Formation of professional competencies of future builders in technical school

O I Vaganova 1, Zh V Smirnova 1, O P Kozlova 2, N A Vishnevetskaya 3 and A V Prostov 4

1 Minin Nizhny Novgorod State Pedagogical University, 603004, Chelyuskin str., 9, Nizhny Novgorod, Russia, z.v.smirnova@mininuniver.ru

2 Volgograd State Technical University Institute of Architecture and Building Construction, 400005, Chair of Linguistics and Intercultural communication, Lenina prosp, 28, Volgograd, Russia, kornienko_o@list.ru

3 Volgograd State Technical University Institute of Architecture and Building Construction, 400005, Chair of Linguistics and Intercultural communication, Lenina prosp, 28, Volgograd, Russia, nattimsweet@mail.ru

4 Volgograd State University, 400062, Universitetsky prosp, 100, Volgograd, Russia, sacha_prost@volsu.ru

E-mail: z.v.smirnova@mininuniver.ru, kornienko_o@list.ru, nattimsweet@mail.ru, sacha_prost@volsu.ru

Abstract. The conditions of the modern labor market in the construction sector, the new technology in the construction industry, changes due to scientific and technological progress and the implementation of modern information technologies require special training of mid-career professionals. The society needs graduates who are ready to independent inclusion in production processes, who are able to solve life and professional tasks that they come across. It is necessary to update the content-technological support for the formation of professional competencies of future builders to a higher level because of the transition to competence-oriented training in the system of secondary vocational school. The authors have developed a model of professional competencies development to improve the training of builders within the framework of secondary vocational schools. The model can be realised in any construction college taking into account current requirements of Russian employers and the All-Russian Intersectoral Association of Employers “Russian Union of Builders” to the level of professional knowledge of a modern graduate of secondary vocational schools and training features of modern builders.

1. Introduction

Nowadays there are a lot of global changes in modern education which are connected with the adoption of new Federal state educational standards [1].

These transformations are the answer to the technical updating, computerization and expansion of communication channels and flows, changing needs of the country and society [2].
It is obvious that some specialties are not much in demand among young people that's why it is necessary to update them, to create new specialties which will allow developing professional competence on higher level [3]. The training of a competent general professional is becoming an increasingly complex multi-stage task [4,5,6]. O.V. Akulova, V.A. Bodrov, N.F. Rodionova, N.N. Surtaeva, A.P. Tryapitsina, N.V. Chekalev have contributed to the development of the issue of training students under the competence approach [7].

The competence-based approach focuses on such educational goals such as:
- the quality of education;
- learnability [8,9];
- self-determination [10];
- self-actualization;
- socialization [11];
- the development of the individuality of the student [12].

Today, due to the changes in society we have indicated the needs of society and country. Thus, it has become necessary to improve the quality of professional training for mid-career professionals [13,14]. A modern graduate of technical school should solve any professional tasks, apply knowledge and skills in practice, be ready for continuous self-improvement and professional growth [15].

Mid-career professionals have to have special training to work with modern information technologies in the construction sector. Besides, if the developer wants to be competitive it is necessary to update the ways of building.

2. Methodology
Training of future builders in institutions of secondary vocational education is carried out within the framework of the competence approach. In the new conditions, the process of forming competencies should take into account the requirements of modern employers. Therefore, the authors have developed a model consisting of several blocks, the purpose of which is the formation of professional competencies in technical school of future builders. This model can be applied in any of the construction technical schools since it meets the modern requirements of employers and takes into account the specifics of the training of builders. The model contains: targeted, informative, technological and efficient blocks.

3. Results and discussion
Formation of professional competencies in students of secondary vocational schools is a process that involves the creation of forms and conditions for the student to achieve a certain result, that is, the generated competencies necessary for the implementation of future professional activities in accordance with the requests of employers and opportunities for further education. The requirements of the Russian Union of Builders are reflected in Table 1.

Table 1. Requirements of Russian employers and the All-Russian Intersectoral Association of Employers “Russian Union of Builders” to the level of professional knowledge of a modern graduate.

| №  | Content requirements                                                                 |
|----|--------------------------------------------------------------------------------------|
| 1. | Know the theoretical foundations of special disciplines.                              |
| 2. | To be able to transform acquired knowledge into innovative technologies.               |
| 3. | Be able to independently find, perceive and analyze new information, taking into account existing legislative and social legal regulations. |
| 4. | To be able to work with global information sources based on computer and information and communication tools. |
5. To be able to make decisions in uncertain, suddenly complicated professional conditions.

6. To own computer-aided design systems.

7. Master the methods of system analysis.

8. Master the methods of conducting scientific research.

9. Own software systems design technical solutions.

10. To possess adequate methods of professional communication and behavior, ability to cooperate and work in a group for a common result.

11. Have the ability to be creative and innovate when dealing with professional tasks.

12. Understand the trends and main directions of development of science and technology.

13. Identify information needs, use and give them a professional assessment for solving specific problems.

Requirements analysis showed that employers consider the ability of a graduate to solve non-standard professional tasks, apply computer tools, information and communication technologies possess such personal qualities as initiative, communication, reflexivity, creativity [16,17]. Preparation of students of a technical college should meet modern requirements associated with changes in modern construction [18]. If in the 1950s - 1980s, Soviet typical panel or brick residential buildings were built mainly five-story with small apartments, today the construction of high-rise buildings, townhouses and duplexes, cottages and private households is developing [19]. Therefore, future professionals require the acquisition of relevant competencies. Based on the technical specification, architects and designers create drawings in the corresponding computer programs [20,21,22]. Their list is quite large and Archi-CAD remains the most famous [23]. Virtual drawings have a major advantage. Any change is made on a computer and does not require processing dozens of paper schemes [24]. That is, the software allows you to freely change the parameters and create copies of buildings with different layouts. After checking the drawings for compliance with state standards and the wishes of the customer, a three-dimensional model is created [25]. For this, computer programs are also used [26].

Generally recognized among professionals is 3dsMax. It allows you to create a three-dimensional layout based on computer drawings and provides the client with the opportunity to see what the future house will look like. After the approval of the layout, the designers create a paper version of the project in order to transfer it for inspection to the city architecture, contractors, foremen and builders. This system is actively developed and proves its effectiveness. Modern design is impossible without the full use of computer technology and the latest programs. Today, students of a construction technical school should master the necessary computer programs corresponding to the modern level of construction technology.

The specificity of the competence-based approach of modern vocational education consists in training specialists at a functional level, which implies not only arming students with a certain set of knowledge and skills in the chosen field, but also the formation of the personality of a future professional who is capable of individual creative solutions and learning. The formation of professional competencies of future builders in secondary vocational education [27,28,29] is aimed at this. The composition of professional competencies is structured in such a way that the qualifications of a graduate of technical school meet the requirements of employers and the regional labor market and allow, after a short adaptation period, to fully engage in the work of an enterprise at an appropriate level.

For the successful formation of professional competencies of future builders, we developed a model that can be applied in any construction technical school, since it takes into account all the features of the training of builders, as well as meets the modern requirements of employers specified by us earlier.
The target component of the model includes goal, methodological approaches (cognitive; activity; competence; personality-oriented), principles (science, continuity, subjectivity, variability, systematic, interactivity). The content block reflects the content of educational disciplines that implement the development of several activities: survey, design and engineering, production and technology, experimental research, installation and commissioning, and service and operational. In the technical unit, the following methods are used: methods (knowledge transfer, design, implementation of social partnership technologies, master classes, workshops); forms (lectures, seminars, individual lessons, internships at enterprises, project implementation); means (electronic textbooks, interactive boards, theodolites, levels, range finders, electronic total stations). The effective block reflects pedagogical conditions (gradual and sequential complication of the process of formation of competencies, strengthening practice-oriented orientation, the use of modern educational technologies). Also, the effective block contains the criteria for competencies development (motivational, epistemological, motivational, organizational, corrective-reflexive).

4. Conclusion
The competence-based approach in education allows you to prepare creative-minded professionals who are able to approach outside the standard to solve new and well-known problems that can take responsibility for the decision. The developed model can improve the conditions for the formation of professional competencies and increase their level of improvement among future builders studying in secondary vocational schools taking into account the basic requirements of modern employers.

References
[1] Vaganova O I, Smirnova Zh V, and Abramova N S 2019 Baltic Humanitarian Journal 8 (1 (26)) 277-280.
[2] Ajeenky D, Patil Y, Dr. Gagandep Deep Nagra and Dr. Gopal R A 2014 International Journal of Management 5(5) 1-6.
[3] Arkhipova M V, Belova E E, Gavrikova Y A, Lyulyaeva N A, and Shapiro E D 2018 Advances in Intelligent Systems and Computing 622 380-386. DOI: 10.1007/978-3-319-75383-6_49.
[4] Ibatova Aygul Zufarovna, and Ippolitova Natalia Viktorovna 2018 International Journal of Civil Engineering and Technology 9(3) 394–399.
[5] Barber M, Donnelly K, Rizvi S, & Summers L 2013 An avalanche is coming. Higher Education and the revolution ahead 73. URL: http://www.studyNet2.herts.ac.uk/intranet/lti.nsf/0/684431DD8106AF1680257B560052BCC C/SFILE/avalanche-is-coming_Mar2013_10432.pdf
[6] Abramova N S, Vaganova O I, and Smirnova Zh V 2019 The azimuth of scientific research: pedagogy and psychology 8 (1 (26)) 13-15
[7] Braine G 2013 Non-native educators in English language teaching. Routledge. URL: https://www.taylorfrancis.com/books/9781135461867
[8] Ergunova O T , Lizunkov V G, Malushko E Yu, Marchuk V I, Ignatenko A Yu 2017 OP Conference Series: Materials Science and Engineering 177(1) 012046. DOI: 10.1088/1757-899X/177/1/012046
[9] Smirnova Z V., Abramova N S, Vaganova O, Loshkareva D A, Konyaeva E A, and Gladkova M N 2019 IOP Conference Series: Materials Science and Engineering 483 (1) 012003
[10] Vaganova O I, and Ilyashenko L K 2018 Vestnik of Minin University 6 (3) 2. DOI: 10.26795/2307-1281-2018-6-3-2.
[11] Gruzdeva M L, Smirnova Z V, Chaikina Z V, Golubeva O V, and Cherney O T 2019 Lecture Notes in Networks and Systems 57 1193-1199.
[12] Prokhorov M P, and Vaganova O I. 2019 Bulletin of the Minin University 7 (1 (26)) 4.
[13] Ilyashenko L K, Smirnova Z V, Vaganova O I, Prokhorova M P, and Abramova N S 2018 International Journal of Mechanical Engineering and Technology (IJMET) 9 (4) 1097-1105.
[14] Malushko E, Bolsunovskaya L, and Martyushev N 2019 Asian EFL Journal 23 (3.2) 315-328.
[15] Ilyashenko L K, Vaganova O I, Smirnova Z V, Sedykh E P, and Shagalova O G 2018 *International Journal of Mechanical Engineering and Technology* **9** (4) 1029-1035.

[16] Ilyashenko L K, Smirnova Z V, Vaganova O I, Chelnokova E A, and Kaznacheeva S N 2019 *International Journal of Mechanical Engineering and Technology* **10** (2) 908-917.

[17] Ilyashenko Lubov Kryialovna 2018 *International Journal of Civil Engineering and Technology* **9**(3) 607-616.

[18] Manikandan, and M. Muthumeenakshi 2018 *International Journal of Mechanical Engineering and Technology* **9**(3) 706-710.

[19] Markova S M, Sedykh E P, Tsyplakova S A, and Polunin V Y 2018 *Advances in Intelligent Systems and Computing* **622** 129-135. DOI: https://doi.org/10.1007/978-3-319-75383-6_17.

[20] Kamenez N V, Vaganova O I, Smirnova Z V, Bulayeva M N, Kuznetsova E A, & Maseleno A 2018 *International Journal of Engineering and Technology (UAE)* **7**(4) 4085-4089.

[21] Frolova O A, Chanchina A V, Frolova N V, Shevchenko S M, Chelnokova E A, & Bystrova N V 2017 *European Research Studies Journal* **20** 549-556.

[22] Fedorov A, Zakablukovskiy E, & Galushkina A 2018 *E3S Web of Conferences* **48** Doi: 10.1051/e3sconf/20184802007

[23] Smirnova Zh V, and Krasikova O G 2018 *Vestnik of Minin University* **6** (3) 9. DOI: 10.26795/2307-1281-2018-6-3-9.

[24] Fedorov A A, Ilaltdinova E Y, & Frolova S V 2018 *Vysshee Obrazovanie v Rossii* **27**(7) 28-38. Doi: 10.31992/0869-3617-2018-7-7-28-38

[25] Smirnova Zhanna V, Mukhina M V, Kutepova L I, Kutepov M M, and Vaganova O I 2018 *Advances in Intelligent Systems and Computing* **622** 187-193.

[26] Fedorov A A, Ilaltdinova E Y, & Frolova S V 2019 *Perspektivy Nauki i Obrazovania* **37**(1) 262-274. DOI: 10.32744/pse.2019.1.19

[27] Kamenez Natalie V, Smirnova Zhanna V, Vaganova Olga I, Bystrova Natalia V, and Tsarapkina Julia M 2019 *International Journal of Mechanical Engineering and Technology* **10**(02) 899–907

[28] Ilyashenko Lubov K, Smirnova Zhanna V, Vaganova Olga I, Chelnokova Elena A, and Kaznacheeva Svetlana N 2019 *International Journal of Mechanical Engineering and Technology* **10**(02) 908–917

[29] Vaganova O I, Smirnova Zh V, Markova S M, Chaikina Zh V, and Bulaeva M N 2019 *Perspectives of Science and Education* **39**(3) 500-514. DOI: 10.32744/pse.2019.3.38