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PEDAGOGICAL EDUCATION TECHNOLOGIES AND MECHANISM FOR THEIR IMPLEMENTATION AT UNIVERSITY COMPLEX

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Abstract

The study substantiates the technologies that have relevant and strategic value for increasing the efficiency of pedagogical education in Russia. The functional mechanism of the technologies realization in the conditions of University complex is revealed in the study. That is development and analysis of the significant issues matrix of technological renovation; design and implementation of organizational and pedagogical model of technological renovation; implementation of functions, indicators, indicators of technological renovation of pedagogical education. The study proves that relevant strategic technologies implemented through the functional mechanism have a positive impact on the quality of teachers education at the University. In the conducted research the technologies having urgent and strategic importance for pedagogical education in Russia were proved. As a result of experiments carried out in several countries, it was possible to reveal the functional mechanism of technological renovation, including several stages: 1) development and analysis of the significant issues matrix of technological renewal, allocation the technologies that are relevant and strategically important; 2) design and implementation of organizational and pedagogical model of technological renovation in the conditions of the University complex; 3) realization of functions, indicators, indexes of technological renovation of pedagogical education, diagnostics and monitoring the quality of pedagogical education.

Keywords: Technology, model, function, mechanism, education, indicators.

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1. Introduction

The changes that have taken place in the universities of Russia (consolidation of universities into University complexes, transformation of economics of education to market conditions, reframing the ideology and methodology of education, moving towards two - and three-level system, introduction of new competence based standards, modular and interdisciplinary programmes, computerisation and gamification in education, etc.) raised concerns about new didactics of higher pedagogical education – new objectives, principles, methods, technologies (curriculum) of education organising (Isaev & Makarova, 2002; Kodzhaspirova, 2004; Grunt & Lymar, 2007; Makarova & Sharshov, 2011). Western European universities have the same situation. Everybody discusses effective pedagogical education curriculum (Menter, 2015; Galvin, 2016). The concept of the curriculum in Western Europe is synonymous with the concept of technology in Russia, and the phrase learning technology used in Western counties is similar in meaning to the Russian phrase teaching methods (Barsukov & Panicheva, 2016; Menter, 2015; Galvin, 2016; Alliaud & Feen, 2015; Darling-Hammond, 2016; McMahon, Forde, & Dickson, 2013; Hatwood Futrell, 2010).

Learning technologies in Russia, curriculum in the countries of Western Europe have become the subject of intense debate (Kodzhaspirova, 2004; Menter, 2015; Galvin, 2016). In the twentieth century they were associated with methods, techniques, teaching methods and assumed certain algorithms of influence on students, but now – in the 21st century – they are more like the original ways of interaction between the teacher and the student (in the form of games, cooperation, research, remote or network communication, etc.), student plays an active role, and the increase of students' independent work in this interaction according to the plan provides them with self-development and independent activity. Technologies are now opposed to traditional methods as more effective, innovative ways of learning.

However, practice shows that new – technological – ways of learning, developing the procedural qualities of an individual (intelligence, thinking, creativity, etc.), do not always provide the proper level of knowledge, universal learning activities (at school), competencies (at university) which are necessary for the successful completion of the Universal State Exam or passing the State Final Certification. Therefore, educators being under the administrative pressure of the management are often forced to compromise. They develop and show new technologies for administration, but for students (for their daily cognitive activity) they use old but reliable and proven techniques.

Maybe that is the reason why schools and universities of the world (Western Europe, USA) are more interested in the old Soviet experience in education than in the modern education in Russia (Pravda-TV.ru., 2018).

2. Problem Statement

With a view to the above, everyone is concerned about the research task of how to develop technologies that would not only develop the procedural qualities of the individual (intelligence, thinking, creativity, etc.) of a future teacher, but would also form their knowledge and competence necessary to perform qualification tests and successful professional activities at school.

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For the effective organization of pedagogical education at University not any but relevant, strategically demanded and significant for modern education, technologies are necessary. Moreover, the relevance and strategic prospects of these technologies should be determined not by ideologists, economists or educational leaders, but by working teachers, educators, students, employers as they are active participants in the educational process.

3. Research Questions

In order to determine the technologies that are relevant and strategically important for pedagogical education it was necessary to:

1) develop a questionnaire to study the problems of technological renovation, classify the answers of respondents, develop and analyse a significant issues matrix;

2) to design and implement an organizational and pedagogical model of technological renovation of teacher education at the University;

3) to develop a mechanism for the implementation of technologies, to ensure the implementation of functions, indicators, indexes of technological renovation of pedagogical education.

4. Purpose of the Study

To determine the complex of relevant strategic technologies and to develop organizational and pedagogical mechanism of their implementation.

5. Research Methods

Research hypothesis

The complex of relevant strategic technologies will be determined (and this complex will function), if the following are developed:

significant issues matrix for technological renovation of the content of pedagogical education (list of problems and technologies of pedagogical education) (2017);

organizational and pedagogical model of technological renovation of the content of pedagogical education (purpose, objectives, principles) (2018);

functional mechanism of technological renovation of the content of teacher education (functions and indicators), evaluation of the effectiveness of technologies in the conditions of higher pedagogical education (2019).

The methodology of the study was based on the concept of “core competence” by Hamel & Prahalad (2014), the methodology of significant problems of Prigozhin (2007), related to the development of management strategies.

The study used methods of questioning, interviewing, analysis and comparison, methods of summarizing the results of statistics, learning outcomes.

As a result of processing the data obtained during the survey and interviews, four types of problems were identified: 1) root – causing or aggravating other problems; 2) knot – depending on some

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problems, but at the same time causing or aggravating other problems; 3) resulting – are the result of other problems; 4) autonomous – quite significant, but not related to others.

The "+" sign marks the problems that were pronounced in the years of 2016-2019, the "–" sign marks the problems that exist, but cannot be marked as root, knot, resulting or autonomous. The "+" sign means that there is more positive in solving the problem, the "–"sign means the predominance of negative in solving the problem.

6. Findings

We conducted a diagnostic (analytical) and experimental (implementation) research in 2016-2019 in 10 universities (in Russia, Belarus, Poland, Moldova, England, Sweden, Norway). The organizational center of the experiment is the Scientific and Educational Center of Pedagogical Research of Kazan Federal University.

6.1. Stage 1 of the study

As a result of the development of a matrix based on a survey of teachers and students (375 teachers and 1206 students were interviewed), a list of problems of technological renovation of the content of pedagogical education was compiled.

Experts (organizers of pedagogical education) had to remove from the list the problems that they think were insignificant or repetitive, then combine the problems in case it was necessary, and to select from the resulting transformed list the most important ones. After filling in the "empty schedule" by the method of paired comparisons, the main problems of the functional side of the mechanisms of technological renovation of the content of pedagogical education were determined.

The study used Spearman's rank correlation coefficient (Gmurman, 2004). It allowed to establish the dependence of professional competences of future teachers on the degree of implementation of mechanisms of technological renovation at the level of undergraduate, graduate and postgraduate studies.

Thus, a correlation was established – a statistical relationship of several values (quantitative indicators of the most recurrent problems), which can be considered root, knot, resultant, autonomous with some acceptable degree of accuracy. In this case, changes in the values of one or more of these values are accompanied by a systematic change in the values of another or other values.

During the analysis of the matrix data, comparison of problems (root, knot, resulting, autonomous), we determined a set of technologies which were preferred by teachers and university students and with which they referred the effectiveness of pedagogical education, that is, perceived them as technologies that are relevant at present and strategically important for the development of pedagogical education.

From a large list of technologies (with a brief description of their features) we selected 12 (exceeding 50%):

- system-target technology (53% of respondents): the technology is connected with the system organization of the University, high schools of pedagogics, pedagogical colleges, University lyceums in a whole entity – organizational and pedagogical system; target training involves working with graduates of

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high schools of pedagogics, lyceums, with students of pedagogical colleges; as a result, college graduates are able to enter the third year of the University and study the shortened program;

- structurally meaningful technology (57%): the technology is associated both with the diagnosis of the initial level of psychological and pedagogical training of students and with the definition of the content, structure of studies, with the development of the list of competencies, blocks and modules of the content of pedagogical education, and training in new educational programs;

- personalized technology (72%): this involves teaching graduate and implements educational programs of training of subject teachers of higher qualification; successful graduate of subject undergraduate may enroll in a particular educational program subject pedagogical Master's school, in which a student is proved with a personalized path of educational, research, methodical preparation;

- distributed technology (61%): the technology is connected with the parallel training of teachers in different structural units of the University; for example, at the Faculty of Law there is a legal education and concurrently training of law teachers; at the Institute of Management, Economics and Finance economic education and training for teachers of geography, etc.; psychological and pedagogical training of students is carried out by the Institute of Psychology and Education, and the subject-methodical one is carried out by the specialized Institute;

- integrative technology (79%): the technology involves diagnosis, monitoring professional preferences of school, college, and university students, developing second speciality and training programs, transit modules, organizing professional training simultaneously with the main field-specific education. Within this kind of training integration of the subject (the field-specific Institute), psychological and pedagogical (the Institute of psychology and education) and methodological (the Institute of Psychology and Education and field-specific Institute) is carried out.

- mentor technology (54%): the technology is associated with the special role of the teacher as a mentor, tutor (as a mentor, i.e. pragmatic adviser), with his personal experience of success in creative pedagogical activity, with his huge and recognized authority in this field, with his ability not only to share his experience with students, teachers, psychologists, etc., but also to help them in building their creative career focused on the same (or larger) success;

- genius-technology (51%): this technology is more connected with students who show talent, brilliance in different spheres of creative activity; the technologies are integrative, interdisciplinary in nature and are focused on developing creative abilities of future teachers in different spheres of professional pedagogical and scientific-methodical activity;

- gamification technology (52%): the technology of active interaction between a teacher and a student in the modern information environment (including online lectures, distant tasks and network research); this technology requires from both the teacher and the student good preparation for working in the conditions of distance communication;

- technology of innovative culture development (56%): the technology is associated with implementation in the educational process of cognitive, moral, ethical and value aspects, provides teachers' mental and behavioral activity, culture of pedagogical activity and scientific and methodological search;

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- foresight technology (54%): the technology assumes collaborative work of researchers in education with teachers of innovative schools; in practice it is realized through scientific and practical conferences (seminars) where they discuss the problems of integration of university pedagogics with modern educational practice; the technology of constructing a foresight (education of the future) includes the trend of priority development: initial trends fix the starting point of the foresight, and the development of these trends (and derived phenomena) on the time map is set by the process of filling the foresight;

- technology of pedagogical facilitation (55%): the technology is associated with increasing the productivity of education and developing the subjects of professional and pedagogical process due to their special style of communication and personality of the teacher: modern teacher should be facilitator, that is, a person who facilitates manifestation of initiative and students' personal interaction, which contribute to the proc¬ess of their personal development: the phenomenon of facilitation occurs only if the teacher is authoritative, referential, recognized;

- noxology technology (56%): the technology algorithmizates learning process, making it aimed at developing the norms of human behavior, his worldview and acquiring the competences for life security; the technology is integrative in nature, is implemented within studying different disciplines and is linked with developing culture as set of noxology norms, beliefs and attitudes that characterize the attitude of an individual to danger, risk, personal, social and national security.

6.2. Stage 2 of the study

Implementing these technologies in University education (2016-2018) has changed the views of respondents on their relevance and strategy (see Table 1, Figure 01). The greatest preference in the conditions of pedagogical experiment was given to structurally meaningful (62%), personalized (86%), integrative (86%), mentor technology (61%), genius technology (65%), technology of innovative culture development (77%). Respondents emphasized that these technologies are easier to develop and implement.

Table 01. Relevance and strategic value of technologies from the observers' view poin

No.	1	2	3	4	5	6	7	8	9	10	11	12
Technologies	system-target	structurally meaningful	personalized technology	distributed technology	integrative technology	mentor technology	genius-technology	gamification technology	technology of innovative culture development	foresight technology	technology of pedagogical facilitation	noxology technology

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In % before the experiment	53	57	72	61	79	54	51	52	56	54	55	56
At the first stage of the experiment	34	62	86	42	86	61	65	32	77	23	41	36

The majority of the observers emphasized that technologies such as system-target, distributed, technology, gamification, foresight technology, technology of pedagogical facilitation, noxology technology, are not rejected: to implement them, we need a management model and organizational and pedagogical mechanism of implementation of these technologies (with its functions and indicators).

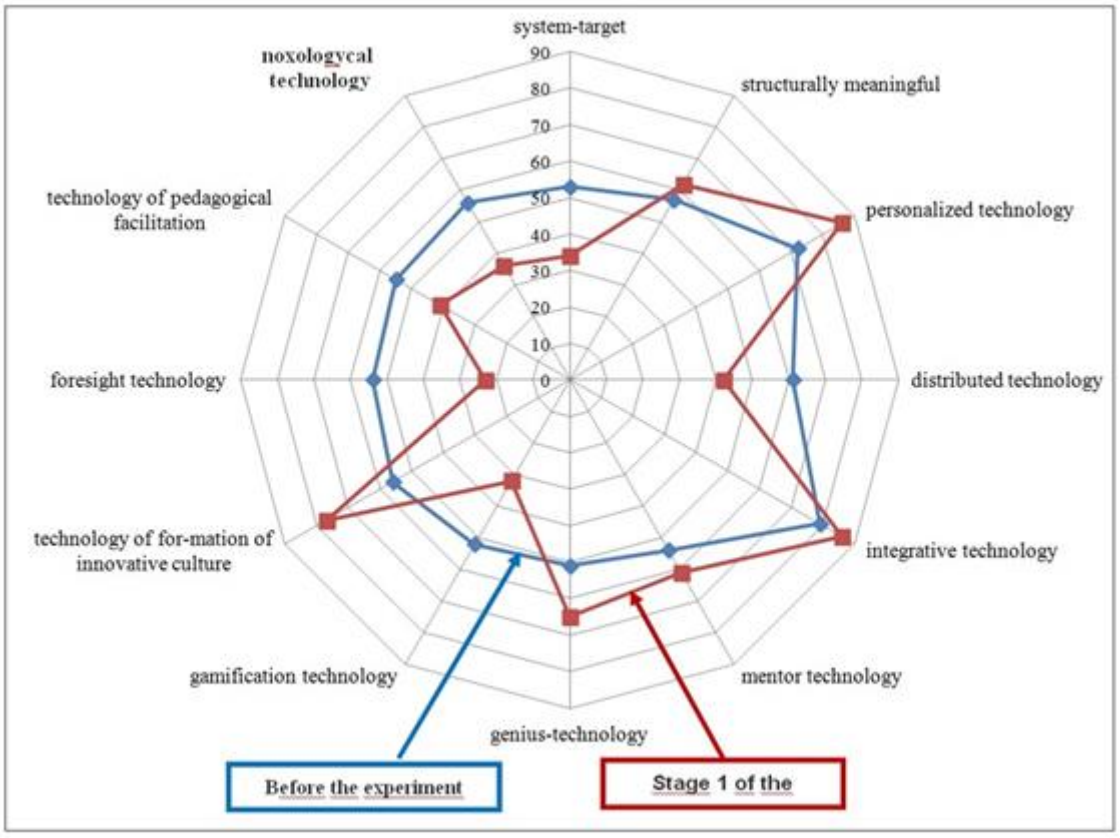

Figure 01. Relevance and strategic value of technologies from the observers' view point before and after the experiment

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Thus, the content of the final stage of the experiment was developing a model, a mechanism for the implementation of the technologies.

6.3. Stage 3 of the study

The model of teacher education

The analysis of significant problems, relevant tasks and strategic initiatives proposed by University professors in the questionnaires were systematized in the matrix which led to the conclusion that in the model the goal, objectives, principles and a specific set of technologies should play a special role.

As a result, it was found that the model should conceptually include the following:

Purpose – a systematic and predictive monitoring of the problems in teacher education, defining effective technologies of psycho-pedagogical and subject-methodological education, their implementation at the level of undergraduate, graduate, and continuing education.

Tasks: improving the professional competence of the future teacher in innovation activity; developing the future teacher's skills in the information and educational environment; developing readiness for life-long self-education; developing the content of teachers education including development of all components of innovation activity, etc.

Principles: the principle of Baseline Assessment of students' motivational needs; the principle of taking into account the psychological structure of pedagogical activity as a process of solving methodological problems; taking into account the components of the operating structure of the problem to be solved; best practices in combination of theoretical knowledge and practical actions; working out the components of operational activities; the principle from simple to complex – from mastering the individual components of the structure of activity to combining them in a single system; the principle of continuity connected with integrating theory with continuous University and postgraduate practice.

Technologies: system-target technology, structurally meaningful technology, personalized technology, distributed technology, integrative technology, mentor-technology, genius technology, gamification technology, technology of innovative culture development, foresight technology, technology of pedagogical facilitation, noxology technology.

Functional mechanism

The study of the mechanism of technological renovation of the content of teacher education (based on questionnaires of respondents-teachers, students, employers) allowed drawing the conclusions that the following functions are currently relevant:

system monitoring of technological support of pedagogical education, scientific achievements in the field of fundamental (subject) science (mathematics, physics, chemistry, etc.), in the field of applied science (psychology, pedagogy, methodology), advanced innovative practice;

conceptualization of data of system monitoring of technological support for the content and the system of pedagogical education;

informatization and gamification of teacher education technologies;

systematization and classification of technological content of teacher education;

forecasting and synergetic analysis, technological support of teacher education of the future;

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reflexion, which involves the analysis of technologies from the point of view of personal contact of a student with the teacher and self-analysis of the student's cognitive, moral and ethical sphere of their future professional activities;

feedback – analysis of technologies of interaction between the University and educational institutions;

continuity – analysis of technologies in terms of training and professional development of educators.

Introducing the technologies at the final stage of the study (in conditions of specification of goals, objectives, principles, functional mechanism at methodological seminars, workshops) allowed to obtain new results (see Table 2, Figure 02). It shows that all technologies, according to respondents assessments, received meaningful characteristics as relevant and strategic (from 65% to 97%), they surpassed the initial level and the level of the first stage of the experiment (see Figure 02).

Technologies efficiency

In assessing the effectiveness of technologies, we took into account the indicators of quality of education, identified by respondents in the analysis of relevant and strategic characteristics of pedagogical education technologies.

Table 02. Relevance and strategic value of technologies from the observers' view point at the final stage of technology testing

No.	1	2	3	4	5	6	7	8	9	10	11	12
Technologies	system-target	structurally meaningful	personalized technology	distributed technology	integrative technology	mentor technology	genius-technology	gamification technology	technology of innovative culture development	foresight technology	technology of pedagogical facilitation	noxology technology
At the final stage of the experiment	76	79	89	92	95	97	67	75	65	77	92	65

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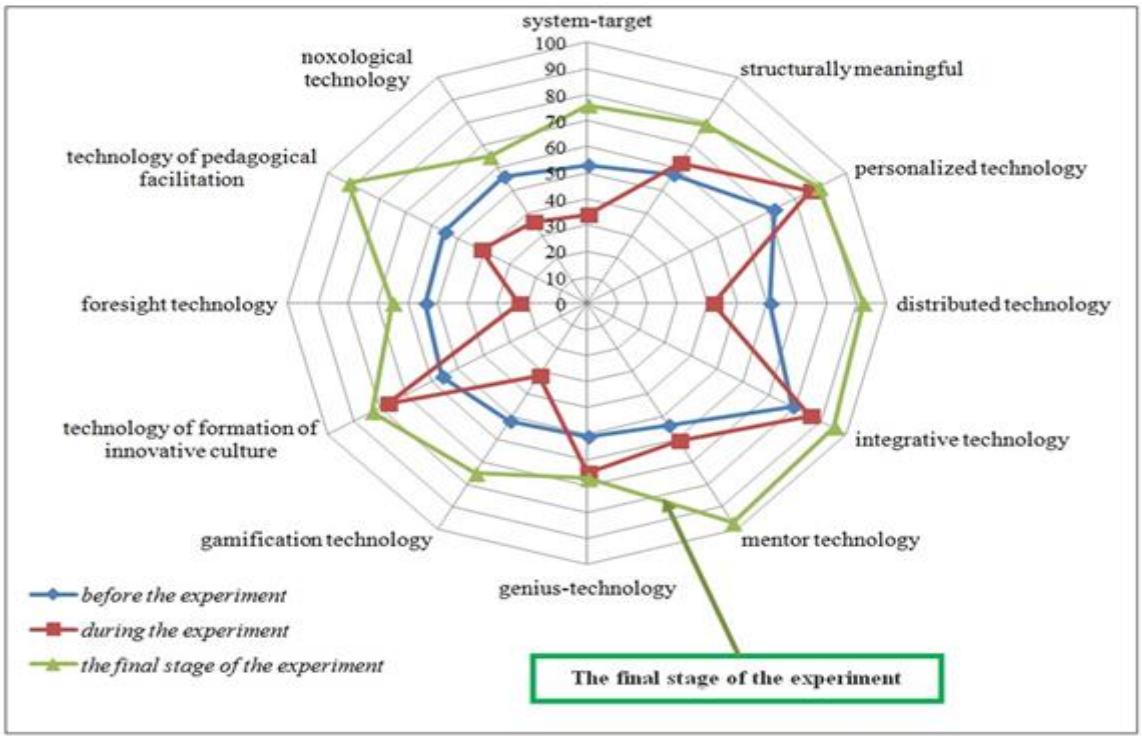

Figure 02. Relevance and strategic value of technologies from the observers' view point at the final stage of the experiment

These included the indicators:

of personal self-realization – the degree of creative self-realization of the student's personality in the classroom was taken into account;

empathic interaction – we took into account the ability of a teacher to find personal contact with a student;

reflexive environment – the ability of the teacher to create a reflexive field (the field of emotional lift, countenance, happiness);

cognitive activity – the ability of the teacher to organize cognitive activity based on the values of the student, to have a positive impact on these values;

communicative core – the ability to make communication topical, interesting, exciting, when the next result of communication falls into the student's "memory trap";

naturalness – the ability to individualize the learning process, to determine for each student an individual route of independent cognitive and creative activity;

interactive and attractive communication – the ability to make educational communication active, attractive, inviting by using traditional and innovative teaching aids;

effective learning – the ability to provide positive dynamics in learning, measured by points (while testing, examining, etc.), the number of positive or negative feedback from employers (heads of educational institutions, district and city departments of education).

Evaluation of the effectiveness of the technologies with these indicators was used in the analysis of the quality of classes and proved to be beneficial (Gabdulchakov & Likhacheva, 2018). During the study, a technological procedure was developed within three levels of expression of self-realization, empathic interaction, etc.

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For example, for the indicator of personal self-realization the questions were: 1) prefers to follow instructions, orders of the teacher (positive answer "+" means about 30% of the intensity of the indicator); 2) seeks to bring "his own", original in the process of completing the task, instructions (positive answer "+" means another 30% of the intensity of the indicator, the sum is about 60%); 3) always likes to perform any task in his own way, makes original proposals up to creating his own project (positive answer "+" means another 30% of the intensity of the indicator, the sum is from 90 to 100%). All indicators were calculated similarly.

The use of this technique in the context of the implementation of relevant strategic technologies showed positive dynamics (see Table 3).

It is noteworthy that the indicators focused on the diagnosis of the level of development of procedural qualities of an individual (personal self-realization, empathy, reflection, etc.) correlated with the indicator of effective learning. The growth of effective learning, recorded by the results of control tests, examination questions and tasks, was 38% (from 45 to 83%).

Table 03. Indicative assessment of the quality of education before and after the experiment in %.

No.	Indicators	Before the Experiment	After the Experiment
1	Personal self-realization	43	76
2	Empathic interaction	35	68
3	Reflexive environment	21	55
4	Cognitive activity	34	79
5	Communicative core	40	77
6	Naturalness	46	82
7	Interactive and attractive communication	28	78
8	Effective learning	45	83

The study used Spearman's rank correlation coefficient (Gmurman, 2004). It allowed to establish the dependence of professional knowledge of future teachers on the degree of development of procedural (intellectual, mental, communicative, etc.) personal qualities.

The study proved that the distinguished in the survey of teachers, students, employers technologies – of system target, structurally meaningful, personalized, distributed, integrative, mentor technology, genius technology, gamification technology, technology of innovative culture development, foresight technology, technology of pedagogical facilitation, noxology technology – are of urgent and of strategic importance: they have a positive impact on the quality of teacher education.

Indicators of personal self-realization, empathic interaction, reflexive environment, cognitive activity, communicative core, naturalness, interactive and attractive communication, effective learning demonstrated an increase in the level of development of not only the procedural qualities of an individual, but also the level of subject and professionally significant knowledge. Thus, the functional mechanism of technological renovation of pedagogical education is an important condition for the implementation of relevant strategic technologies, the condition of the effectiveness of pedagogical education.

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7. Conclusion

In the conducted research the technologies having urgent and strategic importance for pedagogical education in Russia were proved. As a result of experiments carried out in several countries, it was possible to reveal the functional mechanism of technological renovation, including several stages:

1) development and analysis of the significant issues' matrix of technological renewal, allocation the technologies that are relevant and strategically important;

2) design and implementation of organizational and pedagogical model of technological renovation in the conditions of the University complex;

3) realization of functions, indicators, indexes of technological renovation of pedagogical education, diagnostics and monitoring the quality of pedagogical education.

As a result of the research it is proved that the relevant strategic technologies implemented through the functional mechanism have a positive impact on the quality of teachers education in the University complex (teachers of mathematics, physics, biology, etc.).

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