

# Modeling quality management of future training competitive specialists in vocational educational institutions

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**Abstract.** The most important condition that provides the opportunity for the professionalism of professionals is their competitiveness. The current task of vocational (technical) education institutions GP(VT)E is to prepare a qualified and competitive specialist who not only has a certain level of knowledge, skills and abilities, but can practically apply them in their professional activities. The quality of training of future specialists is based on the ability to adapt to rapidly changing production conditions. This is due both to the prospect of Ukraine's accession to the European Union and to the internal situation in the country, where a large number of applicants in GP (VT) E and institutions of professional higher education (GPHE) do not always meet the requirements of the labor market. This requires a reset of educational goals and objectives of vocational education, taking into account global changes in society, production, technology. The work was performed as part of research on "Training of competitive professionals in the context of educational change" (RK 0117U006772). The purpose of this article is to substantiate the model of quality management of training of competitive specialists in GP (VT)E taking into account the identified factors affecting the quality of training and contradictions that need to be resolved in the process of training and experimental verification of its effectiveness. To create a model and test the effectiveness, a set of theoretical and empirical methods was used, which identified the components that have become key in creating a model of quality management training of future competitive professionals in vocational education institutions. To determine the effectiveness, a set of questionnaires was developed and within the framework of the pedagogical experiment a section was conducted among entrants, applicants, graduates, pedagogical workers, heads of GP (VT) E regions of Ukraine and employers, the results were analyzed.

## 1 Introduction

The intensive process of transformation of the economic sphere is becoming dominant, which determines the trends and directions of improvement of the country's economy. Today, the leading attribute of socio-economic efficiency of enterprises on the world stage is the factor of competition, due to technical, investment, mineral resources. In connection with the introduction of new technology, the use of modern information technology in the management of production processes, the issues of developing measures aimed at the practical solution of tasks to develop the potential of human resources are becoming quite important.

In solving this problem, the role of the system P(VT)E, which acts as a locomotive of the structural components of the labor market and should become an effective marketing tool for production development. The determining factor within this is the updating of the content of vocational education, which puts forward new requirements for the forms of training of applicants in IP(VT)E in accordance with the requirements of employers to the level of qualification and competitiveness of future professionals. This problem is exacerbated by changes in the system of links between education and industry. The order for the preparation of competitive production potential, adapted to systemic changes in professional activity and in the labor market, is increasing. In the focus of this prominent place is occupied by the education management system, as a

result of complex pedagogical modeling.

Modeling is determined by the main (primary) method of systematic pedagogical research, «in relation to it all other methods act as secondary, due to it» [1]. Many studies are devoted to the problems of modeling in pedagogy ((S. Arkhangelsky, T. Ilysova, V. Kraevsky, V. Mizintsev, V. Mikheev, O. Ovakimyan, L. Turbovich, A. Uvarov, A. Chentsov, V. Shtoff), which is considered by scientists as a creative purposeful process of constructive-design, analytical-synthetic activity (based on the processing of existing information) in order to reflect the object that is the subject of attention in general, or its characteristic components that determine the functional orientation of the object, ensure the stability of its existence and development [2], which involves a certain logical sequence of mental and practical actions, expressed in the formation of cognitive (ideal) images, reflection of technologies for creating idealized images of objects, experiment (practical testing) model, processing during the experiment of information, the transition from empirical activity to abstraction, theoretical generalization, subsequent modeling, formalization of information, formulation of theoretical provisions and on their basis practical scientifically substantiated requirements» [3]. In foreign literature, scholars consider the concept of «model» as a conceptual image that specifically represents many physical systems, showing a specific pattern, reflects the possibilities for distinguishing the physical system [4]

and distinguish the following pedagogical conceptualizations: research modeling, expressive modeling, experimental modeling, estimation modeling and cyclic modeling. Collectively, they are called modeling pedagogy [5].

In the philosophical literature there are several scientific approaches to understanding the concept of «model». These are: a specific object for the purpose of obtaining or storing information (in the form of a mental image, description by symbolic means or material system), which reflects the properties, characteristics and connections of the original object of free nature, important tasks to be solved subject [6]; a certain analogue of some fragment of natural or social reality, a substitute for the original in cognition and practice [7]; isomorphic display of certain properties and relations of the investigated objects and processes through properties and relations of certain, different from them objects and processes.

The model performs several functions: it clearly identifies the components that make up the system; schematically and realistically shows the relationships between the components, in addition, the relationships within the simulated object can be compared with the relationships within the model; is a tool for comparative study of various features of the phenomenon, process [8]; mentally imagined or materially realized system, which, reflecting or reproducing the object of study, is able to replace it so that its study provides new information about this object [9].

Applying the method of modeling, we propose to create an appropriate model of quality management system for the training of future competitive specialists in IP(VT)E, the structural elements of which to determine the conceptual, functional and technological components; components - «input», «process» and «output»; content - opportunities and results that should be interdependent and interdependent.

## 2 Research methodology

According to the goal, a set of interrelated research methods was used.

*Theoretical methods:* systematic analysis of pedagogical and methodological literature, aimed at studying the process of modeling. Based on the study of varieties of models [10]: model of developmental education (V.D. Davydov, V.V. Flyakov, etc.); traditional model of education (J. Majo, L. Crowe, J. Kraplya, D. Ravych, C. Finn, etc.); rationalist model of education (P. Bloom, R. Ganier, B. Skinner, etc.); phenomenological model of education (A. Maslow, A. Combs, K. Rogers, etc.); non-institutional model of education (P. Goodman, I. Ilyich, J. Goodled, F. Klein, J. Holt, L. Bernard, etc.) the author's structural-functional model of quality management of training of future competitive specialists in IP(VT)E is defined.

*Empirical methods:* survey (questionnaire, interview), method of expert assessments, interview, self-assessment,

analysis of documents, statistical data by groups of indicators: I - «The content of vocational training and its comprehensive and methodological support»; II - «Motivation and accessibility of P(VT)E»; III - «Professional success of graduates»; IV - «Personnel potential of the educational institution»; V - «Material and technical base». The questionnaires were developed by the authors.

*Methods of mathematical statistics:* in order to verify the accuracy of the data was carried out quantitative and qualitative processing of the results with the help of computer technology.

The representativeness of the sample was ensured by a sufficient number of respondents, as well as a plausible way to form a sample using the method of nest (serial) sampling, in other words for the study were selected not individual units of the general population, but series (nests) of such units - focus groups. pedagogical workers, employers). Focus group participants were selected at random.

The following were interviewed: 14 IP(VT)E, of which 9 IP(VT)E and 5 institutions of professional higher education (colleges, technical schools); 175 entrants; 175 students; 86 employers; 84 managers and 280 teachers; 548 graduates of IP(VT)E of ten regions of Ukraine.

IP(VT)E - Kryvyi Rih professional mining and technological lyceum of Dnipropetrovsk region; SPTEI «Pershotravensk Mining Lyceum» of Dnipropetrovsk region; Ternivsky professional mining lyceum of Dnipropetrovsk region; SPTEI «Interregional Center for Jewelry Art» in Kyiv; Bilopil Higher Vocational School of Sumy Region; SEI «Odessa center of vocational education» of Odessa region; SEI «Professional lyceum of Ukrainka» of Kyiv region; Dniprorudne Vocational Lyceum of Zaporizhia Region; Higher Vocational Mining School (Horishni Plavni), Poltava region.

## 3 Results and discussion

The monitoring of the current state of professional training of future specialists in IP(VT)E indicates the imperfection of mechanisms for the formation of a competitive workforce, which is primarily due to low motivation and conscious choice of profession, low quality of training of future specialists, insufficient training of teachers, the inconsistency of the content of professional training to modern changes in production technologies [11].

This necessitated the creation of modern tools for modeling and implementation of innovations aimed at solving these problems.

The object of the study was the process of forming the competitiveness of future professionals, which is reflected in the structural and functional model. This type of model differs from other simulation of the internal organization of the process, the functions of which are stable and characteristic of this system.

The proposed model is imitative. By type of activity - conceptual; for the purpose of modeling - structural;

according to the structure - schematic; by form - informational; by the degree of detail - detailed; by development over time - relevant; according to the degree of approximation to the application of quantitative indicators - structural and functional; according to the object of research - a model of educational tasks related to the creation of a quality management system for the training of future competitive specialists in IP(VT)E.

The structural scheme of the model of quality management of training of future competitive specialists in IP(VT)E is presented as one that includes a set of processes, the quality of implementation of which should ensure the effectiveness and efficiency of its implementation.

The practical value of the model is determined by its identity to the studied aspects of the object. At all stages of construction of the model the basic principles are considered:

- clarity - obvious expressiveness of the model: constructive, symbolic, symbolic, visual, functional;
- certainty - clear identification of significant aspects of the object of study and insignificant;
- objectivity - independence of conclusions from the personal beliefs of the researcher [12].

Modeling the process of forming the competitiveness of future professionals was based on the replacement of the object of study with others like it. The results of the study on the model were transferred to the object, and the model became the final result of the forecast. The priority role in the development of this model was given to the application of a systematic approach, which involved considering the competitiveness of future professionals as a holistic system of improving the quality of training through management and pedagogical functions, in the relationships and interactions of each element (Fig. 1).

At the same time, three successive stages were singled out, according to which the competitiveness of future specialists was formed.

The first stage is the formation of a qualitative composition of consumers of educational services, represented by a triad of components entrant/IP(VT)E / employer. At this stage, it is recommended to complete the study groups by implementing the selection for training, the method of assessing the applicant's ability to carry out training and his abilities, coordination of professional desires and plans of the applicant with the plans of the enterprise.

The second stage - the formation of professional competence of future professionals is to introduce pedagogical conditions for the formation of competitiveness of future professionals. Within this stage, special attention is paid to the selection of forms and methods that ensure the effective implementation of each of these conditions.

The third stage - involves the formation of the results of professional training of future competitive professionals and includes final control,

monitoring and employment.

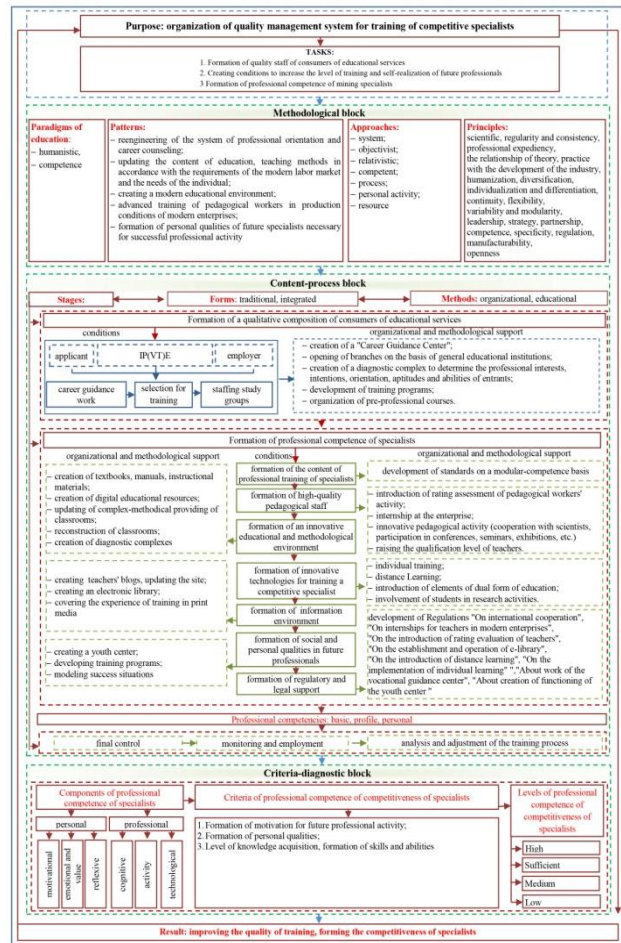


Fig. 1. Model of quality management of training of future competitive specialists in IP(VT)E

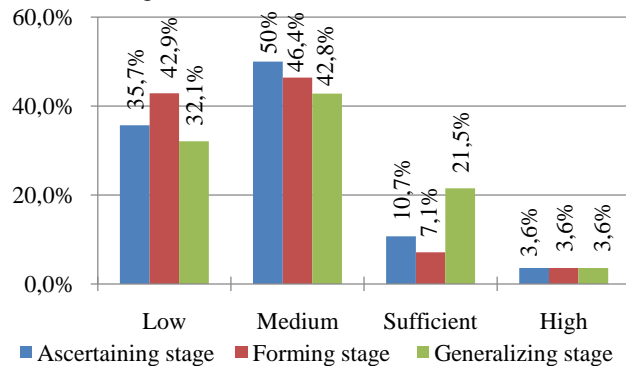
According to the results of the implementation of the model in the system of training of future specialists and evaluation of certain groups of indicators allowed to identify some dynamics.

Regarding the assessment of the level of motivation in students (according to the method of studying the motivation of professional activity of specialists [13]) the following dynamics was observed: in the control group decreased the number of people with unsatisfactory (-3.6%), low (-7.2 %) level of motivation, at the same time the number of people with average (+ 7.2%) increased; sufficient and high levels remained unchanged; in the experimental group there is a lack of people with unsatisfactory level of motivation, decreased the number of people with low (-23.2%) and medium (-23.1%) levels, increased the number of people with sufficient (+ 15.5%) and high (+ 46.2%) levels of motivation. The obtained intermediate results show that the creation of a career center and its educational and methodological support helped to coordinate actions on professional desires and plans of the applicant with the plans of the enterprise, respectively, and increase the motivational component to professional activity (table 1).

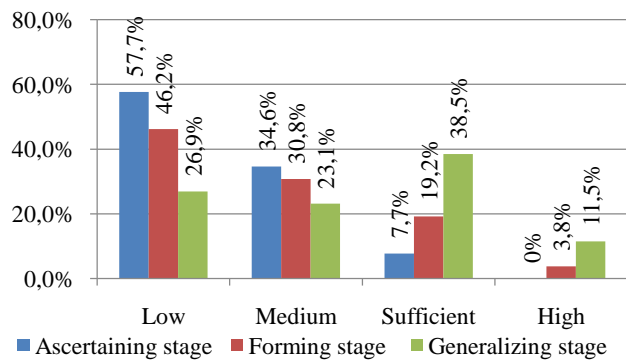
**Table 1.** Comparative analysis of quantitative diagnosticsmotivation of professional activity in students of control and experimental groups

Motivational complexes	Ascertaining stage		Forming stage		Generalizing stage	
	control group/ CG,%	experimental group/ EG,%	control group/ CG,%	experimental group/ EG,%	control group/ CG,%	experimental group/ EG,%
Level: unsatisfactory	7,1	15,4	3,5	0	3,5	0
Level: low	60,8	34,7	57,2	15,4	53,6	11,5
Level: medium	7,1	38,5	14,3	19,2	14,3	15,4
Level: sufficient	10,7	7,6	7,1	23,1	10,7	23,1
Level: high	14,3	3,8	17,9	42,3	17,9	50

As a result of determining the level of knowledge acquisition and the formation of skills revealed a decrease in low levels in the control group (-7.1%), an increase in medium (+ 0.2%) and sufficient levels (+ 7.3%), high levels remained unchanged and equal to 3.6%; in the experimental group there is a decrease in indicators of low (-30.8%) and medium levels (-11.5%), respectively, increased indicators of sufficient (+ 30.8%) and high levels (+ 11.5%) (Fig. 2, 3).

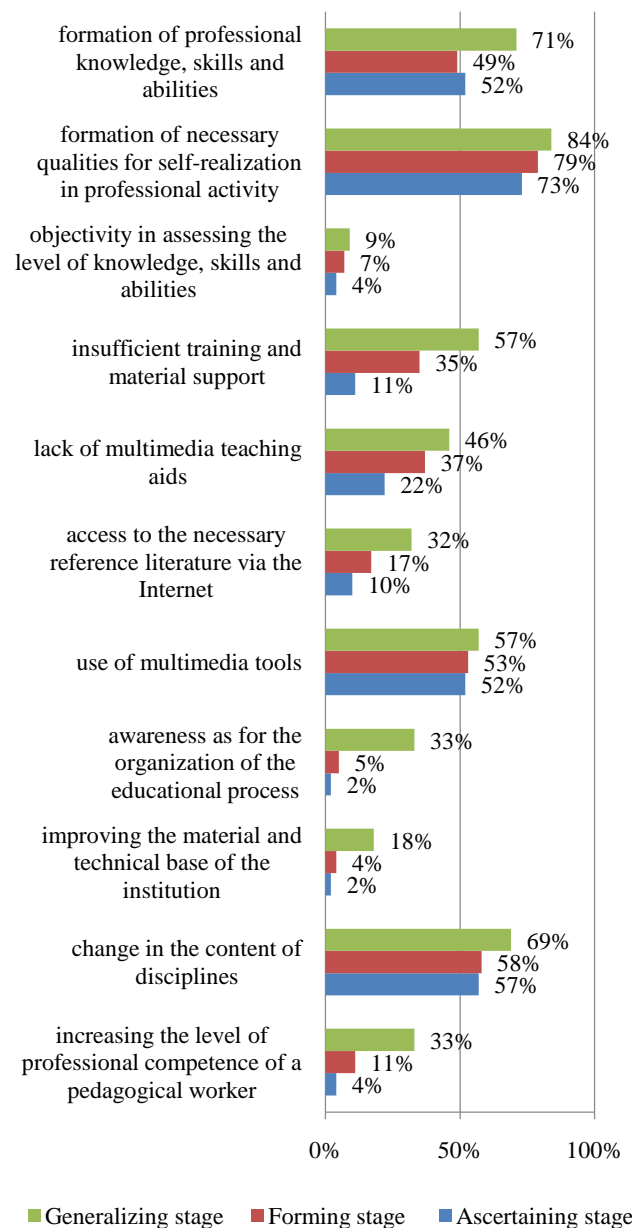


**Fig. 2.** Relationship between the levels of knowledge acquisition and the formation of skills in the subjects of professional-theoretical and professional-practical cycles (control group).

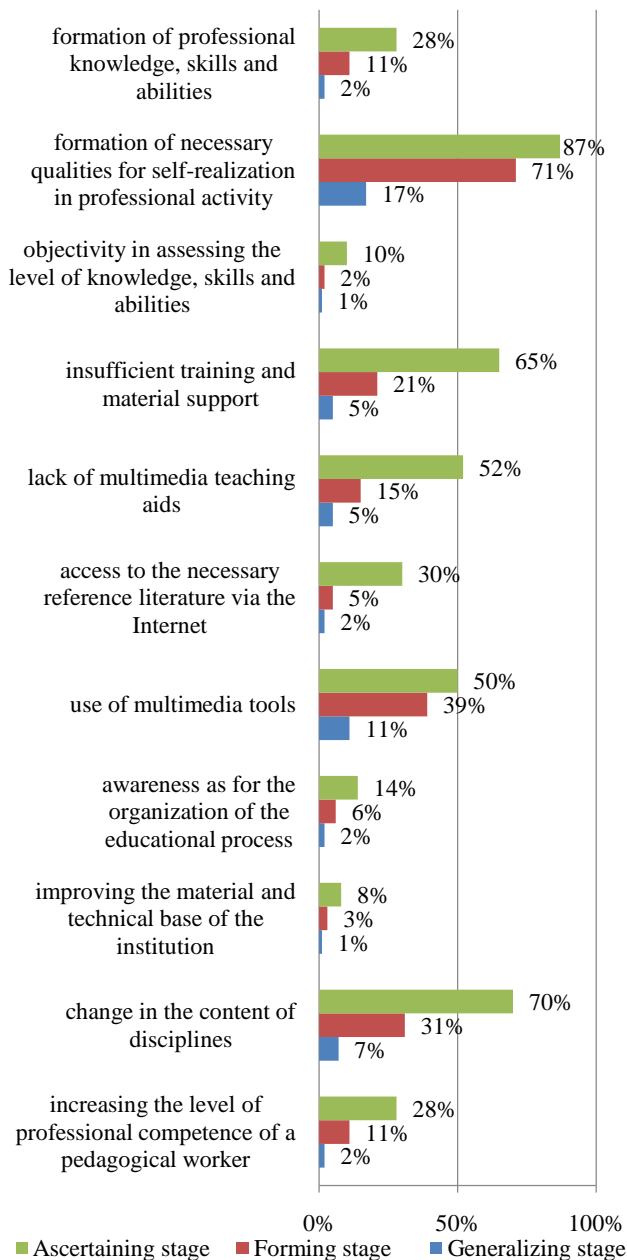


**Fig. 3.** Relationship between the levels of knowledge acquisition and the formation of skills in the subjects of professional-theoretical and professional-practical cycles (experimental group)

The dynamics of the level of knowledge acquisition and the formation of skills in the subjects of professional-theoretical and professional-practical cycles before and after the experiment indicates positive changes, which confirms the results of a survey of students of the experimental group on the state of professional training. (+47%), updating the content of disciplines (+63%). Respondents also noted an increase in attention during the preparation for the formation of qualities necessary for self-realization in professional activities (+70%). At the same time, among the representatives of the control group there is a tendency to use multimedia tools (52%), change the content of disciplines (57%), the formation of qualities necessary for self-realization in professional activities (73%), which confirms the need for technology (Fig. 4, 5).

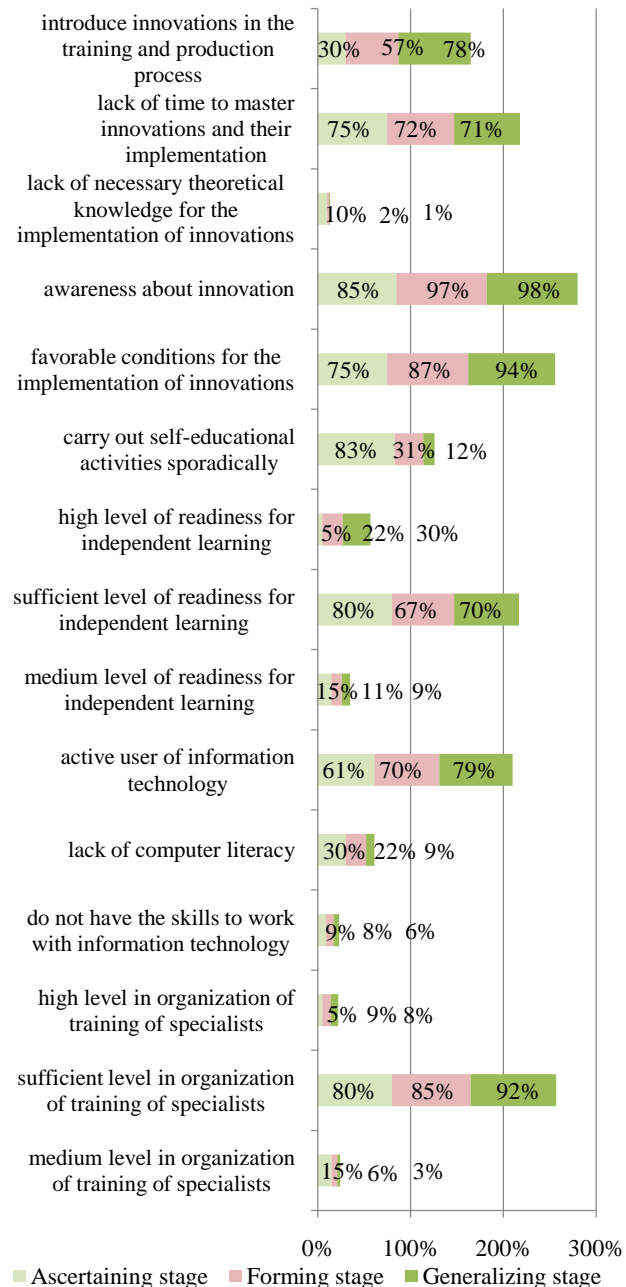


**Fig. 4.** Results of the survey of students on the state of professional training (control group)



**Fig. 5.** Results of the survey of students on the state of professional training (experimental group)

The survey of teachers on the level of professional competence, self-education and training of future professionals revealed: an increase in the number of teachers implementing innovations in the training and production process + 48%, 19% increased the level of assessment of conditions for innovation, 9% increased the number of users of information technology, the level of readiness of teachers for independent learning has increased by 18%. The percentage of teachers informed about innovations also increased (+ 13%). At the same time, the percentage of pedagogical workers who occasionally carry out self-educational activities decreased by 71% (Fig. 6).



**Fig. 6.** Survey of teachers on the level of professional competence, self-education and level of training of future professionals

The study of the state of formation of personal qualities of students shows an increase in performance after the experiment in both control and experimental groups. Thus, teachers provided the following assessment of the formation of personal qualities of students according to the criteria: sociability - high level is 5% CG; 11% EG (+3%; +8%), sufficient - 8% CG; 28% EG (-1; + 21%), medium-31% CG; 37% EG (+6%; - 3%), low - 50% CG; 27% EG (-8%; - 26%); discipline - high level is 10% CG; 19% EG (0%; +8%), sufficient - 7% CG; 23% EG (+2%; +17%), medium (38% CG; 34% EG (+1%; -1%), low - 45% CG;

52% EG (-3%; -27%); intellectual development - high level is 3% CG; 19% EG (+1%; +17%), sufficient - 16% CG; 27% EG (-3%; +17%), medium - 37% CG; 36% EG (-1%; +1%) , low - 46% CG; 43% EG (-1%; -10%); initiative - high level is 6% CG, 21% EG (+1%; +18%), sufficient - 12% CG; 29% EG (+1%; +20%), medium -53% CG; 30% EG (+1%; -22%), low - 28% CG; 20% EG (-3%; -16%) ; ability to learn - high level is 15% CG, 29% EG (+2%; +19%), sufficient - 9% CG; 24% EG (+2%; +19%), medium - 23% CG; 25 % EG (0%; +1%), low -53% CG; 60% EG (-4%; - 39%); creative potential high level is 9% CG, 21% EG (+1%; +15%), sufficient - 13% CG; 23% EG (+1%; +12%), average - 36% CG; 31% EG (-2%; 0%), low -42% CG; 25% EG (-4%; - 27%); leadership qualities - high level is 12% CG, 23% EG (+1%; + 15%), sufficient -13% CG; 27% EG (+4%; +19%), medium - 43% CG; 47% EG (+1%; -16%), low - 31% CG; 19% EG (+6%; -20%) (Fig. 7, 8, 9).

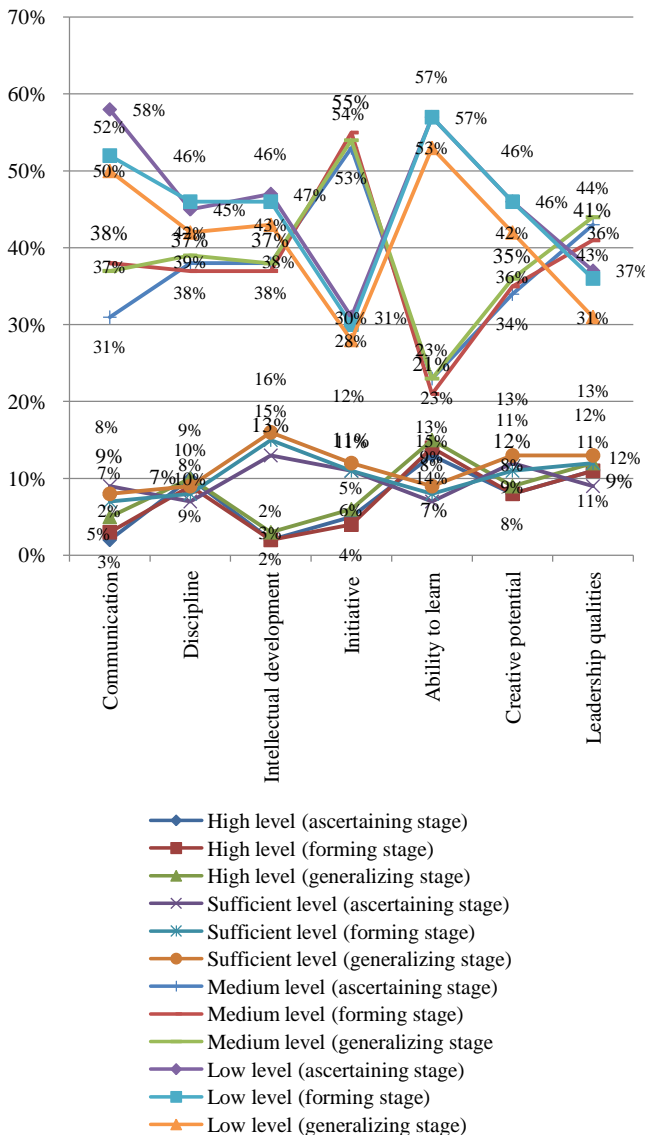


Fig. 7. Intermediate results of determining the level of formation of personal qualities of students (control group)

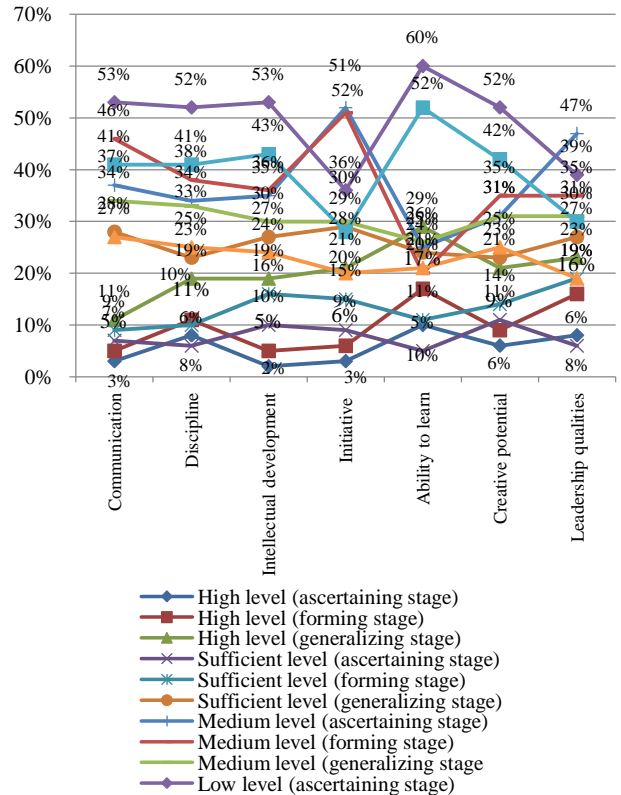


Fig. 8. Intermediate results of determining the level of formation of personal qualities of students (control group)

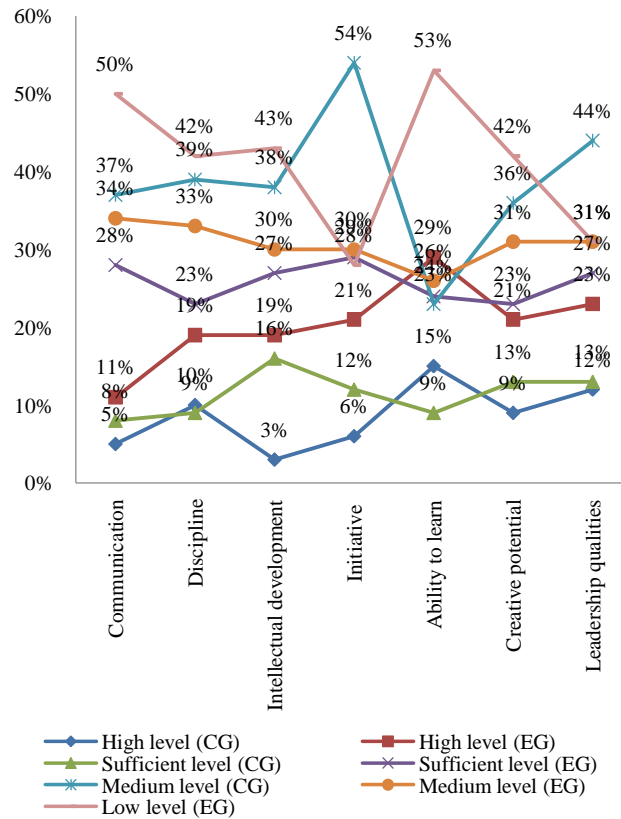


Fig. 9. Comparative analysis of intermediate results of the level of formation of personal qualities of students of education of control and experimental groups

There is a positive dynamics of change in the quality levels of professional training of future specialists according to the results of the survey of employers, which has the following form: high level - 12% CG; 33% EG (+2%; +4%), sufficient level - 34% CG; 37% EG (-1%; +7%), medium level - 39% CG; 40% EG (-1%; +3%), low level - 15% CG; 5% EG (0%; -3%) (Fig.10)

#### 4 Conclusions and prospects for further research

During the implementation of the model of quality management of training of future competitive specialists in IP(VT)E and testing its effectiveness, we came to the conclusion that professional training of future specialists becomes effective in implementing of scientifically grounded pedagogical conditions.

The study of the current state and prospects of development, analysis of problems of training future specialists in IP(VT)E, ways to solve them, as well as the results obtained during the study allow to substantiate recommendations for improving the training process, the introduction of which will promote competitiveness:

- creation of a regulatory framework at the level of public authorities and administration that meets the requirements of today, in particular regulation: the processes of vocational guidance with the synchronization of the interests of IP(VT)E, general education institutions and employers; mechanisms of motivational stimulation of pedagogical workers for high quality indicators of training of future specialists, professional development and introduction of innovative methods; cooperation of scientific institutions, employers and IP(VT)E on the development of educational and methodological support of the educational process; financial support for the development of infrastructural and technical components of the educational process;

- strengthening the role of employers: in the development of educational and methodological support for the training of future professionals (work on the development of textbooks, manuals, teaching materials); organization of training of future specialists in the dual form of education (with the attachment of mentors, the allocation of jobs, the organization of training and production work in accordance with the curricula and programs); assistance in raising professional competencies by pedagogical workers and students on the basis of industrial enterprises; conducting training sessions on subjects of professional and theoretical training by specialists with experience in production; organization and conduct of career guidance activities and selection of applicants for training; development of motivation for future professional activity through the implementation of nominal scholarship payments;

- in IP(VT)E: formation of the content of professional training in accordance with the requirements of the labor market; improvement of vocational guidance work through the organization of professional career centers on the basis

of general education institutions, the creation of a diagnostic complex of professional interests, intentions, orientation, aptitudes and abilities of the individual, the introduction of courses to master professional competencies; involvement of specialists from the enterprise in the development of educational and methodological support of professional training; development and implementation of digital educational resources as an effective tool for expanding the information space of students; implementation of the principles of continuity and accessibility of education through the introduction of distance, individual education and the introduction of elements of dual form of education; promoting the dissemination of innovative experience in organizing the training of future professionals through trainings, seminars, webinar conferences.

The experimental search does not cover all aspects of the problem of forming the competitiveness of future professionals. Further research is needed by: problems of professional and pedagogical education of pedagogical workers of IP(VT)E, study of optimal conditions for stimulating self-development and self-improvement of teachers; continuity of vocational training of the adult population.

#### 5 Acknowledgment

This study was conducted within the dissertation work, which is performed in order to determine the effectiveness of the developed model of quality management training of competitive specialists in IP(VT)E.

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