Perception of IT teachers on their methodological development: A case at Kazakhstan universities

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Abstract

This paper provides an analysis of the viewpoints of IT discipline teachers at Kazakhstani universities regarding the need for the development of methodological competence. The purpose of this study is to provide IT teachers with a philosophy of necessity to develop their methodological basis to train future IT specialists. The sociological survey was conducted among them and the answers to the questionnaire showed that teachers understand the relationship between their methodological training and the quality of education. The interviewed teachers use a variety of technologies and methods of teaching and evaluating the achievement of learning outcomes by students in the educational process which indicates that they have a certain level of methodological competence. Nevertheless, the problem of unclear understanding of the differences between the concepts of technology and teaching method is revealed. This suggests the need for measures to strengthen the general pedagogical training of teachers. The study's findings have shown that IT discipline teachers at Kazakhstani universities understand the need for constant development of their methodological competence. The opinion of teachers in the IT discipline about the need to develop methodological competence is positive and they are ready for continuous improvement. The study gives a foundation for research on the level of formation of methodological competence in general and its components, organizational forms of development of methodological competence and the possibility of strengthening the general pedagogical training of future teachers of IT disciplines.

1. Introduction

One of the central problems of modern higher education is the level of methodological training of teachers and this is one of the key issues that are in the focus of the European Higher Education Area. The Rome Communique [1] adopted "Recommendations to National Authorities for the Enhancement of Higher Education Learning and Teaching in the EHEA". These recommendations are based on the need for student-centered learning and improving teaching. The factors in improving teaching are the competence of the teacher especially the methodological competence. The improvement of teaching significantly affects the quality of higher education not only the quality of higher education but also the quality of digital literacy among the population which presupposes the development of the methodological competence of IT disciplines teachers [2].

In the development of methodological competence among teachers of information technology disciplines, it is important to build an adequate, stable and consistent system in a new competence paradigm.

The relevance of the study is confirmed by the Kazakhstan concept of the development of higher education and science for 2023-2029 through the development of a system of continuing education involving the addition of new professional competencies to existing ones (https://adilet.zan.kz/rus/docs/P2300000248).

In the previous study, we defined Astana IT University researchers the "methodological competence of an IT teacher" [3]. Furthermore, the team considered the issue through the organization of the process of developing the methodological competence of IT teachers [4] by creating a structural model of the system of developing the methodological competence of IT teachers [5].

We define the research significance through the essential necessity of developing methodological competence as the ability and readiness to design and implement the educational process as well as to reflect on one's teaching activities, formed at the basic level. The features of the IT area in most cases represent along with methodological competence IT teachers lack methodological culture that includes knowledge of effective methods of teaching and upbringing, the structure and content of methodological activities, knowledge of methodological terminology, etc.

The research framework includes a sociological survey of 358 IT discipline teachers from 42 higher education institutions. The tool of the survey was a questionnaire that concerned participation in the development of teaching materials, familiarity with the content of pedagogy, regulatory documents of the sphere, the need for knowledge of methodology, etc.

Our study posts research questions about how IT discipline teachers perceive the necessity of methodological development and its formation.

We tried to make a screening of the viewpoints of IT discipline teachers about the development of methodological competence as part of the professional characteristics of a teacher before proceeding to the development of measures for the development of methodological competence based on the developed model. The subject of our research is limited to the IT disciplines teacher of higher educational institutions.

Such a study will give an impetus and determine the right trajectory for further actions on the formation and development of methodological competence among teachers of IT disciplines.

2. Research Methods

The study included two stages: a review of scientific literature and a questionnaire.

The analysis of the results of domestic and foreign scientific research using the methods of content analysis of secondary data (articles, methodological recommendations, etc.) and the descriptive method.

The next step was to conduct an empirical study using questionnaires which is considered a universally applicable research methodology for research in the field of education [6].

Quantitative methods were used as understanding and applying quantitative research tools is crucial for advancing research in education, both theory and practice as it contributes to the accuracy and reliability of research results [7, 8].

When conducting an empirical study, cluster sampling has become the main sampling method which will allow us to study the problem more accurately and in detail. The sample size is determined from a known population and calculated by the formula of Krejcie and Morgan [9] for a known number of populations. At the same time, 95% and an error of 5% are taken as the level of confidence.

Statistical methods of data processing and methods of output statistics are used in data analysis.

3. The Level of Research on the Problem

We analyzed the necessity of methodical competence for the teaching process in this paper. A teacher must obtain a set of knowledge, skills and attitudes that enable someone to plan and implement namely didactic competencies [10]. Didactic and pedagogical skills are understood as the acquisition of routines that every teacher needs to save time and energy for the more significant aspects of work [11].

Peterson and Tonnesen categorized didactic competencies as competencies in curriculum development, teaching and evaluation and reflection of education [12]. It is an ongoing process of learning that will help improve the teachers' competence repertoire as critical and reflexive practitioners [13].

Furthermore, we consider the studies on the formation level of competence including the methodical ones.

Competence level formation in different directions is currently a topic for study by scientists.

In that case, researchers from 13 universities in Germany, Austria and Luxembourg developed the model of teachers' assessment competence that defines teachers' assessment competence [14]. Experimental work to define methodical

competence formation was carried out based on vocational education institutions in Dnipropetrovsk, Poltava and Sumy regions of Ukraine and conducted in three main stages (conduction of a survey and development of educational electronic resources to exchange experience) [15].

The problem of developing the general methodological competencies of university teachers was also studied by Uzbekistan researchers at Tashkent State Transport University [16]. The formation of professional and methodological competence in teachers was diagnosed through the development of tasks to assess the subject competencies of the teacher and the methodological competencies of the teacher [12].

In Kenya, Florah Katanu Karimi sought to establish the levels of didactic competencies among the teaching staff of the universities and her results showed the requirements for teaching staff to be re-trained [17].

The scientists at Miguel Hernández de Elche University evaluated teaching competencies through the development of a questionnaire but such a study has limitations and proposes to analyze the validity of this scale's content and construct, expanding the sample of students and estimating structural regression models corroborating the results obtained [18].

In Cambodia, Czech experts carried out the external evaluation of teachers' competencies, having chosen the comprehensive inspection as a tool for evaluation and developed the form sorted into 4 clusters (pedagogical aspect, didactical aspect, interactive aspect and managerial aspect). The results show an urgent need for teachers to be trained throughout their lives [19].

The academic staff at the Chilean University passed the course in online engineering education and pedagogy to improve digital and pedagogical competence in engineering educational contexts [20].

The investigations into the pedagogical competence of teachers with non-educational background allowed creating a model of pedagogical competence development. The researchers revealed the need for special training in the form of workshops for such teachers [21].

We consider how teachers assess and reflect on their core competencies. Some results showed that teachers considered the most important of the competencies is the capability to promote students' motivation, effort and responsibilities [22, 23] but more frequently, the scientists carry out the monitoring of teachers' opinions in the context of a certain competence: digital [24], intercultural [25], teaching [26, 27] etc.

The literature study shows the necessity of the development and evaluation of teaching competence (including methodical, didactical). The researcher used the following main tools in their studies: questionnaires, surveys, results obtained after courses on the development of teaching competencies, students' assessments of teaching competencies, etc.

The review presents the lack of studies on teachers' understanding of a level of methodical competence and their opinions including teachers of specialized directions, particularly IT teachers.

4. The Materials and Results

4.1. Research Design

We surveyed IT discipline teachers as part of our research on why they should be methodologically competent. According to the National Educational Database, more than four thousand teachers of IT disciplines work in 120 Kazakhstani universities.

In our study, 358 teachers from 42 universities participated in the survey. All administrative regions of the country were covered (see Appendix 1).

The questionnaire consisted of 14 questions: four introductory (age, gender, work experience, degree), 10 on the subject of the questionnaire, of which four had one choice and six had multiple choice answers) (see Appendix 2). The questions about the study concerned participation in the development of teaching materials, familiarity with the content of pedagogy, regulatory documents of the sphere, the need for knowledge of methodology, etc.

4.2. Research Methodology

Since in our case the general population was known, the sample size was calculated according to the formula of Krejcie and Morgan for a known number of populations and amounted to 351 people with a confidence level of 95% (Z-score or X = 1.96) and a statistical error of 5%.

4.3. Survey Results

Of the 358 survey participants, 234 were female (65.4%) and 124 were male (34.6%). People aged 31-40 years predominate (36.9%), teachers aged 51 and over were the smallest (only 8.4%). According to work experience, the distribution is as follows: Figure 1 shows that there were 124 people (34.6%) under the age of five; 39 people (10.9%) between the ages of five and ten, 129 people (36%) between the ages of eleven and twenty and 66 people (18.4%) above the age of twenty.
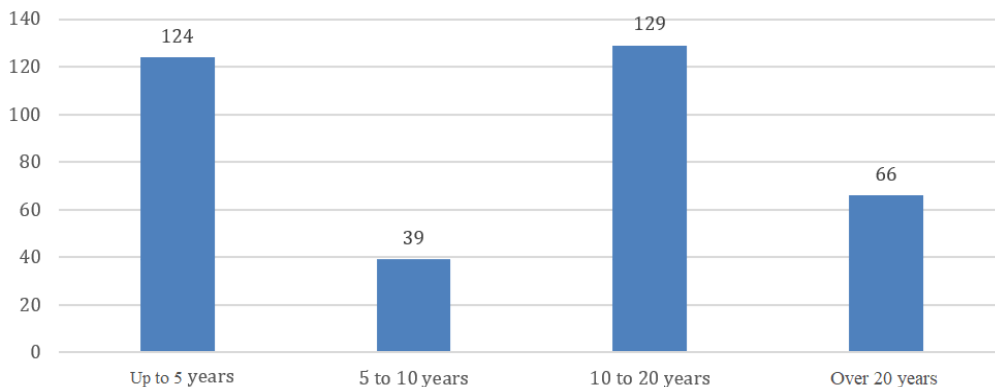
Figure 1.
Distribution of respondents by work experience.

Thus, teachers with different work experiences participated in the survey.

The survey participants are mostly graduates (264 people or 73.7%) followed by candidates of sciences and PhD (88 people/ 24.6%), 6 doctors of sciences (1.68%) also participated. 8 people indicated that they did not have a degree (see Figure 2).
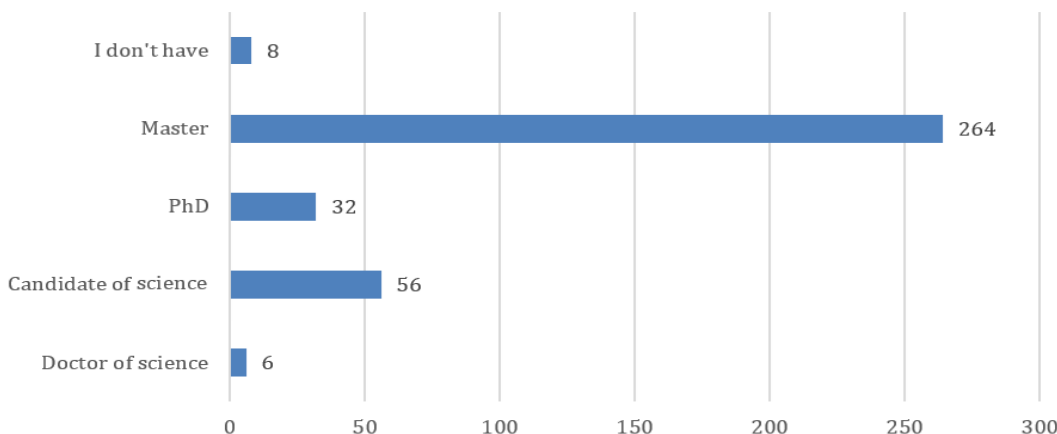

Figure 2.
Academic degrees of the survey participants.

It is necessary to pay attention to the answer *"I do not have"*. Here, we mean people who graduated from higher education before switching to three-level training (specialty) since under the legislation of Kazakhstan bachelors do not have the right to teach at universities.

According to the question, *"Did you participate in the design of educational programs, educational and methodological packages etc.?"* 68 teachers answered "no" which means that 19% have no experience in this area. Nevertheless, the majority has experience in developing an educational and methodological package (290 people / 81%), of which 51 people participated in the development of educational programs (14.2%) and 34 have an author's course implemented in the educational process (9.5%). Thus, most of the teachers were involved in the design of educational and methodological and scientific products.

Most of the survey participants (96.1%) are sure that teaching requires knowledge about the basics of pedagogy. However, 11 people (3.07%) consider that such knowledge is not necessary.

In Kazakhstan, "general requirements for knowledge, skills and work experience" are established in professional standards. In the field of education, this is the professional standard of teacher. Therefore, we tried to find out how well teachers of IT disciplines know the requirements for their profession as reflected in this document. 77.7% (278 people) replied that they were familiar with the content of the document and 52 respondents (14.5%) partially, 28 people (7.8%) unfortunately are not familiar with the content of the document. It is alarming that such a significant proportion of teachers of IT disciplines do not know or partially know the requirements for their professional activities.

Next, we asked respondents to rank the labor functions of a teacher specified in professional standards by priority. The results are shown in Table 1.

Table 1.
Ranking of the teacher's work functions.

Work function	1	%	2	%	3	%	4	%	5	%
Teaching	114	31.8	43	12	50	14	43	12	108	30.2
Research	88	24.6	74	20.7	78	21.8	77	21,5	41	11.5
Methodological	76	21.2	89	24.9	83	23.2	43	12	67	18.7
Social-communicative	49	13.7	75	20.9	61	17	116	32,4	57	15.9
Educating	31	8.7	77	21.5	86	24	79	22,1	85	23.7

Among the labor functions of a teacher, according to respondents, the most important is the teaching function (114 people or 31.8%).

The primacy of the teaching function is due to the fact that the first, historically established mission of a higher educational institution is education.

According to respondents, the next important function of a teacher is research. 88 people or 24.6% of respondents put it in the first place.

In terms of functions, according to the first choice, the methodological function is in 3rd place (76 people / 21.2%). This means that teachers attach great importance to this function understanding the importance of the teacher's role as a methodologist.

Next, according to the respondents, the social and communicative function is located according to the first choice (49 people or 13.7%). According to only 31 teachers (8.7%), it should be stated that the educational function is paramount. This can be explained by the fact that mostly adults formed personalities study at universities and the function of the university is not in education but in personal development including in the social aspect.

The distribution of the choices by ranking the functions of the teacher as a whole is shown in Figure 3.
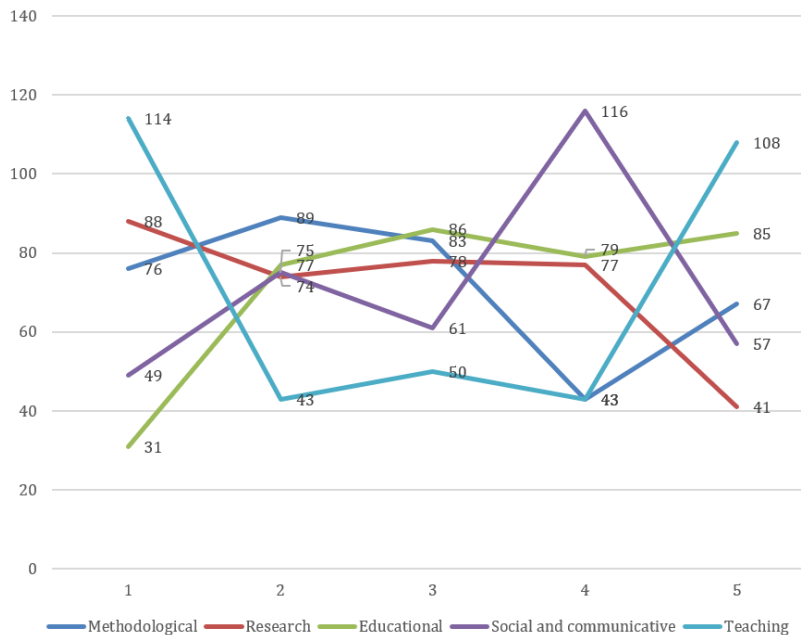

Figure 3.
Distribution of elections by ranking of teacher functions.

Noticeable discrepancies were observed in the first and last elections. Otherwise, the teachers ranked the functions almost equally (with slight deviations).

The next question concerned the importance of knowledge of the methodology of teaching the discipline for the teacher. 44.4% of respondents (159 people) believe that knowledge of the methodology of teaching the discipline is necessary. Almost the same number of respondents (147 people / 41.1%) believe that knowledge of the subject area and knowledge of teaching methods are equally important. On the contrary, 46 people (12.8% of respondents) gave primary importance to knowledge of the subject area and 6 respondents generally believe that "it is possible to do without teaching methods" (1.68%).

It can be concluded that the overwhelming majority knows and understands the importance of the methodological component of their activities. Nevertheless, some rely on their own experience rather than on a formalized teaching methodology.

The next block of the questionnaire consisted of multiple-choice questions. The respondent can choose several answers. The first of them concerned what methodological competencies a modern university teacher should have. Five core competencies were given to choose from. The ranking of the response selections is as follows (see Table 2):

Table 2.
Distribution of teachers' methodological competencies.

Competencies	Number of response selections	%
Informational (Search and analysis of information)	329	91.9
Research	208	58.1
Communication-speech	192	53.6
Organizational and managerial	167	46.6
Self-development and self-study	156	43.6

Most respondents (91.9%) chose informational competencies (due to the nature of the teacher's profile teaching IT disciplines) followed by research (208 people/58.1%), communication and speech (192 people/53.6%), organizational and managerial (167 people/46.6%) and self-development and self-study (156 people/43.6%). In general, the choice of competencies is uniform not counting informational ones.

The next question determined the pedagogical approaches and technologies most frequently used by the teacher, the respondent had to write his own version (several variants) of the answer. Frequency analysis made it possible to select the most frequently mentioned approaches and technologies (see Table 3).

Table 3.
Distribution of pedagogical approaches and technologies.

Pedagogical approaches and technologies	Number of response selections	%
Partially search	234	65.4
Case technology	186	52
Quest (Web-quest)	163	45.5
Organization of search and research activities	152	42.5
Differentiated approach	149	41.6
Working in small groups	142	39.7
Individual approach	118	33
Problem-based learning	115	32.1
Organization of project activities	103	28.8
Critical thinking development and technology	26	7.26

The calculation of the results showed that the most frequently used technologies are partially search and case technologies. Most respondents indicated that they rely on differentiated and individual approaches.

Nevertheless, the answers showed that some teachers do not see the difference between technologies, approaches and methods of teaching. As a result, in 19 cases, teaching methods were indicated. This indicates the need for additional work on the general fundamentals of pedagogy.

The next question is aimed at determining the most frequently used methods and forms of monitoring of educational results of students, here respondents as in the previous question had to write their own answers. Among these responses, only those who scored more than 20% were selected (see Figure 4).
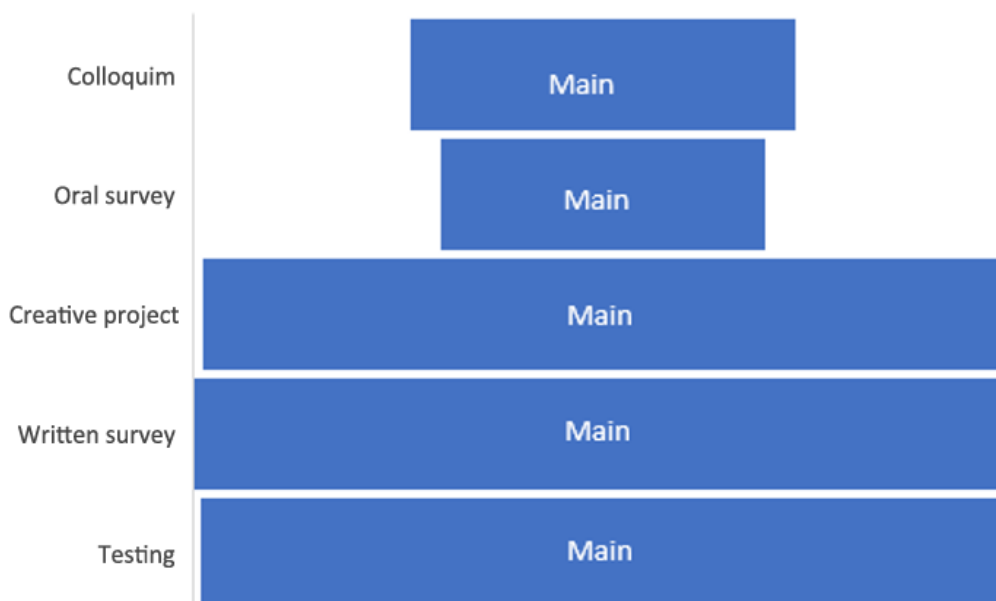

Figure 4.
Frequently used methods and forms of control.

It follows from the answers that the most common form of monitoring the achievement of educational results by students is testing (86.3% of respondents wrote). This indicates that today testing is the most objective and formalized form of control in the implementation of the educational process. A colloquium and a written survey are also often used. At the same time, it was found out that the written survey is often used by teachers with more than 20 years of experience (87.9% of them wrote this option).

Table 4 presents the results concerning teachers' professional development. Respondents had to give one or more of their options. Since in Kazakhstan professional development is mandatory for teachers at least once every 3 years, the majority (80.7%) indicated the passage of short-term (36-72 hours) professional development programs.

Table 4.
Distribution of forms of professional development.

Types and forms of professional development indicated by respondents	Number of response selections	%
Participation in webinars and conferences on the internet.	296	82.7
Mastering professional development programs.	289	80.7
Conferences, master classes, competitions, exchanges and courses.	267	74.6
Participation in seminars and conferences in offline mode.	93	26
Attending open lessons and master classes with your colleagues.	78	21.8
Participation in professional associations and online communities of teachers.	61	17
Conducting open lessons and master classes and participating in their discussion.	48	13.4
Participation in professional competitions and Olympiads.	39	10.9
None	2	0.56

According to the results of the survey, it turned out that 2 teachers wrote that they do not practice "any" forms of professional development. Professional development is a legal requirement that affects the relationship with the employer (an employment contract can be terminated based on this). These answers do not correspond to the true state of affairs.

The last question was asked to find out what forms of professional competence development teachers prefer. Table 5 presents the results of questioning academic staff where the majority of them (71.5%) prefer certification courses followed by the development of scientific, professional and methodological competencies.

Table 5.
Distribution of types of advanced training courses.

Types and forms of professional development indicated by respondents	Number of response selections	%
Professional certification and specialized courses.	256	71.5
On the development of scientific and professional competencies.	197	55
On the development of methodological competencies.	169	47.2
On the development of methodological competencies.	92	25.7
On the development of communication and speech competencies.	89	24.9
On self-development technologies, self-learning competencies.	68	19
On the development of informational competencies.	51	14.2
None	2	0.56

Again, in this question, 2 people answered that they did not want to attend any courses. Based on the answers, it can be concluded that teachers positively assess the need for continuous development of professional (including methodological) competencies.

In general, according to the results of the analysis of the survey results, it was revealed that IT discipline teachers at Kazakhstani universities understand the need for constant development of their methodological competence. The development of methodological competence for them stands in almost the same place as research. In the structure of methodological competence, respondents paid more attention to the skills of searching and analyzing information while other competencies are considered almost at the same level.

5. Conclusion

The analysis showed that teachers of IT disciplines use a variety of teaching technologies but also revealed the problem of unclear understanding of the differences between them as well as between the concepts of "technology" and "teaching method". This suggests the need for measures to strengthen the general pedagogical training of teachers to maintain students continued learning motivation [28].

It was also found out that teachers use many forms of monitoring the achievement of learning outcomes but mostly resort to the test form due to its frontal, formalized and non-subjectivity. Nevertheless, written and oral questioning and the development of creative projects are widely used. A certain number of teachers use mutual control (checking the assignment of one student by another) as a method of formative assessment. The variety of applicable teaching

technologies, forms and methods of control shows a good level of teachers' mastery of methodological skills but this level requires additional verification by other scientific methods.

We can say that the opinion of teachers of IT disciplines about the need to develop methodological competence is positive. In the future, it is possible to study the level of formation of methodological competence in general and its components, organizational forms of development of methodological competence and the possibility of strengthening the general pedagogical training of future teachers of IT disciplines. It also requires the creation of a system for predicting the development of the methodological competence of teachers in the conditions of lifelong education [29].

The research implications are to study factors influencing the quality of teaching IT disciplines, to develop a concept for the development of methodological competence for IT discipline instructors based on an analysis of advanced domestic and international experience in preparing future professionals and enhancing the qualifications of educators, to develop and implement a system for forecasting and continuous support of the development of methodological competence for instructors taking into account the specific characteristics of the taught IT disciplines, to develop a system of course and post-course support for IT discipline instructors including software and educational materials, to develop and implement competency standards based on the professional standard "Educator" and an educational program for advanced courses in the development of methodological competence for IT discipline instructors.

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Appendix 1.
List of universities and number of survey participants.

№	University	Number of respondents
1	L.N.Gumilyov Eurasian national university	12
2	K.I. Satpayev Kazakh national research technical university	24
3	Al-Farabi Kazakh national university	19
4	Aktobe Regional university named after K.Zhubanov	1
5	Atyrau University named after H.Dosmukhamedov	2
6	S. Amanzholov East Kazakhstan university	4
7	D.Serikbayev East Kazakhstan technical university	17
8	Zhetysu university named after I.Zhansugurov	7
9	Karaganda industrial university	9
10	Karaganda technical university	12
11	Karaganda State university named after academician E.A.Buketov	1
12	Sh. Yesenov Caspian university of technology and engineering	2
13	Kokshetau university named after Sh.Ualikhanov	3
14	Kostanay regional university named after A. Baitursynov	4
15	Kyzylorda university named after Korkyt Ata	2
16	Pavlodar pedagogical university	2
17	Toraigyrov university	3
18	Rudnensky industrial institute	4
19	North Kazakhstan university named after M.Kozybaev	7
20	University named after Shakarima G. Semey	7
21	M.H.Dulati Taraz regional university	8
22	M.Auezov South Kazakhstan university	6
23	Academy of logistics and transport	4
24	Almaty university of energy and communications named after G. Daukeev	14
25	Almaty university of technology	9
26	Kazakh-British technical university	23
27	International educational corporation	2
28	International university of information technology	19
29	Astana medical university	1
30	KIMEP university	16
31	Narkhoz university	4
32	Kazakh university of technology and business	9
33	Astana IT university	44
34	Atyrau institute of engineering and humanities	6

№	University	Number of respondents
35	Eurasian university of technology	7
36	Ekibastuz engineering and technical institute named after academician K.Satpayev	5
37	West Kazakhstan university of innovation and technology	9
38	Kazakh automobile and road institute named after B.Goncharov	4
39	Kazakhstan university of innovative and telecommunication systems	9
40	Kazakh-American free university	3
41	Karaganda economic university of Kazpotrebsoyuz	10
42	Caspian public university	4

Appendix 2
"Development of methodological competencies of teachers of IT disciplines" survey.
Dear participant!
Please answer questions about your experience, qualifications and the specifics of performing professional duties
Thank you in advance for your time and answers!
Participation in this issue is completely voluntary and will take only 6-8 minutes.
All answers provided by you will be kept strictly confidential.

1. Personal data
2. Place of work (name of the locality and educational organization)
3. Sex.
4. Age:
- 20-30
- 31-40
- 41-50
- 51 and more
5. Specify your work experience as a teacher
6. Which university did you graduate from?
7. Academic degree
8. What pedagogical disciplines have you studied while studying at a university or as part of non-formal education?
9. Have you participated in the design of EP, educational materials, etc.?

Part 2 Assessment of methodological competencies
1. Do you agree with the statement that a teacher should have knowledge of the basics of pedagogy?
2. Are you familiar with the content of the Professional standard "Teacher"?
3. Please rank the teacher's work functions by priority:
   1. Methodological
   2. Research
   3. Teaching
   4. Social-communicative
   5. Educating
4. How important, in your opinion, is knowledge of the methodology of teaching the discipline for a teacher?
5. Name the sources of tasks that you use to conduct classes
6. What methods and forms of monitoring the achievement of educational results of students do you most often practice?
7. What pedagogical approaches and technologies do you use most often?
8. Do you develop individual projects based on the personal characteristics of the students? (if yes, describe which ones in the other column)
9. Do you consider your individual characteristics in the design of teaching activities? (if yes, describe which ones in the other column)
10. Are you fluent in the educational material?
11. Do you implement personality-oriented teaching methods in your teaching activities? (if yes, describe which ones in the other column)
12. Do you know how to justify the chosen teaching methods and tools?
13. In your opinion, what competencies should a modern teacher have?
14. What forms of assessment of your professional competencies do you use?

Part 3. Professional development
1. What forms of professional development do you practice?
2. What forms of advanced training courses, in your opinion, are the most relevant for teachers?
3. When deciding to take advanced training courses, what do you pay attention to first?
4. Please indicate which of the following problems you have encountered if you wish to take advanced training courses?

- inconvenient time of the course
- management did not let me go to the courses
- there was no financial opportunity to go to the courses
- I received information about the courses late
- need to carry out missed classes during the time spent on the courses

5. What advanced training courses would you like to attend?