational-communicative; creative-independent. The research methodology was based in accordance with the system of scientific approaches, implementation of which is provided by theoretical justification and experimental verification of the efficiency of pedagogical conditions for the formation of information-communication competence of the future agricultural engineering specialists: axiological; competent; activity; personal; interdisciplinary.

The purpose of the first – motivational-installation – stage was implementation of the pedagogical condition “Integration of knowledge in professional disciplines in information-communication interaction of the future agricultural engineering specialists in agricultural institutions of higher education”, which was aimed at acquisition by the applicants for higher education the necessary knowledge about the essence of the concept of “information competence”, familiarization and awareness of the significance of this phenomenon in the professional activities of the future specialists of agricultural engineering. At this stage the individual work of the applicants for higher education with informative sources was assumed.

At the second – information-communicative – stage, the pedagogical condition “Saturation of the educational process with interactive teaching methods, aimed at mastering information-communicative skills” was introduced, which involved working them out through the introduction of active teaching methods, role-playing games, solving situational problems, solving conflict situations, case method, trainings, methods of concrete situations, round table. The following methods of work were used: the error analysis; the audio-visual teaching method; brainstorming; discussion with invitation of experts; business game, assessment of the participants’ actions; master classes; the method of analysis and diagnosis of the situation; the interview method; the project method; modelling; the problem method; public speaking; work in small groups; individual and group trainings. Seminar classes were used that ensured the development of creative professional thinking, cognitive motivation and professional use of knowledge – free mastering of the business language, operation with engineering terms, concepts, definitions.

The final, creative-independent stage was aimed at the implementation of the pedagogical condition “Actualization of the experience of professional communication of future agricultural engineering specialists in extracurricular activities” and provided for various extracurricular types of work, independent creative activity of applicants for higher education, participation in scientific and practical conferences. At this stage the distance learning forms were introduced intended to form the ability of self-organization and self-education among the applicants for higher education.

The result of the implementation of the proposed model is the formed information- communication competence of the future agricultural engineering specialists at low, satisfactory, sufficient levels.

When conducting a pedagogical experiment, the diagnostics of the current state of the formation of information-communicative competence of the future specialists in agroengineering was carried out, the quantitative and qualitative characteristics of the phenomenon were determined. At this stage, 100 applicants for higher education establishment “Podolsky State University” took part. They made up experimental and reference groups in which it was supposed to do experimental work, introducing certain pedagogical conditions. Appropriate methods were selected in order to determine the levels of formation of information-communication competence of the future agricultural engineering specialists according to certain indicators of separate components and criteria.

With the motivational component that characterizes the setting criterion, the indicators are: the presence of motivation for the implementation of the activities of the agricultural engineering specialists; the presence

of professional values; the presence of motivation to achieve success in professional activities. The methods used were the questionnaire “Motives for choosing a profession” (R. Ovcharova); questionnaire “Value Orientations” (M. Rokeach); questionnaire “Motivation for success” (A. Reana).

With the cognitive component, which characterizes the pre-set criterion, indicators were: communicative literacy; awareness of the spelling of technical terminology and the norms of the modern Ukrainian language; awareness of the ways and methods of efficient professional communication in the work of agricultural engineering specialists; awareness of the modern ICT, used in agricultural engineering. The methods used were: adapted tests according to N. Kraevskaya; diagnostics of communicative and characterological features of personality (L. Umansky, I. Frenkel, A. Lutoshkin, A. Chernyshev, etc.); questionnaire (adapted after the author G. Stechak).

With the activity component, which characterizes the behavioural criterion, the indicators are: presence of communicative skills and abilities; presence of predictive skills; availability of skills to work with an electronic system of engineering support in agroengineering. The methods used were: a test to determine the communicative abilities of the applicants for higher education (I. Humenna); a test for diagnosing the level of the ability to predict the ways how to improve the efficiency of information and communication activities, using information and communication technologies (ICT) (developed by M. Rozenberg); a block of test tasks (developed by the authors).

In the case of the personal component, which characterizes the emotional-volitional criterion, the indicators were: presence of empathy; presence of communicative tolerance; presence of emotional self-regulation. The following methods were used: diagnostics of the level of empathy (according to E. Rogov); diagnostics of communicative tolerance (according to the method of V. Boyko); adapted questionnaire (according to A. Lazurenko).

Let us present the levels of characteristic features of certain criteria for the formation of information and communicative competence of agricultural engineering specialists.

The conducted pedagogical experiment confirmed that the implementation of pedagogical conditions, introduction of the experimental methodology for formation of information and communicative competence of the future agricultural engineering specialists in the process of professional training made it possible to achieve significant changes in the levels of formation of the studied phenomenon in the experimental group compared to the reference group.

Results and discussion

Analysis of the results of the experiment for the educational degree “Master” of specialty 208 “Agroengineering” showed the efficiency of definite criteria for the formation of information-communication competence of training the applicants for higher education.

Based on the method of observing the applicants for higher education during the classes, it was analysed how the experimental methodology influenced the quality of knowledge and skills of the applicants for higher education in terms of certain criteria for the formation of information-communication competence of the future agricultural engineering specialists at an agricultural institution of higher education. Let us present the results according to certain criteria for the formation of information-communication competence in the same sequence as at the ascertaining stage of the pedagogical experiment. The dynamics of changes in the results of information-communication competence of the future specialists in agroengineering from CG and EG according to the setting criterion is shown in Fig. 2. As it is evident from the data in Figure 2, the results of the levels of information-communication competence of the future agricultural engineering specialists have changed in both groups. So, in the experimental group the results at the sufficient level increased by 5.4%, at the satisfactory level – by 9.1%, at the low level the results decreased by 14.5%. In the reference group the results did not change so much. At the sufficient level they increased by 1.8%, at the satisfactory level – by 1%, at the low level, the results decreased by 0.5%. The dynamics of changes in the results of information-communication competence of the future specialists in agroengineering from CG and EG, according to the criterion of knowledge gained, is shown in Figure 3.

As evident from the data in Figure 3, in the experimental group the results of the final stage of the experiment by the criterion of the acquired knowledge have changed significantly for the better. At the sufficient level they increased by 9.1%, at the satisfactory level – by 13.7%, at the low level, the results

decreased by 19.6%. Positive changes occurred also in the reference group, but not as much as in the experimental group: at the sufficient level the results increased by 3.7%, at the satisfactory level by 2.8%, and at the low level they decreased by 6.5%.

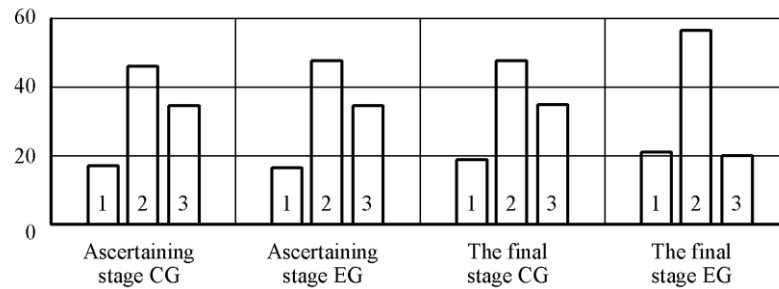


Fig. 2. Dynamics of changes in the levels of ICC formation according to the setting criterion (%): 1 – low level; 2 – average level; 3 – sufficient level

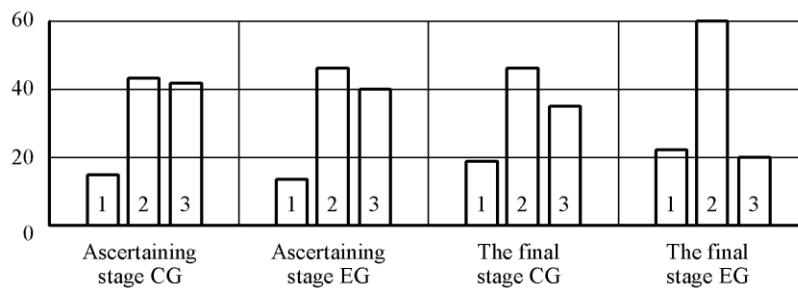


Fig. 3. Dynamics of changes in the levels of formation of ICC according to the criterion of the acquired knowledge (%): 1 – low level; 2 – average level; 3 – sufficient level

Further, the levels of formation of information-communication competence of the future agricultural engineering specialists in the reference and experimental groups were determined according to the criterion of behaviour. The dynamics of changes in the results of information-communication competence of the future specialists in agroengineering from CG and EG, according to the behavioural criterion at the ascertaining and final stages of the study, is shown in Fig. 4.

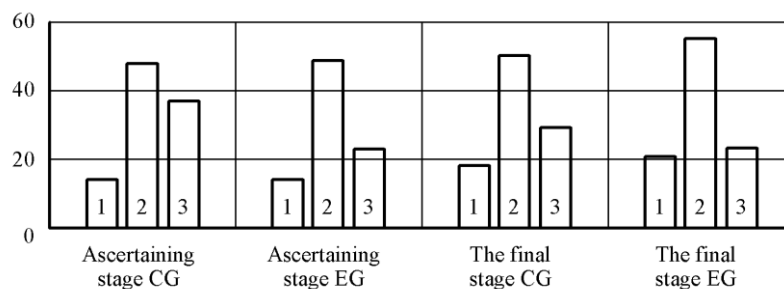


Fig. 4. Dynamics of changes in the levels of formation of ICC according to the behavioural criterion (%): 1 – low level; 2 – average level; 3 – sufficient level

As it is evident from the data, shown in Fig. 4, according to the behavioural criterion in the experimental group, the results of the final stage of the experiment by the behavioural criterion also changed: at the sufficient level they increased by 6.7%, at the satisfactory level – by 6.3%, at the low level the results decreased by 12.7%.

In the reference group, according to the behavioural criterion, positive changes also occurred but not as much as in the experimental group: at the sufficient level the results changed by 4.2%, at the satisfactory level by 2.2%, but at the low level they decreased by 7.4%.

Visually the dynamics of changes in the results of information-communication competence of the future specialists in agroengineering are shown from CG and EG according to the emotional-volitional criterion at the ascertaining and final stages of the study in Fig. 5.

As it can be seen from the data, shown in Fig. 5, according to the emotional-volitional criterion in the experimental group the results of the final stage of the experiment improved significantly: at the sufficient level they increased by 6.4%, at the satisfactory level – by 7.2%, but at the low level the results decreased by 13.7%. Positive changes occurred also in the control group: at the sufficient level the results increased by 0.9%, at the satisfactory level – by 2.9%, at the low level – decreased by 3.8%.

The dynamics of changes in the results of the levels of formation of information-communication competence of the future agricultural engineering specialists at the ascertaining and final stages of the experiment is clearly shown in Figures 6 and 7. As it is evident from Fig. 6, in the experimental group the results of formation of information-communication competence of the future specialists in agroengineering improved significantly: at the sufficient level they increased by 6.0%, at the satisfactory level by 8.0%, but at the low level the results decreased by 14.0%.

As evident from the data in Fig. 7, in the control group there were also positive changes in the levels of formation of information-communication competence of the future agricultural engineering specialists: at the sufficient level the results increased by 1.0%, at the satisfactory level – by 2.0%, but at the low level – the results decreased by 3.0%.

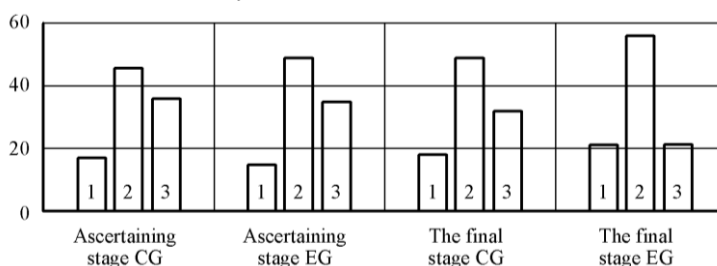


Fig. 5. Dynamics of changes in the levels of ICC formation according to the emotional-volitional criterion (%): 1 – low level; 2 – average level; 3 – sufficient level

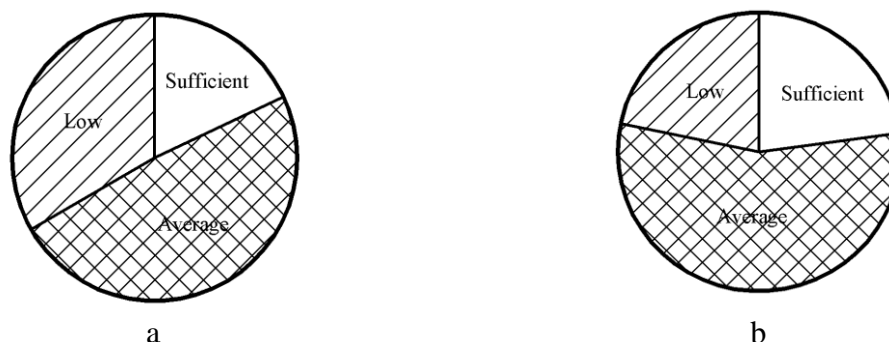


Fig. 6. Results of changes in the levels of formation of ICC in the experimental group (%): a – ascertaining stage; b – final stage



Fig. 7. Results of changes in the levels of formation of ICC in the reference group (%): a – ascertaining stage; b – final stage

Thus, the obtained results of the levels of formation of information-communicative competence of the future agricultural engineering specialists, after the experimental work, indicate the need for

purposeful experimental work with the introduction of a corresponding model of formation of the phenomenon into the educational process of the institution of higher agricultural education.

Conclusions

Thus, the conducted pedagogical experiment confirmed that the implementation of pedagogical conditions, introduction of an experimental methodology for the formation of information-communication competence of the future agricultural engineering specialists in the process of professional training, made it possible to achieve significant changes in the levels of formation of the studied phenomenon in the experimental group, compared to the reference group. Comparison of the data, obtained at the ascertaining and final stages of the experiment, revealed that in the experimental group the results of formation of information-communicative competence of the future specialists in agroengineering improved significantly: at the sufficient level they increased by 6.0%, at the satisfactory level – by 8.0%, at the low level the results decreased by 14.0%.

The positive dynamics of the level of knowledge, revealed as a result of experimental testing, gives reason to assert the efficiency of the proposed organizational and pedagogical conditions of the proposed methodology for the formation of information-communicative competence of the future agricultural engineering specialists in the process of professional training.

Author contributions

Conceptualization, O.B.; methodology, O.B., L.Z. and S.H.; formal analysis, O.B., L.Z. and S.H.; investigation, O.B., L.Z. and S.H.; data curation, O.B., L.Z. and S.H.; writing – original draft preparation, O.B. and I.D.; writing – review and editing, O.B., L.Z., S.H. and I.D.; visualization, O.B. and I.D. All authors have read and agreed to the published version of the manuscript.

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