

RESULTS OF ORGANIZATION OF DUAL EDUCATION AT THE LEVEL OF “INDUSTRY-ENTERPRISE-HIGHER EDUCATION” AND SELF-ASSESSMENT IN THE FORMATION OF STUDENTS' COMPETENCES IN THE TRAINING OF QUALIFIED ENGINEERING PERSONNEL

Kodirov Ismail Norkobilovich

Candidate of physical and mathematical sciences, professor of the department of alternative energy sources, Karshi Engineering and Economics Institute, kodirov@gmail.ru

ABSTRACT

The article presents information on the clarification of the principles of successful implementation of dual education at the level of “Industry-Enterprise-University”, the development of new methodological support for dual education, the involvement of graduates in self-assessment in the formation of general competencies, and the results obtained. There are many features of the organization of the dual education system, the most important of which are analyzed in detail. Based on a number of principles, advantages, and a comparison of the characteristics of dual and traditional education systems, it was determined that eight categories of dual education are considered extremely important in organizing dual education at the level of “Industry-Enterprise-University”. The diagram of the results of the assessment of the organization of dual education by graduates of higher educational institutions (HEIs) showed that organizing dual education at the “Industry-enterprise-higher education” level is more difficult than building it at the “Enterprise-department (laboratory)” level. When self-assessing the level of development of ten competencies by HEIs graduates, not a single respondent chose the position of “competence is not developed”, but respondents noted the weak development of certain competencies (from 10.4 to 42.2%). The results of the study showed that for the successful development of competencies within the framework of dual education, it was found that it is necessary not only to implement the principles of its organization, but also to improve teaching methods. The respondents' answers showed that building dual education at the "industry-enterprise-higher education" level is more difficult than at the "enterprise-department (laboratory)" level. It became clear that the content of professional module subjects requires consideration based on the requirements of production enterprises, and it is advisable to bring the laboratory equipment of higher education institutions to the level of modern production equipment. In organizing the implementation of dual education at the "industry-enterprise-higher education" level, reliance on the principles of dual education is its distinctive feature. An analysis of the practice of implementing dual education at the "industry-enterprise-higher education" level revealed the need to improve the regulatory and legal framework for its development.

Keywords: Dual education, "Network-enterprise-higher education", principles, characteristics of education systems, dual education module, competencies, self-assessment.

INTRODUCTION

In the context of the sustainable development of the world economy, the training of qualified engineering personnel in higher educational institutions is an ongoing pressing issue. On June 20, 2024, the President of the Republic of Uzbekistan held a videoconference meeting on the issues of “Priority tasks for the training of personnel in engineering fields and further improvement of the activities of higher educational institutions”, where he highlighted the

importance of innovation and engineering personnel in the republic today and identified the main tasks to be carried out, including:

- Based on the "Industry - Enterprise - University" chain, each university will be assigned an industrial partner, and "Higher Engineering Schools" will be opened at 10 universities in the republic.

- Departments will be opened at partner enterprises of all engineering universities, dual education will be established, etc.

Also, in order to further develop the application of dual education in the Republic of Uzbekistan, the Regulation on the procedure for organizing dual education in the professional education system was approved by the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 163 dated March 29, 2021 "On measures to organize dual education in the professional education system". In addition, the development of a national plan and a special program for the training of qualified engineering personnel in the field of renewable energy sources in the Republic of Uzbekistan, the creation of a new system for training engineering personnel using the dual education system in higher and secondary specialized educational institutions for this field are urgent issues [1,11].

The problems that arise in the implementation of dual education have been considered, and it has become clear that the form of dual education is not always and everywhere suitable for implementation and does not work [3,11]. However, to date, the methods of dual education and the methodological foundations and methodological principles of its organization have been poorly studied, and insufficient scientific research has been conducted in this area.

The possibilities of participation of future engineering personnel and employers in the implementation of dual education, their involvement in self-assessment in the formation of competence development in the context of dual education, have not been sufficiently studied, and these issues are relevant.

In addition, in the dual education environment, students are given the opportunity to consciously acquire knowledge and skills, taking into account the results of self-assessment, to more successfully form their personal and professional knowledge, reflecting skills, experience, and knowledge among students. This allows teachers to further improve their teaching methods and sets the task of developing excellent teaching software in the dual education environment, based on the experience and knowledge of students.

LITERATURE REVIEW

The dual education system is widely used in many countries such as Germany, China, the USA, Korea, Denmark, France, Macedonia, Montenegro, Switzerland, the Netherlands, Denmark, Austria, Serbia, Slovenia, Macedonia, Montenegro, Switzerland, the Netherlands, and some Asian countries, that is, in more than 60 countries, and it is one of the modern teaching and learning technologies and is considered the main system of education, in which the integration of the educational process and practice serves as the basis for the high-quality training of qualified specialists in various fields of production enterprises [5].

Speaking of the name "dual", dualism (Latin dualis - two-sided) is a doctrine that promotes the coexistence of incompatible states, principles, ways of thinking, worldviews, aspirations, and epistemological principles. Dualism is one of the manifestations of pluralism. The term dualism was introduced by the German philosopher H. Wolf (1679-1754). Dualism represents the

following pairs of concepts: the world of ideas and the real world. Dualism can be manifested in philosophical, religious, anthropological, and ethical forms[2].

L.V.Sidakova recognizes that the dual education system is “an educational system that involves the combination of educational activities of an educational institution with the activities of production enterprises” [3]. The dual education system of specialist training can be considered as “a system of education aimed at training specialists with the required level of qualification in a specific profession, clearly coordinated between higher vocational education and employer production enterprises” [4]. Also, with a deeper analysis of domestic and foreign literature, the dual education system can be imagined as an educational model in which theoretical training can be carried out in educational institutions, and practical training can be carried out in production enterprises [5]. The analysis of scientific and pedagogical literature shows that at present it is possible to answer a number of questions that have arisen regarding the organization of dual education, and the technical meaning of such concepts as “dual education”, “dual education program”, and “dual training” has been clarified [10-11].

METHODOLOGY

A number of problems are encountered in the process of introducing the dual education system into the educational system of higher educational institutions. The main difficulties in training personnel are the insufficient level of training readiness of the enterprise, namely the lack of training places at the enterprises; the need for a mandatory increase in the price of the manufactured product, the lack of funds for training in order to attract students to training; the formation of the content and methods of newly created dual education programs in cooperation; the formation of the principles and categories of dual education, the lack of equipment, the lack of funding, and the lack of many activities within the framework of dual education, etc.

One of the most important problems in the training of engineering personnel in higher education institutions (HEIs) is that students' theoretical and practical training in higher education institutions is not carried out in a coherent manner and cannot be mastered simultaneously due to changes in it, and there is a gap between employers and the labor market. The application of the dual education module in the higher education system is effective in eliminating this problem (Figure 1).

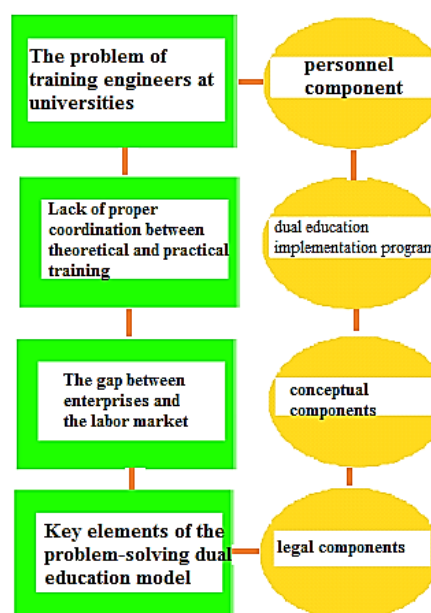


Figure 1. Using the dual education model to solve problems in higher education institutions.

In recent years, measures have been taken in the Republic of Uzbekistan to further improve the higher education system and gradually reduce this gap by introducing state educational standards and professional standards adapted to the future job functions of higher education graduates. The implementation of such a model of education in the training of future specialists of any profession is possible using the dual education system [5-11].

For the successful implementation of dual education in the higher education system, it is proposed to develop a dual education model based on cooperation between participants in the educational process [5].

The main elements of this model are:

- legal components;
- conceptual components;
- a program for introducing dual education for higher education institutions;
- personnel component.

Each of the proposed elements mutually recognizes the other. In this case, the conceptual component is represented by a number of conditions for the activity of the technological, methodological, personal-resultative levels, mechanisms and students' motivation for learning.

It is known that when building a dual education system at several structural levels, such as "Enterprise - University", "Enterprise - Department", "Enterprise - Laboratory", "Network - Enterprise - University", a number of problems related to dual education arise. In this case, the necessary one is selected depending on the goal set.

There are many features of the organization of the dual education system, and based on an analysis of the most important of them, based on a number of its principles, advantages, and a comparison of the characteristics of the dual and traditional education systems, it was determined that eight (8) categories of dual education are considered extremely important:

1. The structure, content and scope of specialist training correspond to the actual needs of the enterprise.
2. The practice is carried out directly on modern equipment of production enterprises.
3. Laboratory, coursework, and graduation thesis topics are oriented towards the potential needs of employers.
4. The presence of modern analogues (real models, samples) of production equipment in each auditorium of the enterprise.
5. Students will become familiar with the corporate culture of the enterprise and work as a team.
6. The state is responsible for the theoretical part of education, the enterprise is responsible for the practical part, or both are jointly responsible.
7. Practical work is carried out under the guidance of a mentor from the enterprise.
8. Teachers have the opportunity to improve their skills in special subjects at the enterprise.

A comparative analysis of the differences between dual and traditional education systems shows that it is appropriate to select the above points for the organization and implementation of dual education at the "Industry-Enterprise-Higher Education" level.

Currently, the methodological foundations and methodological principles of organizing dual education have not been fully studied. Also, the possibilities of student participation in the implementation of dual education programs, their involvement in self-assessment in the

formation of their competences in dual education conditions have not been sufficiently studied. In addition, in dual education conditions, it will be possible to monitor the more successful formation of personal and professional knowledge, reflecting the conscious acquisition of their knowledge, experience and skills, taking into account the results of self-assessment. Based on the self-monitoring of students' experience and knowledge, teachers will need to develop excellent teaching software in dual education conditions, which will allow improving the methods of teaching students.

The purpose of the research is to clarify the principles of successful implementation of dual education at the "industry-enterprise-higher education" level, develop methodological support for dual education, and involve graduates in self-assessment in the formation of general competencies.

Research methods: dual education analysis of scientific and pedagogical literature in the field; mutual evaluation of the content of the higher education program; research; survey, comparison, analysis.

Approval of dual education: Approval of the organization of dual education at the "industry-enterprise-higher education" level was carried out at the Karshi Institute of Engineering and Economics in the Republic of Uzbekistan within the framework of implementing dual education in the specialty 607111000-Alternative Energy Sources.

RESULTS

It is shown that methodological categories of modern education such as "objects", "types", "elements", "conditions for the implementation of professional activity" can allow the formation of methodological principles for organizing dual education at the "Industry-enterprise-higher education" level.

As is known, in the context of dual education, students should be prepared for practical training, develop skills in working with objects, and gain experience in professionally important types and elements of their activities during practical training.

The diagram of the results of the assessment of the organization of dual education by university graduates showed that organizing dual education at the "Industry-enterprise-higher education" level is more difficult than building it at the "Enterprise-department (laboratory)" level. When self-assessing the level of development of ten competencies by university graduates, not a single respondent chose the position of "competence is not developed", but respondents noted the weak development of certain competencies (from 10.4 to 42.2%). The results of the study showed that for the successful development of competencies within dual education, it was found that it is necessary not only to implement the principles of its organization, but also to improve teaching methods.

As a result of the analysis of the current practice of introducing dual education, it was determined that, first of all, it is necessary to further improve the existing regulatory and legal framework and ensure the creation of conditions for the development of dual education in all areas of education.

The organization of dual education in higher education institutions is carried out based on its principles. According to the results of a comparison of dual and traditional teaching methods, the following basic principles of organizing dual education at the "Industry-Enterprise-University" level were identified:

1. The structure, content and scope of specialist training should correspond to the actual needs of the enterprise.

2. The topics of laboratory, coursework, and final qualification thesis should be oriented towards the potential needs of employers.

3. The modern equipment of the practical production enterprise must be passed, etc.

4. When organizing dual education at a higher education institution and a manufacturing enterprise, the higher education institution should be responsible for the theoretical part of the education, and the manufacturing enterprise should be responsible for the practical part, and they should jointly monitor the developing skills of future engineers.

Based on the above, the following specific methodological principles for organizing dual education at the "Industry-Enterprise-Higher Education" level have been developed:

1. Higher education institutions and manufacturing enterprises should work together to develop new dual education programs for the training of engineering specialists.

2. Types, elements, and implementation conditions of professional activities in the training of engineers in higher educational institutions should correspond to the topics that reflect the professional competencies of enterprises.

3. The objects, types, elements, and implementation conditions of professional activities should be revealed through new dual education programs in the content of the department's disciplines, as well as the formation of competencies reflected in the professional activities of enterprises.

4. In the context of dual education, practical training for students at universities and enterprises should be carried out, ensuring the formation of skills in working with the necessary objects, and the formation of experience in carrying out engineering professional activities.

5. Involve teachers from manufacturing enterprises that employ them as teachers in teaching specific sections of specialized subjects, and if necessary, conduct additional training seminars for them.

It was found that the rational organization of dual education at the "Industry-Enterprise-University" level, the diversity of the proposed methodological principles, and the educational and methodological complexes of the disciplines allow solving the problems of coordinating and developing the educational and cognitive activities of students (theoretical and practical classes), the formation of dual education in them.

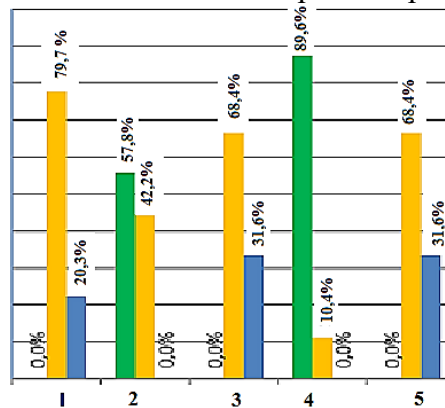
In this regard, the results of the survey and questionnaire conducted among graduates of the "Alternative Energy Sources" educational program show that a survey of students who graduated in 2023 was conducted in the fall of 2024. The results of the new survey showed that 18 out of 21 graduates responded to the requirement for the effectiveness of dual education. The results of the experiment show that they learned the knowledge needed in production enterprises at higher education institutions, since they received engineering professional knowledge in accordance with the requirements of production enterprises on the basis of dual education.

Due to the above-mentioned difficulties in implementing the principles of organizing dual education, 100% results were not achieved. The results of the study of existing problems are reflected in two diagrams:

The first diagram reflects the evaluation of graduates in the training of personnel based on programs within the framework of the professional module, organized in all disciplines of the department, with dual training at the level of "Industry-Enterprise-University" (Figure 2).

The second diagram shows the organization of dual training at the level of professional laboratories of enterprises and higher educational institutions, and the extent to which students mastered the subjects of the educational direction "Alternative Energy Sources" (Figure 3). Graduate students were asked to evaluate and evaluate their positions in the organization of dual education, corresponding to points 1, 2, 3, 5 of the 8 criteria listed above, using four different assessments ("not implemented", "weakly implemented", "highly implemented", "100% implemented"). It should be noted that none of the respondents chose the "not implemented" position, and there were no "weakly implemented" answers in their answers.

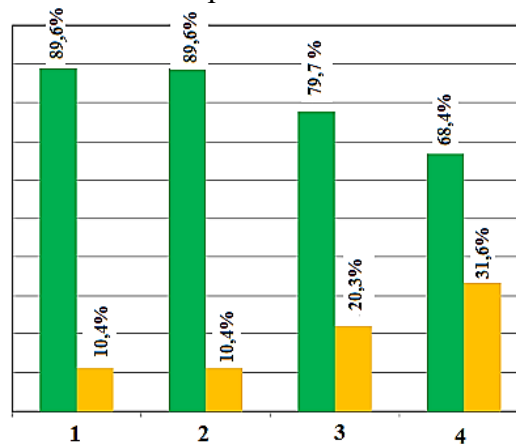
The respondents' answers showed that building dual education at the "Industry-Enterprise-University" level is more difficult than at the "Enterprise-Department (Laboratory)" level.



■ 100% implemented. ■ Mostly implemented. ■ Poorly implemented.

Fig. 2. Assessment of the organization of dual training at the level of "industry-enterprise-university " by graduates.

1- Dual training contributed to professional development during the training period; 2- Graduates got acquainted with the corporate culture during training; 3- Practical training was carried out directly on modern production equipment; 4- Graduation qualification projects were focused on the prospective needs of employers; 5- Content and scope of professionally oriented courses corresponded to the enterprise needs.



■ 100% implemented. ■ Mostly implemented.

Fig. 3. Assessment by graduates of the organization of dual training at the "enterprise - department(laboratory)" level.

1-Dual training implemented at the "enterprise - department (laboratory)" level has contributed to professional development; 2-Dual training at the "enterprise - department (laboratory)" level provided for familiarization with corporate culture; 3-Practical training was carried out directly on modern production equipment; 4-Content and scope of

professionally oriented courses corresponded to the "enterprise - department (laboratory)" needs.

It became clear that the content of professional module subjects requires consideration based on the requirements of manufacturing enterprises, and it is advisable to bring the laboratory equipment of the university to the level of modern production equipment.

The results of the self-assessment of the level of development of competencies of graduating students of the educational direction "Alternative Energy Sources" were considered. Graduates were offered a list for conducting a self-assessment of the level of development of their competencies, which is presented in the diagram in Figure 3. The assessment was carried out using the following scale: 0 - competence is not developed, 1 - weakly developed, 2 - practically developed, but not fully developed, 3 - fully developed. The results of the study are presented in Figure 3. The results of the study are presented in Figure 4.

Analysis of the results of self-assessment shows that not a single person chose the position "competence is not developed". At the same time, respondents chose the position "competence is poorly developed" in relation to one, maximum two competencies. According to the results of the survey, the lowest result was received by the position "Ability to communicate in Russian" (Fig. 4). The results obtained show that for the successful formation of competencies in future engineers, it is necessary not only to implement the principles of dual education, but also to improve the methodology of dual education.

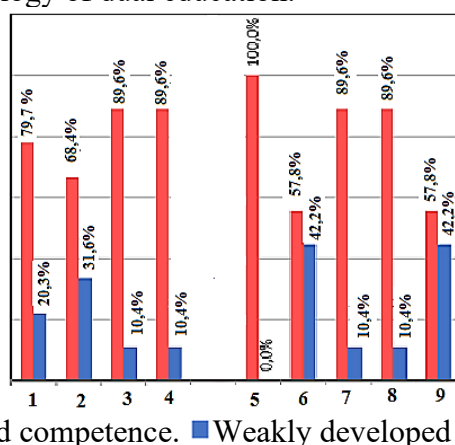


Fig. 4. Self-assessment by graduates of the level of competence development.

1-Self-education ability; 2-Self-organization ability; 3-Strive for creative self-organization; 4-Readiness for professional growth; 5-Ability to communicate in Russian; 6-Ability to collaborate with colleagues, ability to work in a team; 7-Ability to independently solve problems related to professional activities; 8-Readiness to show responsibility; 9-Capability of systemic thinking.

CONCLUSION

1. In organizing the implementation of dual education at the "industry-enterprise-higher education" level, reliance on the principles of dual education is its distinctive feature. Implementation of dual education at the "industry-enterprise-higher education" level The analysis of the practice revealed the need to improve the regulatory and legal framework for its development.

2. The methodological principles of organizing dual education at the level of "Industry-Enterprise-Higher Education" allow for a more successful formation of a joint educational platform between a higher education institution and an enterprise. The development of new

dual education curricula in cooperation between a higher education institution and an enterprise and the rational organization of the educational process are of great importance in conducting theoretical and practical training of students.

3. The results of a special survey among graduates of the "Alternative Energy Sources" educational program revealed that the qualifications acquired within the framework of dual education and the materials studied meet the requirements of manufacturing enterprises.

4. According to the questionnaire survey conducted among students, it turned out that the successful organization of dual education "Industry-Enterprise-Higher Education" is more difficult to build a dual process than organizing it at the "Enterprise-Department (Laboratory)" level. In addition, the need to revise the composition of the subjects taught and the content of the materials in them, taking into account the needs of the enterprise, was identified.

5. It was found that involving students and graduates in the evaluation of the dual education system, and the self-assessment process in further developing their competencies, will help improve dual education.

6. To promote the successful formation of competencies, it is important to implement the principles of organizing dual education, and it is necessary to continue conducting scientific research on further improving the methods of teaching students based on dual education.

REFERENCES

1. Postanovlenie Kabineta Ministrov Respubliki Uzbekistan ot 29 marta 2021 goda No. 163 "O merakh po organizatsii dualnogo obrazovaniya v sisteme professionalnogo obrazovaniya". <https://lex.uz/ru/docs/5346217>
2. Mullaboyeva N. *Professional pedagogy*. Namangan, 2019, 364 p.
3. Sidakova L.V. Suschnost i osnovnye priznaki dualnoy model obucheniya. *Education and training*. 2016; 2: 62 – 64.
4. Rastegaeva D.A., Filimonyuk L.A. Basic realization of the system of dual education and professional preparation of students of higher education organization. *World science, culture, education*. 2017; 6 (67): 110–112.
5. Tereshchenkova E.V. The dual system of education is the foundation of specialist training. *Scientific and methodological electronic journal "Koncept"*. 2014; 4: 41 – 45.
6. G.N. Uzakov, X.A. Almardanov, I.N. Kodirov, L.A. Aliyarova. Modeling the heat balance of a solar concentrator heliopyrolysis device reactor. *BIO Web of Conferences*, 71, 010,98 (2023). pp. 1-11. *CIBTA-II-2023. RUSSIA*. <https://doi.org/10.1051/bioconf/20237101098>.
7. Kodirov I.N. Dual education system in training qualified alternative energy personnel in cooperation with manufacturing enterprises. *Proceedings of International Educators Conference*. Hosted online from Rome, Italy. E-ConferenceSeries.Date: 25 th March, 2024. ISSN: 2835-396X. pp.100-110.
8. Shumakova O.V., Mozjerina T.G., Komarova S.Yu., Gavrilova N.V. The experience of dual education as the possibility of increasing the effectiveness of professional training // *Elektronnyi nauchno-metodicheskiy zurnal Omskogo GAU*. 2016. No. 4 (7). URL <http://e-journal>.
9. Matveev N.V. Dual noe obuchenie studentsov tekni-kuma: preimushchestva i riski v otsenke vypusnikov, pre-podavateley i rabotodateley // *Vestnik Novgorodskogo gosudarstvennogo universitetaim*. Yaroslava Mudrogo. 2015. No. 5 (88). s. 71-74.
10. Serkova G.G. Dual education: problems, perspectives // *Innovative development of professional education*. 2016. No. 12. s. 72-76.
11. Kodirov I.N. The Method Of Training Engineering Personnel In The Field Of Alternative Energy Through The Dual Education System. *Pedagogical Cluster-Journal of Pedagogical Developments*. PCJPD: Volume 2 Issue 2, February 2024. pp. 512-518.