

Formation of Professional Competence of University Students Based on a Systematic Approach

<https://doi.org/10.3991/ijet.v16i10.19347>

Gulnur Issakova (✉), Gulnar Kaltayeva
S. Seifullin Kazakh Agro Technical University, Nur-Sultan, Kazakhstan
is_gul_oral@mail.ru

Gulshat Bakhtiyarova
K. Zhubanov Aktobe Regional State University, Aktobe, Kazakhstan

Kulyan Ibrayeva, Sayagul Kudaibergenova
S. Seifullin Kazakh Agro Technical University, Nur-Sultan, Kazakhstan

Abstract—The purpose of this article is to demonstrate the feasibility and effectiveness of a systematic approach to the formation of professional competence of students in higher educational institutions. The study has been conducted at the S. Seifullin Kazakh Agro Technical University with the participation of 126 master students (2 groups) of the specialty “Vocational Education”. Using a complex of theoretical, empirical and statistical methods, it was possible to show the ways to increase the effectiveness of the educational process. The basic principles for the training of students were formulated as: 1) systematic approach to the formation of professional competence together with organization and implementation of the educational process; 2) program-targeted formation of the indicative basis of the upcoming professional activity, and 3) creating a competency model of the corresponding specialist as a hierarchy of the student’s professional competency system, its subsystems, and supersystems. It is recommended that Kazakhstan universities should improve tools and procedures for assessing and monitoring students’ level of knowledge, as well as create new programs for developing students’ professional competencies to ensure their successful employment. The further research on the matter may be the systematic comparative study of contemporary teaching methods and techniques to determine the most productive ways to prepare future professionals.

Keywords—Learning efficiency, professional competence, specialist readiness, systematic approach, teaching techniques, vocational education

1 Introduction

Higher education has undergone significant changes recently. Globalization and technological changes are forcing educational institutions to engage in innovation and comprehensive quality improvement [1], including the personalization of content and services to adapt the education for the students with different needs, abilities and

requirements [2]. The global economy becomes exceedingly demanding of the human capital, requiring the workers to have high emotional intellect, constantly develop their knowledge and professional skills, as well as demonstrate flexibility and a multidisciplinary approach to problem-solving [3].

Requirements for the quality of education, which grew up in the context of its restructuring and integration into the world community, significantly change the level of social expectations in relation to the effectiveness of the whole complex of higher education. The transition to competency-based education is a natural step in modernizing the system of higher professional education, which allows us to resolve the contradictions between the requirements of the state and the employer for its quality, developing labor markets and actual results [4]. Currently, specialist training is determined by two factors: 1) the general philosophical level, depending on the historical era, its environment and civic education, and 2) the level of professional education of the graduate, due to the quality of training appropriate to one's time, and the realization of the possibility of continuous training [5]. Professional competence is the acquired quality of a person, which is determined by the student's level of professional knowledge and skills, which further provides the graduate of a higher educational institution with demand in the labor market, social adaptation in society, self-realization and self-sufficiency [6]. It should be noted that to achieve the professional competence of students the knowledge and skills acquired in the university per se are not enough. It is necessary to learn how to apply them easily in professional activities and build necessary inner confidence in the quality of one's knowledge and skills [7].

Ye. V. Borisova [8] denotes two steps to the formation of effective professional competence of students: 1) expanding the interdisciplinary component in the structure of curricula, i.e., to include educational material from other areas of scientific knowledge and practice more widely, indicating the possibilities of use, and 2) creating the concept of introducing professional competency-based elements in all educational areas of the curriculum. Thus, the author presented requirements for the curriculum, focused on student competency, and not on the reproduction of the material. In the process of obtaining knowledge and skills under such a program, educational activity acquires research or practical search character.

The student's professional competence is defined as a dynamic system and as a set of competencies, socially and professionally significant personality traits, as well as certain systemic representations that ensure the student's readiness with a conscious responsibility to carry out professional activities subject to its continuous improvement and development [9]. Consideration of professional competence and its constituent components (competencies, personal and professionally significant qualities, and systemic representations of the student) as systems allows us to build an appropriate model and logical scheme for their implementation (Figure 1).

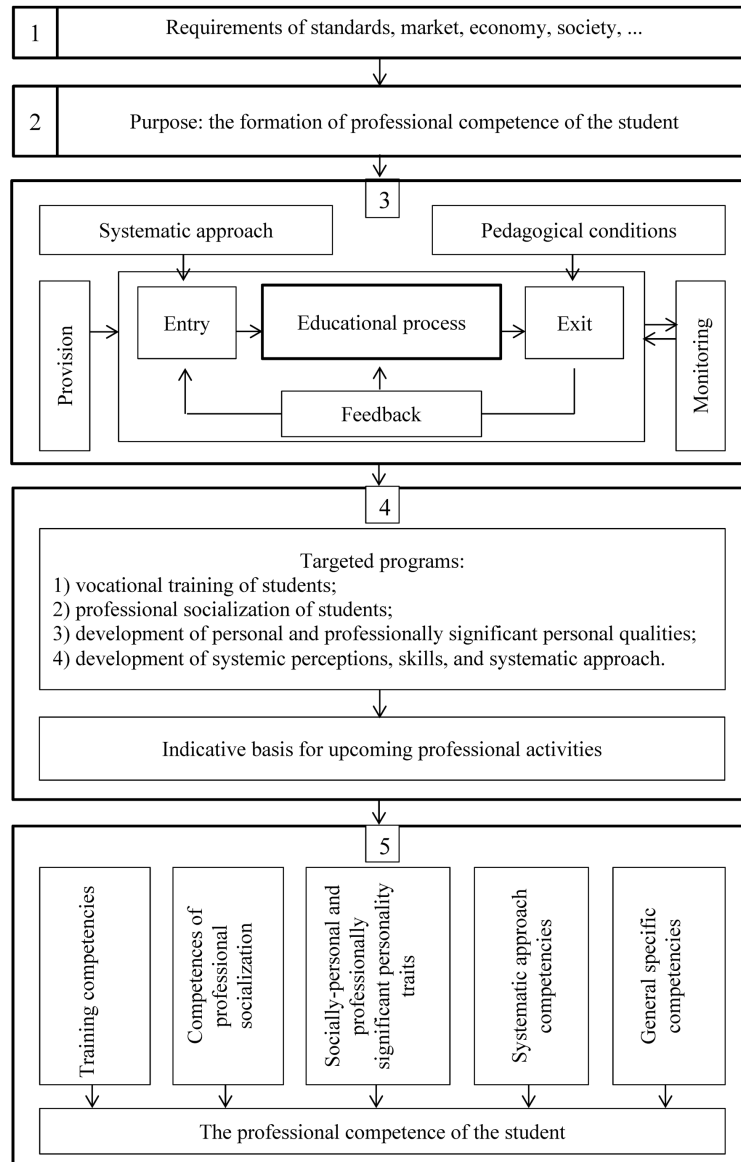


Fig. 1. Model of a student’s professional competency formation system

Based on Figure 1, the professional competence of university students is formed in five stages:

1. Planning the acquired competencies according to the requirements of standards, legislation, society, economy, market, etc.
2. Stating the purpose of education as a system-forming factor.
3. The implementation of the educational process based on a systematic approach in appropriate pedagogical conditions, with the necessary support and with the mandatory monitoring. At this stage, the educational process is an independent system, which serves as the basis and means of the formation of skills. “Entry” to this system implies all that is necessary for the educational process: the teacher’s competence, the availability of properly equipped premises, technical facilities, a curriculum, teaching materials, etc. “Exit” reflects the results of educational, research, practical and other activities of students, so as the outcomes of the educational process and their assessment. “Feedback” is a mechanism for the active interaction of participants in the educational process.
4. In the process of implementing target programs, as well as relevant technologies and methods of training, education and development, the necessary competencies, professional competence, personal and professionally significant qualities, competencies of a systematic approach and systemic representations of students are formed, the whole set of which is the so-called indicative basis of the upcoming professional activities of students.
5. The set of competencies, as well as personal and professionally significant qualities and systemic representations of the student, form the basis of the professional competence of a university graduate.

In this case, there is a hierarchy of a holistic system of vocational education. A supersystem of a higher order in this hierarchy is the sphere of the professional activity of a graduate of a higher educational institution.

When developing the educational process, it is very important to choose the necessary techniques and training methods. To improve the quality of higher education, the most productive seems to be a systematic approach characterized by the following features:

- Dominated by a ternary or conjunctive logic.
- Focused on the goal to be achieved (purpose).
- Relational and global.
- Oriented by the present and future (prospective).
- Open to the diversity of realities and the plurality of solutions.
- Embracing the emergence of novelty and invention [10].

The systematic approach changes the methods of producing theoretical knowledge, the scheme of cognitive movement in an object, re-discovering the subject of research and the way it is described; changes the structure of knowledge about the subject, the conceptual structure of science and the style of scientific thinking. This is a methodological direction in science, the main task of which is to develop methods for the study and construction of complexly organized objects – systems of different types and classes.

Among the important tasks of the systematic approach are: 1) the development of means of representing the studied and constructed objects as systems; 2) the construction of generalized models of the system, models of different classes and specific properties of systems; 3) study of the structure of theories of systems and various system concepts and developments.

Learning based on a systematic approach implies the organization of the educational process in such a way as to comprehensively develop students' general and special (professional) abilities. The university should provide the graduate with knowledge and skills that guaranteed to help him in solving the basic functional tasks of professional activity in the future. Having analysed the relevant scientific literature, we can identify six components of a system of professional competence as:

1. Competence in personal qualities.
2. Competence in goal setting.
3. Competence in motivating others and self-motivation.
4. Competence in developing a program of activities and making managerial decisions.
5. Competence in the field of informational basis of activity.
6. Competence in the organization of practical activities.

The value of the system approach is that it allows to study each element individually, compare them, determining the similarities and differences, the relationship between them, the dynamics of development of each one separately and the entire system. At the same time, the system-forming factor for constructing the model of this system is primarily the goals, which, in relation to each element, can be different. This allows to update and consider various aspects of the functioning and development of system components.

In the process of a systematic study of a specific professional situation, students are required to use not only the acquired knowledge and skills but also go beyond the framework of the relevant discipline (disciplines) with coverage of the external (relative to the situation being studied) environment. In such cases, it is advisable to use a systematic approach that promotes a holistic knowledge of the studied objects and the environment, actively develops systemic representations, as well as skills and systemic thinking of students [11].

European higher education is moving “from the concept of qualification to the concept of competence,” and the same trend can be observed worldwide [12], [13]. Competence becomes a more accurate concept [14], [15]. A set of acquired competencies is integrated into the concept of “professional competence,” which is a personal quality of a highly qualified graduate [16], [17]. Professional competence is often defined as the ability of an expert to solve a certain class of professional problems [18]. A competency-based approach has certain impacts on the system of knowledge assessment with a focus on students' employment prospects [15]. At the same time, the emphasis is now shifted from controlling how well particular subjects are mastered, to monitoring the development of competencies required for work [19], partly due to the fact that the level on which particular competencies are formed often depends on the student's personality [20].

In the face of technological progress, according to B.Z. Turayev and T.E. Delov [21], a modern specialist should have extensive knowledge in the field of computer science, know the basics and prospects of new information and communication technologies, have practical skills in using modern technical means of information and communication systems, be able to evaluate information resources for making professional decisions. This is also the opinion of M.V. Sleptsova [22], who studies the formation of students' social competence in a virtual educational environment, and O.I. Vaganova [23], who studies the formation of competence in the mastery of modern educational technologies at the university. A.R. Masalimova and V.G. Ivanov [24] study the conditions for the preparation of competitive specialists with well-formed professional competencies in the framework of the interaction “production” – “educational institution”. They emphasize that the problem of the organic combination of the needs and production of society with the level of development of a vocational school is very important.

Thus, the actual problem of the higher education system is to determine effective methods for acquiring professional knowledge and skills of university students, which is due to the need to train competitive specialists that meet the requirements of the modern labour market.

2 Materials and Methods

The study used a set of theoretical and empirical methods. To achieve the goal of the article there were used such theoretical methods as studying new subject literature, analysing and synthesizing the data obtained from it, modelling and designing. Observation, conversations with students, analysis of the results of their activities, questionnaires, interview – these are empirical methods that have made it possible to identify the main trends in the process of forming professional competence of students in higher educational institutions based on a systematic approach. Also, when processing experimental research data, methods of mathematical statistics were used.

The research took place in three stages:

1. Analysis of the current state of the problem in the framework of pedagogical theory and practice.
2. Definition of the basic methods and techniques for achieving the effectiveness of a systematic approach to the organization of the learning process. Processing and interpretation of the data.
3. Systematization of research results and formulation of conclusions.

The study was conducted with the participation of 126 master students of the specialty “Vocational Education” in S. Seifullin Kazakh Agro Technical University during the 2018–2019 academic year. Students were divided into two groups: experimental (64 people) and control (62 people). During the year, undergraduates from the experimental group were included in the learning process aimed at formation of professional competence based on a systematic approach. The control group was trained according to the educational program 6M012000 “Vocational Education”.

The implementation of the student's professional competency formation system was carried out through targeted programs such as: 1) vocational training; 2) professional socialization; 3) the development of personal and professionally significant qualities; 4) the development of systemic representations; 5) the formation of competencies in a systematic approach. Thanks to the last two programs, opportunities were created for students to develop systemic ideas, skills, and systems thinking and a systematic approach in ongoing and upcoming professional activities. The presence of certain systemic ideas and systemic thinking among students is an important invariant and a key reserve of the professional competence of a future specialist.

In the educational process, along with the traditional ones, the methods of active learning and the methods of the system approach developed by us were also used, in particular, the method of systemic structuring, study and minimized presentation of information about the subject in question and the method of a systematic study of specific situations (problems). The essence of the methods of systemic structuring, study and minimized presentation of information about the object in question, as well as the method of a systematic study of a specific situation (problem) is as follows:

1. With a comprehensive study of the object (problem) are carried out: analysis; modelling; identification and accounting of the initial and changed conditions for the functioning and development of the object; identification and accounting of influencing factors; identification and accounting of the consequences of exposure to conditions and factors; the study of various issues related to the object, methods of its study and ongoing activities; monitoring the process and results of the study; identification, study and resolution of problems; prediction of the state of the object; synthesis; generalization, etc.
2. The object is studied twice: first in the initial conditions (in a static state), and then in modified conditions (in a dynamic state).
3. These methods are used not only in relation to the studied objects (including various disciplines) but also for the study of professional competence. In such cases, they allow to identify the effectiveness of the formation of professional competence in the development of the studied disciplines.
4. These methods contribute to the assimilation of the proposed types of activities and actions, as well as their corresponding ways of thinking, which can constitute an indicative basis for the effective achievement of the goal (s) and solving the tasks of the upcoming professional activity. All this significantly increases the competitiveness of the future specialist.
5. The use of cognitive and other methods contributes to the development of systemic representations, abilities, and skills of systemic thinking and a systematic approach in the ongoing and upcoming professional activities.
6. These methods contribute to the development of synthetic thinking, as well as a holistic knowledge of the studied objects and the surrounding reality.
7. These methods develop the subject's ability to form informed proposals for making managerial decisions.

As current study has shown, the method of a systematic study of a specific problem situation significantly complements and develops the well-known case-method, al-

lowing to obtain much more interesting and significant results. The indicative basis of the professional activity of the future specialist as a system includes ideas about the relevant state policy and strategy of the state, about the relevant industry, state, and international programs, about the legal support for their implementation, actual problems and ways to solve them, about the “subject” area, including the future state of its objects, about the main provisions of theory and practice, about goals (including strategic), new principles, content, functions, plans, methods, tools, requirements, conditions, features, resources, etc., as well as the required competencies, skills, abilities and ways of thinking, assimilated by the subject, ensuring the willingness to carry out this activity effectively.

3 Results

At the end of the 2018–2019 academic year, students of both study groups were interviewed about their willingness to engage in professional activities in the future. Young people were asked only one question: “As far as do you feel ready to work in your specialty (in percentage terms)?”. Then, after the end of the academic year, teachers who worked with students from the experimental and control groups were interviewed. They were asked the question: “As far as are the students ready to work in their specialty (in percent)?”

The employers who recruited students from research groups for a job by profession were interviewed in November–December 2019. They were asked the question: “How much the education of students meets professional requirements (in percent)?”

Table 1. The level of readiness of graduates to work in the specialty (%)

Groups	Respondents					
	Students		Teachers		Employers	
	Min	Max	Min	Max	Min	Max
Experimental group	75	95	81	94	68	85
Control group	53	68	76	85	48	60

In the control group, the results of the study showed that teachers rated students’ professional competence much higher than the students themselves – the difference in the minimum value is 23%, and in the maximum – 17%. The difference between the results of the survey of teachers and employers was significantly larger: 28% (min) and 25% (max) in favour of the former. And the difference between the results of the survey of students and employers is very small: min – 5% and max – 8% in favour of the former. This shows that they almost equally determined the conformity of education and professional requirements.

In the experimental group, percentages are much higher than in the control group. The maximum value of students and teachers is more than 90%. Also in the experimental group, the level of professional competence was highly appreciated by the students themselves:

- Compared with teachers: min – by 6%, max – by 1%.
- Compared with employers: min – by 7%, max – by 10%.

As for teachers and employers, here the regularity has been preserved. The teachers rated the willingness to work by profession on students of the experimental group at 13% (min) and 9% (max).

If we compare the data obtained as a result of the study (Figure 2), we can specifically determine the effectiveness of the formation of professional competence of masters based on a systematic approach. The highest level of readiness and greater compliance with the requirements of the labour market of students in the EG were recognized by all groups of respondents. So, students determined the effectiveness of training at the level of 22% (min) and 27% (max), teachers – 5% (min) and 9% (max), employers – 20% (min) and 25% (max).

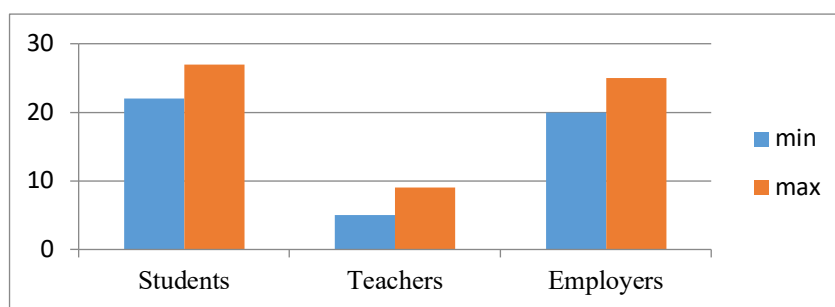


Fig. 2. Increasing the effectiveness of the formation of professional competence based on a systematic approach in the experimental group compared to the control group

Thus, the results of the study show that students of the experimental group feel more confident in their abilities and knowledge after graduation than graduates of the control group. They are ready to start work in their specialty, as they have all the necessary knowledge, skills and abilities for this. Based on the data collected, this is noted by their employers.

The next stage of the study was conducted 6 months after graduation. This period is not enough for any fundamental change to occur in the level of competencies developed while studying at university. However, it is sufficient time for finding a job. A survey of graduates from S. Seifullin Kazakh Agro Technical University assessed the success of their employment. This made it possible to estimate the impact of professional competencies and their components on employment. The respondents were 126 graduates and their employers. The survey was conducted remotely by sending a questionnaire by e-mail.

Graduates of the experimental and control groups were asked to agree or disagree with the statements in the questionnaire (Table 2), which were built in accordance with Maslow's hierarchy of needs [25].

Table 2. The list of statements to evaluate the employment success of university graduates, and their answers

№	Statement	Experimental group (N = 64)		Control group (N = 62)	
		Agree	Disagree	Agree	Disagree
1.	You work in your degree field	64	0	62	0
2.	Your salary is (or above) the industry average	38	26	30	32
3.	You are satisfied with your salary	49	15	24	38
4.	You are satisfied with your working conditions	43	21	22	40
5.	You feel as a part of the team	52	12	26	36
6.	You enjoy working with your colleagues	53	11	28	34
7.	You get support from your colleagues	59	5	29	33
8.	Your colleagues respect you	60	4	28	34
9.	Your management and team approve your work	60	4	20	42
10.	You enjoy your work	63	1	24	38
11.	You feel you have realized your potential at this stage of your competencies development	63	1	14	48

The questionnaire results (as a percentage) are shown in Figure 3.

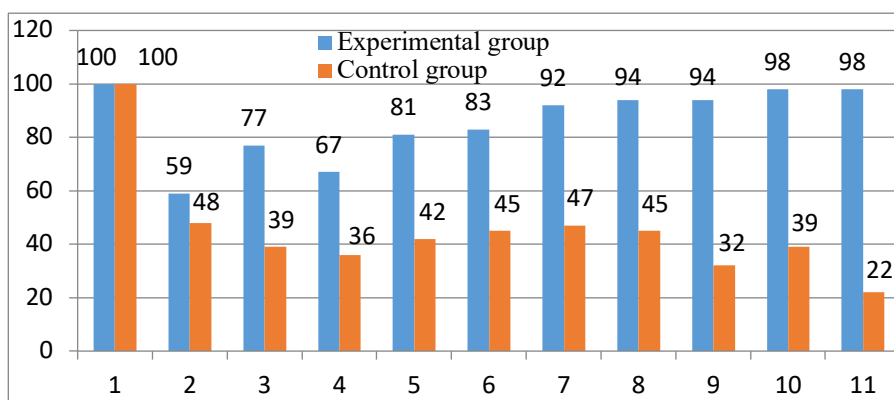


Fig. 3. Successful employment of graduates of the experimental and control groups

The data in this diagram indicate that the graduates of the experimental group rated the success of their employment higher than the respondents in the control group. The presence of work by received profession, competitive salary, and satisfied professional needs are indicators of a high level of competence of graduates.

At the same time, the assessment of the professional competence of graduates was given by their employers. The list of statements used to determine the level of professional competence (Table 3) was based on recommendations of the Council of Europe

[26] that identify main competencies and focus on the ability to adapt to the work environment. The evaluation procedure was the same as for graduates – questionnaire.

Table 3. The employer’s determining the professional competencies of university graduates

No	Statement	Experimental group (N = 64)		Control group (N = 62)	
		<i>Agree</i>	<i>Disagree</i>	<i>Agree</i>	<i>Disagree</i>
1.	Employee is prone to conflict	4	60	14	48
2.	Able to make decisions and take responsibility for them	55	9	38	24
3.	Enjoys working in a team	59	5	36	26
4.	Had warnings and penalties for misconduct	6	58	10	52
5.	Demonstrates racism or other forms of discrimination	0	64	0	62
6.	Afraid of change	4	60	15	47
7.	Tolerant of their colleagues	54	10	42	20
8.	Respects all members of the team regardless of their education, nationality, age, position	55	9	44	18
9.	Fluent in a foreign language	34	30	20	42
10.	Expresses their ideas clearly	51	13	42	20
11.	Can defend their point of view	48	16	36	26
12.	Is good at IT technologies	50	14	39	23
13.	Initiates positive changes in the company	35	29	30	32
14.	Able to structure and organize information	60	4	38	24
15.	Proficient in working with databases	41	23	25	37
16.	Able to use critical thinking	55	9	31	31
17.	Able to use system thinking	58	6	32	30
18.	Constantly seeks to improve themselves	58	6	41	21
19.	Strives for career growth	64	0	45	17
20.	Participates in professional development programs, trainings, workshops	58	6	15	47
21.	Proficient in subject matter	60	4	33	29
22.	Knowledgeable	59	5	41	21
23.	Has necessary practical skills	54	10	25	37

The results of a survey of employers (as a percentage) are shown in Figure 4.

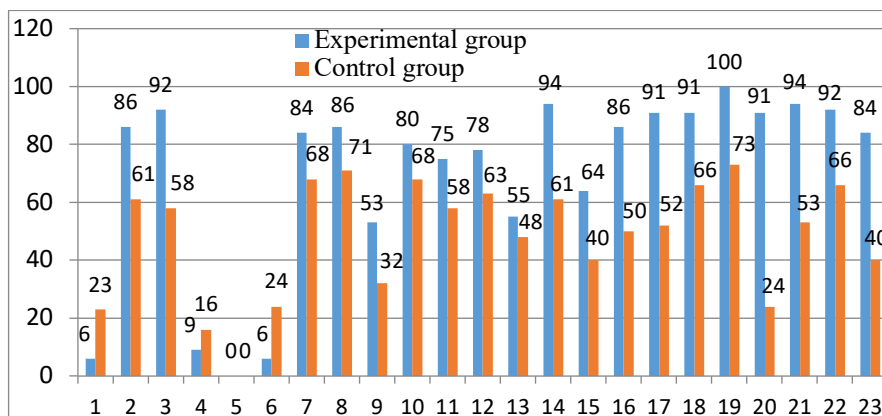


Fig. 4. Assessment of professional competence of the experimental and control groups

The data in this diagram indicate that the professional competence of all graduates participating in the study is high, but employers rated the knowledge, skills, and abilities of participants in the experimental group higher. All former students of the experimental research group are recognized as such that seek career growth. None of the 126 graduates participating in the study showed any racism, xenophobia, or other forms of discrimination in 6 months of work.

Thus, the results of the research show that there is a strong relationship between the level of students' professional competence and the success of their employment. Within this approach professional competencies are perceived not as a sum of subject knowledge and skills, but as an integrated value of acquired abilities based on the knowledge and skills acquired at university.

4 Discussion and Conclusion

The data from Table 1 indicate that classical education does not match the labour market. And the requirements for graduates are increasing every year. Professional qualities are the capital of the student, which is formed in the process of obtaining higher education. Therefore, the forms and methods of teaching are of great importance in the process of forming professional competence. The study showed that the minimum level of readiness of graduates to work in the specialty was determined by employers, evaluating students in the control group – 48%. The maximum level was determined by students of the experimental group – 95%. Thus, the jump in research indicators from the worst to the best is 47%. This suggests that the effectiveness of the formation of professional competence based on a systematic approach is quite large. General to this was the fact that in recent years at S. Seifullin Kazakh Agro Technical University have been created experimental facilities for practical training, increased the duration of internship from 3 to 7 or 8 months, initiated the reforms of the educational system that aimed at the integration of scientific, educational, and practical components. During the study, difficulties often arose with the

material providing university. In the conditions of modern rapid technological progress, most of the techniques require the availability of special equipment, special classrooms or situational centres. In the event of a lack of equipment, there were used available methods to maximize the involvement of students in the learning process.

The findings suggest that the employment prospects of university graduates will increase with a higher level of professional competencies. This can be achieved only by transforming the learning process and providing students with more opportunities to gain practical skills.

It should be noted that the study is based only on a limited sample of respondents, so the conclusion about the level of professional competencies in the entire system of higher education in Kazakhstan may be questioned. However, it can be safely concluded that to increase the level of students' professional competencies, Kazakhstan universities should not only restructure the content and training technologies aimed at achieving the expected results but also improve tools and procedures for evaluating these results and the procedure for individual student assessment. Employers have different requirements, although educational institutions award standard diplomas (state recognized). At the same time, universities often copy the content of educational programs from each other, which demonstrates a lack of a unique approach. Therefore, programs for developing students' professional competencies should be created with a focus on competencies ensuring successful employment. For educational activities to be productive, it is necessary to alternate and combine teaching methods, diversify the structure and type of classes. It is necessary to interest students – to allow them to gain knowledge, and not just to hear and record them. This is precisely the advantage of a systematic approach: teaching on its basis is interesting for students since it is diverse, comprehensive and effective.

The following basic specific principles for the training of future specialists based on a systematic approach were formulated:

1. Systematic formation of professional competence of a future specialist.
2. Systematic organization and implementation of the educational process.
3. Program-targeted formation of the indicative basis of the upcoming professional activity as the “core” of professional competence of a graduate.
4. Systematic formation of professional competence.
5. Placing the student in the context of professional competence of the corresponding specialist.
6. Building the hierarchy of the student's professional competence system, its subsystems, and supersystems (the model of competence).

The problem requires further research. The next step in this direction may be the study of different teaching methods and techniques in universities to determine which one is most productive in the formation of students' professional competence.

5 References

- [1] N. A. M. Senan, "Developmental review program impact on enhancing the effectiveness of "Teaching and Learning" in accounting program: a case study in a Saudi University," *Entrepreneurship and Sustainability Issues*, vol. 6, no. 2, pp. 1001-1017, 2018, [https://doi.org/10.9770/jesi.2018.6.2\(35\)](https://doi.org/10.9770/jesi.2018.6.2(35))
- [2] C. Karagiannidis, C. Kouroupetroglou, and A. Koumpis, "Special needs at different educational levels: A forecast of 2020," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 7, no. 4, 4-19, 2012, <https://doi.org/10.3991/ijet.v7i4.2168>
- [3] R. Es. Janshanlo, O. Yu. Kogut, and K. Czerewacz-Filipowicz, "Human Capital Management Trends in the Innovative Economy of Kazakhstan," *Polish Journal of Management Studies*, vol. 20, no. 2, pp. 267-277, 2019, <https://doi.org/10.17512/pjms.2019.20.2.22>
- [4] Y. B. Omarov, D. G. S. Toktarbayev, I. V. Rybin, A. Z. Saliyeva, F. N. Zhumabekova, S. Hamzina, N. Baitlessova, and J. Sakenov, "Methods of forming professional competence of students as future teachers," *International Journal of Environmental and Science Education*, vol. 11, no. 14, pp. 6651-6662, 2016. [Online serial]. Available: <https://files.eric.ed.gov/fulltext/EJ1116067.pdf> [Accessed Oct. 19, 2020].
- [5] A. G. Sergeev, *Competence and competencies in education*. Vladimir: Vladimir University, 2010. [E-book]. Available: <https://docplayer.ru/60688716-Kompetentnost-i-kompetencii-v-obrazovanii.html> [Accessed Oct. 2, 2020].
- [6] G. A. Arsamerzaev, I. G. Dauletova, J. Z. Sakenov, and G. S. D. Toktarbayev, "Formation of professional competence at students (on the example of creative pedagogical specialties)," *Life Science Journal*, vol. 11 (6s), pp. 97–101, 2014. [Online serial]. Available: http://www.lifesciencesite.com/lj/life1106s/017_24044life1106s14_97_101.pdf [Accessed Mar. 22, 2020].
- [7] Y. Sapazhanov, A. Orynassar, S. Kadyrov, and B. Sydykhov, "Factors affecting mathematics achievement in Central Asian specialized universities," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 15, no. 19, pp. 143-153, 2020, <https://doi.org/10.3991/ijet.v15i19.15629>
- [8] Ye. V. Borisova, "System approach in the formation of students' competence groups by active methods," *Innovatsionnaya Nauka*, vol. 12-2, pp. 200-203, 2015. [Online serial]. Available: <https://cyberleninka.ru/article/n/sistemnyy-podhod-v-formirovanii-grupp-kompetentsiy-studentov-aktivnymi-metodami/viewer> [Accessed Mar. 29, 2020].
- [9] A. Kurmanbayeva, D. Zulkarnaeva, S. Sadvakasova, D. Ospanova, and A. Kulataev, "Model of formation of professional competence of future specialists," *Science and Technology*, vol. 1-2, pp. 110–115, 2017. [Online serial]. Available: <https://scieuro.com/wp-content/uploads/2017/05/110-115.pdf> [Accessed Oct. 2, 2020].
- [10] G. Donnadiou, D. Durand, D. Neel, E. Nunez, and L. Saint-Paul, *The Systemic Approach: What is it all about? Synthesis of the work conducted by the AFSCET group "Dissemination of the systemic thinking"*, [online document], 2017. Available: <https://www.afscet.asso.fr/Archives/Systemic-Approach-eng.pdf> [Accessed Apr. 2, 2020].
- [11] D. H. Meadows, *Thinking in Systems: A Primer*. Vermont: Chelsea Green Publishing, 2008.
- [12] J.-C. Coulet, "The concept of competence: A model for describing, evaluating and developing competencies," *Le Travail Humain*, vol. 1, no. 74, pp. 1–30, 2011, <https://doi.org/10.3917/th.741.0001>

- [13] A. C. Butler, “An introduction to the forum: Cognitive perspectives on the assessment of professional competence,” *Journal of Applied Research in Memory and Cognition*, vol. 7, no. 2, pp. 65–166, 2018, <https://doi.org/10.1016/j.jarmac.2018.04.002>
- [14] Ø. L. Martinsen and A. Furnham, “Cognitive style and competence motivation in creative problem solving,” *Personality and Individual Differences*, vol. 139, pp. 241–246, 2019, <https://doi.org/10.1016/j.paid.2018.11.023>
- [15] S. Herppich, A.-K. Praetorius, N. Förster, I. Glogger-Frey, K. Karst, D. Leutner, L. Berhmann, M. Böhmer, S. Ufer, J. Klug, A. Hetmanek, A. Ohle, I. Böhmer, C. Karing, J. Kaiser, A. Südkamp, “Teachers' assessment competence: Integrating knowledge-, process-, and product-oriented approaches into a competence-oriented conceptual model,” *Teaching and Teacher Education*, vol. 76, pp. 181–193, 2018, <https://doi.org/10.1016/j.tate.2017.12.001>
- [16] R. E. Mayer, “What professionals know: Contributions of cognitive science to the assessment of professional competence,” *Journal of Applied Research in Memory and Cognition*, vol. 7, no. 2, pp. 217–218, 2018, <https://doi.org/10.1016/j.jarmac.2018.03.004>
- [17] S. Y. Guraya and S. Chen, “The impact and effectiveness of faculty development program in fostering the faculty's knowledge, skills, and professional competence: A systematic review and meta-analysis,” *Saudi Journal of Biological Sciences*, vol. 26, no. 4, pp. 688–697, 2019, <https://doi.org/10.1016/j.sjbs.2017.10.024>
- [18] P. L. Mihaela, “Dimensions of teaching staff professional competences,” *Procedia-Social and Behavioral Sciences*, vol. 180, pp. 924–929, 2015, <https://doi.org/10.1016/j.sbspro.2015.02.245>
- [19] N. Kachalov, A. Kornienko, R. Kvesko, Y. Nikitina, S. Kvesko, and Zh. Bukharina, “Integrated nature of professional competence,” *Procedia – Social and Behavioral Sciences*, vol. 206, pp. 459–463, 2015, <https://doi.org/10.1016/j.sbspro.2015.10.083>
- [20] U. Baizak, K. Kudabayev, M. Dzhazdykbayeva, G. Assilbekova, B. Baizakova, and A. Mintassova, “Competency-based approach to the assessment of professional training for a medical student to work with medical equipment,” *International Journal of Emerging Technologies in Learning (iJET)*, vol. 12, no. 6, pp. 108–119, 2017, <https://doi.org/10.3991/ijet.v12i06.7008>
- [21] B. Z. Turayev and T. E. Delov, “Formation of professional competence of future it-engineers in the modern information society,” *Science and World*, vol. 11, no. 7, pp. 85–86, 2014. [Online serial]. Available: <https://dialnet.unirioja.es/descarga/articulo/4758712.pdf> [Accessed Oct. 3, 2020].
- [22] M. V. Sleptsova, “Formation of students' social competence in a virtual educational environment,” *Education and Information Technologies*, vol. 24, no. 1, pp. 743–754, 2019, <https://doi.org/10.1007/s10639-018-9798-z>
- [23] O. I. Vaganova, “Formation of competence in the possession of modern educational technologies at a university,” *Amazonia Investiga*, vol. 8, no. 23, pp. 87–95, 2019. [Online serial]. Available: <https://amazoniainvestiga.info/index.php/amazonia/article/view/851/792> [Accessed Oct. 2, 2020].
- [24] A. R. Masalimova and V. G. Ivanov, “Formation of graduates' professional competence in terms of interaction between educational environment and production,” *International Journal of Environmental and Science Education*, vol. 11, no. 9, pp. 2735–2743, 2016, <https://doi.org/10.12973/ijese.2016.716a>
- [25] E. Hopper, “Maslow's hierarchy of needs explained,” *Thoughtco*, August 28, 2020. [Online]. Available: <https://www.thoughtco.com/maslows-hierarchy-of-needs-4582571> [Accessed Oct. 3, 2020].

- [26] Council of Europe, “On key competencies for lifelong learning. Council Recommendation of 22 May 2018. 2018/C 189/01,” *Council of Europe*, 2018. [Online]. Available: [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604\(01\)&rid=7](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&rid=7) [Accessed Apr. 27, 2020].

6 Authors

Gulnur O. Issakova (<https://orcid.org/0000-0001-7272-4786>) is a graduate student of the S. Seifullin Kazakh Agro Technical University, [Department of Computer Systems and Vocational Training](#), the [Department of Vocational Education](#). Republic of Kazakhstan, 010011, Nur-Sultan, 62, Zhenis Avenue.

Gulnar Kaltayeva is a PhD, Candidate of Pedagogical Sciences. She is a lecture of the S. Seifullin Kazakh Agro Technical University, [Department of Computer Systems and Vocational Training](#), the [Department of Vocational Education](#). Republic of Kazakhstan, 010011, Nur-Sultan, 62, Zhenis Avenue.

Gulshat R. Bakhtiyarova is professor at the Department of psychological-pedagogical and special education, K.ZhubanovAktobe regional state university, Pedagogical faculty. She is PhD, Candidate of Pedagogical Sciences, associate professor. K. Zhubanov ARSU, 030000, Aktobe, 34, A. Moldagulova Prospect.

Kulyan Ibrayeva is a professor of the S. Seifullin Kazakh Agro Technical University, [Department of Computer Systems and Vocational Training](#), the [Department of Vocational Education](#). She is a Doctor of Pedagogical Sciences, Professor. Republic of Kazakhstan, 010011, Nur-Sultan, 62, Zhenis Avenue.

Sayagul Kudaibergenova is an associate professor of the S. Seifullin Kazakh Agro Technical University, [Department of Computer Systems and Vocational Training](#), the [Department of physics and chemistry](#). She is PhD, Candidate of the Chemical Sciences. Republic of Kazakhstan, 010011, Nur-Sultan, 62, Zhenis Avenue.

Article submitted 2020-10-19. Resubmitted 2020-12-01. Final acceptance 2020-12-03. Final version published as submitted by the authors.