

## Problems of preservice teachers on technological pedagogical knowledge skills

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### Suggested Citation:

Tugelbayeva, T., Eleupanovna, Z. A., Tokkulova, G., Nizamova, M. & Kulzhanovna, Y A. (2020). Problems of preservice teachers on technological pedagogical knowledge skills. *World Journal on Educational Technology: Current Issues*. 12(4), 361-372. <https://doi.org/10.18844/wjet.v12i4.5189>

Received from 25 July, 2020; revised from August 12, 2020; accepted from October 10, 2020.

Selection and peer review under responsibility of Prof. Dr. Servet Bayram, Yeditepe University, Turkey.

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### Abstract

This study aimed to determine problems of preservice teachers on technological pedagogical knowledge skills. The socio-economic transformations taking place in the country indicate the presence of a society's need for a person who has the ability to set goals and achieve them independently. In this regard, education is faced with the task of forming the personality of the future teacher as a subject capable of diagnosing the process and results of its activities. However, the educational technologies used at the university most often alienate students from educational activities, offering ready-made goals, ways to solve them, and thereby exclude them from the diagnostic process. A change in the modern educational situation actualizes the formation problem of technological pedagogical knowledge skills in a future teacher. The article deals with the development of a scientifically-based system for preparing students for diagnostic activity, which includes theoretical and practical training at the university. The practical significance of the research results lies in the possibility of using the developed methodological recommendations in the practice of training specialists in the field of primary education.

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**Keywords:** Technological pedagogical knowledge, skills, knowledge assessment, preservice teachers, teacher education.

## Introduction

Research in the field of teacher education has improved significantly in relation to how teacher education is perceived or what understanding prevails. Different understandings closely affect the focus, method, interpretation of results and application of researches in the field of teacher education. These understandings of teacher education are grouped under four headings in the literature: program-oriented teacher education, training-oriented teacher education, learning-oriented teacher education and product-oriented teacher education (Mahmood & Hussain, 2017).

Teacher education is an important issue, so it has been on the agenda for a long time (Akca, Demir & Yilmaz, 2016). Teacher efficacy and the quality of the education they receive should be the focus to make all learners in all development fields reach the desired level, become a beneficial individual for their countries and for themselves, grow by having independent thought (Onder & Karatas, 2016; Degirmenci-Uysal, 2017). It is an accepted fact on the part of researchers that the relationship between teachers and teaching qualifications significantly affects society (Ozcan & Genc, 2016, Agranovich, Y., Amirova, A., Ageyeva, L., Lebedeva, L., Aldibekova, S., & Uaidullakzy, E. 2019). The National Science Teachers Association (NSTA) recommends that the science education community supports twenty-first century skills – embedded in student outcomes and defined as creativity, innovation, critical thinking, problem solving, communication, collaboration, personal responsibility, global awareness, social/intercultural skills, team learning and mastery of rigorous academic content – consistent with the best practices across a science education system, including curriculum, pedagogy, science teacher preparation and teacher professional development (Zorluoglu, Kizilaslan, & Donmez Yapucuoglu, 2020; Bagila, Kok, Zhumabaeva, Suleimenova, Riskulbekova & Uaidullakzy, 2019). At present, the ongoing modernization of general education puts forward the first plan for the development of the child's individuality, his ability and inclination, disclosure of creative personality potential, starting from the moment of entering the first grade in a comprehensive school. Therefore, a modern teacher of primary classes should implement training, be able to control the process of constant change of the pupil and ensure that he is at a higher level of his development, to carry out research pedagogical search, deciding on the scientific basis the problem of personalization of a child (Mola & Kelkay, 2020).

The main direction of the modern educational process is characterized by the appeal to the pupil, the search for conditions on supporting a person in self-actualization, in disclosure and development of personal potential, in the elevation of the need to "fulfill him/herself." (Silva & Alves, 2019; Guller & Tokuc, 2020). All of these aspects is possible only if there is an objective "feedback", provided that the school teacher studies the individuality of growing personality. Objective feedback can be ensured by a pedagogical diagnosis. The technological pedagogical knowledge essentially changes the value-technological setting of the teacher, as it is aimed at studying the personality and the processes of its establishment, finding ways of pedagogical help to the schoolchild in educational process (Ongozy & Aksoy, 2015).

The relevance of the present study is due to the modern strategy for updating the content of education, a new paradigm of education - a personality-oriented approach. On the one hand, our research work on the real state of preparation of a future teacher at a pedagogical university for diagnostic activities showed that graduate students actually do not have diagnostic knowledge and skills, do not see the need for pedagogical diagnosis. On the other hand, having familiarized ourselves with the elaboration of the problem of preparing a teacher for diagnosing the educational process, we revealed that the issues of the formation for technological pedagogical knowledge skills of primary school teachers in the country's education system have not yet been studied. Modern ideas and concepts of humanistic pedagogy are aimed at stimulating the subjectivity of the learner, at creating pedagogical conditions for his self-knowledge and self-development (Stafeeva et al., 2020).

In this regard, there are contradictions between:

- Increasing demands of modern society on the subjectivity of the future teacher and the insufficient readiness of higher education to form it;
- Overdue in educational practice, the need to master diagnostic skills and not fully developed their essence, structure and technology of their formation in pedagogical theory;

- The requirements of a modern school for the diagnostic skills of primary school teachers and their insufficient formation among students of a pedagogical university.

Taking into account the revealed contradictions, a research topic was chosen, the problem of which is formulated as follows: the formation of pedagogical diagnostic skills of the future primary school teacher in the educational process of a pedagogical university.

In the course of the study, we proceeded from the hypothesis that the formation of technological pedagogical knowledge skills in a future teacher in the educational process of a pedagogical university will be more effective, if:

- pedagogical diagnostic skills are considered as a set of controlling, evaluative, analytical, corrective, prognostic skills;

- students are aware of the need to master the skills of pedagogical diagnosis;

- the organization of diagnostic activities is based on a personal-activity approach, which involves the development of the student's subjectivity, his individual capabilities, the development of teaching technologies;

- the main criteria for the formation of pedagogical diagnostic skills are awareness, generalization, independence, which determine the readiness of a future teacher for diagnostic activities in the professional field;

- the process of forming the skills of technological pedagogical knowledge will be modeled, including three blocks (theoretical and methodological, psychological and pedagogical, technological), where the educational tasks that are diverse in type, level and functions and ensure the phased mastery of the required knowledge and skills (motivation, algorithmization, forecasting).

In the recent years, research in the field of technological pedagogical knowledge has been conducted in various directions in the pedagogical sciences. Literature analysis related to the research topic was conducted to investigate the meaning of 'diagnosis' in the field of psychology and pedagogy is devoted to the general methodological issues of diagnostics. The essence of diagnosis at a philosophical level was determined by many studies cited in the literature (Golubev & Bitinas, 1989; Nemov, 1994; Gurevich, 1999; Smirnov, 2001; Efremov, 2001; Skopylatov, 2001; Vorontsov, 2001). Philosophy considers diagnostics as a specific type of cognition that differs from other types of cognition, although it is associated with them. So, it is explained that the diagnosis (dia - between, apart, after, through, times; gnosis - knowledge) as a special intermediate type of cognition, standing between the scientific knowledge of a general, internal, regular essence and the recognition of a single, external, random, concrete phenomenon.

Summarizing the philosophical approaches to the diagnostic process, in our opinion, several stages can be distinguished in it. First of all, the identification and recognition of the diagnostic features inherent in a given object and their identification with the phenomenon of its essence. At the same time, the essence of recognition is reduced to the reflection of a phenomenon, a process, its signs, relationships, interrelations. Further, the diagnostic process includes the formulation of a final diagnosis, by which in philosophy it is customary to understand the conclusion that an entity belongs, expressed in a single, to a specific class established by science, type, and a number of objects. The final stage is that the acquired knowledge is put into practice to select the appropriate means of influence and turn into actions to control the system, object and control over their condition. At the same stage, forecasting and modeling of the possible future of the diagnosed system are carried out. The final stage for diagnosis is the goal, source, means of recognition and the criterion of its truth. The problem of the formation of pedagogical diagnostic skills and their components was considered by researchers in a holistic pedagogical process (Verbitsky, 1991; Gorbunova et al., 2018); in educational activities, during the formation of sensory control and evaluation, through forecasting and modeling activities.

In psychology, the diagnosis is understood as "the end result of the psychologist's activity, aimed at describing and elucidating the essence of the individual psychological characteristics of a person with the aim of assessing their current state, predicting further development and working out recommendations determined by the task of psycho-diagnostic examination". It is distinguished symptomatic, etiological and typological diagnoses. The symptomatic diagnosis is limited to stating certain features (symptoms), on the basis of which practical conclusions are drawn. The etiological diagnosis takes into account not only the

presence of certain symptoms, but also the causes of their occurrence. The highest level is a typological diagnosis. It determines the significance of the data obtained in a holistic, dynamic picture of the personality.

An analysis of the definitions of the term "skill" revealed the versatility of its properties, the ambiguity of the use of this term, in the interpretation of which significant differences are observed. The closest to us is the approach to skill as an action category of Leontiev, who interprets the skill as a separate activity aimed at achieving a specific goal, including an agreed system of mental and practical actions. This approach allows us to reveal from the position of the theory of activity both the substantive and operational sides of the skill.

In the psychological and pedagogical literature, skills in educational activities are classified from different perspectives. From the position of the subject of activity in learning, the actions of goal-setting, planning, performing actions, actions of control (self-control), assessment (self-esteem) are distinguished. Each is associated with a particular stage of educational activity and implements it. From the perspective of the subject of educational activity - transformative, research activities. The internal mental activity of the student, which is an integral part of the educational activity, is composed of mental, perceptual, mnemonic, intellectual actions. In educational activities, they also distinguish between reproductive and productive actions.

Diagnostic skills in the educational activity of the educational process of a pedagogical university can be represented by a combination of pedagogical diagnostic skills aimed at monitoring and evaluating the conformity of the result of its goal, analyzing the causes of the existing discrepancy, correcting deficiencies using the selected technology, predicting further transformation of the result of the activity.

The problems of control and evaluation, which are closely related to the diagnosis, are addressed by psychologists and teachers, methodologists-mathematicians (Zhumabayeva et al., 2019; in the context of integrated teaching of diagnostic skills, they are considered in their papers. One of the basic requirements for a primary school teacher is a good knowledge of the disciplines taught and the methods of teaching them. An elementary school teacher should be adequately prepared for the successful implementation of his ever-increasing responsibilities in accordance with the requirements of school reform. A primary school teacher should have a broad scientific outlook, providing the possibility of teaching younger schoolchildren at a high scientific and theoretical level, be able to creatively solve pedagogical problems, and apply his knowledge in practice. His professional training should ensure the effectiveness and quality of teaching disciplines (Jenkins, 1996).

In theoretical studies on the psychological characteristics of the teacher's work, the following main functions of the teacher are noted, the implementation of which mainly consists of the teacher's activities. Based on the activities of primary school teachers and on the basis of the study we conclude that the formation of diagnostic skills in future teachers is ensured by the following pedagogical conditions:

a) *Psychological and pedagogical*: students are aware of the need to master diagnostic knowledge and strive to master the skills of technological pedagogical knowledge as the main component of pedagogical activity;

b) *Organizational and pedagogical*: the organic inclusion of diagnostic knowledge in the content of the studied disciplines; the organization of consistent and systematic implementation by students of various combinations of cognitive and technological actions with the help of educational tasks and educational pedagogical tasks that simulate the diagnostic study of pedagogical phenomena in different types of teacher interaction with children;

c) *Didactic*: the content of diagnostic knowledge corresponds to the current level of development of technological pedagogical knowledge ; ensuring the development, reproduction and modeling of diagnostic actions of students by appropriate technology for the study of pedagogical disciplines.

When developing the technology for the formation of diagnostic competence, it is stated that pedagogical technology is a model of joint pedagogical activity for the design, organization and development of the educational process, which provides optimal conditions for a well-thought-out teacher and students. At the same time, technical standards for possible deviations from the ideal model are mandatory. The achievement of the planned results within their borders must be guaranteed. Accordingly, the idea of considering pedagogical technology as a "model of joint pedagogical activity", which provides for the implementation of three main parts of the teacher's professional knowledge are determined (Gordon, Kane & Staiger, 2006). In this sense, it is considered that the technology of forming diagnostic qualifications as a

program included in the program of methodological education of future primary school teachers, which takes into account the implementation of three components: indicative (project), performance (organization and development of the educational process), and reflexive evaluation (analysis of planned results). This study aimed to determine problems of preservice teachers on technological pedagogical knowledge skills.

## **Method**

### ***Research Model***

Experimental research method was used in the study. This method is used to make a conclusion about the cause-effect relationships between the variables studied in an experimental study. The planning phase of these research methods is easy and fast, but difficult and time consuming to execute. This research method can be divided into two bases as full and semi-experimental, and the main factor of this distinction is whether the groups in the experiment are formed randomly or not (Aydogdu, Karamustafaoglu & Bulbul, 2017).

### ***Participants***

Participants of the study included preservice primary school teachers of general education schools, to be more precise, students who are studying in the specialty *6B01301-Pedagogy* and the methodology of primary education.

### ***Data Collection and Implementation***

During the pedagogical experiment, the following main tasks were solved:

1. To check the conditions for improving the quality of training of a future primary school teacher, which were theoretically justified at the general theoretical, technological, operational stages of designing the process of formation of pedagogical diagnostic skills in a future primary school teacher.
2. To establish the dynamics of changes in the studied characteristics of the personality of students who studied by experimental methods. Compare the results obtained in experimental training, with similar results obtained in traditional teaching. To show the representativeness of the sample of experiment participants in Kazakh National Pedagogical University named after Abai.
3. To analyze the results of experimental work in order to develop recommendations for improving the quality of training of a future primary school teacher.

At the end of the course, it is expected that future teachers will develop the following pedagogical skills: monitoring, evaluation, analysis, correction and forecasting of the process and the results of their own activities and the activities of others, etc.

In accordance with the objectives and logic of the study in the pedagogical experiment, three main stages were identified: ascertaining, formative and control.

In a *ascertaining* experiment, the state of training of future primary school teachers, its conditions were studied, the methodology for conducting the formative and control stages was designed, the participants in the formative and control experiment were selected.

In the *formative* experiment, the research hypothesis was tested; the methodology and conditions for the preparation of the future primary school teacher were specified.

In the *control* experiment, the results obtained in the formative experiment were checked, the representativeness of the sample of the experiment participants was generalized, the data obtained were generalized, and recommendations were developed to improve the quality of professional training of the future primary school teacher.

To increase the level of reliability of the results of the pedagogical experiment, their processing was carried out by various methods. In the experiment questionnaires, testing, self-esteem, modeling of pedagogical processes were used. In the complex of diagnostic measures, surveys, conversations, interviews,

statistical and analytical processing of experimental data, as well as an expert assessment method were also used.

When designing and conducting a pedagogical experiment, we relied on the methods developed by Grabar, Krasnyanskoy, Kraevsky, Lyusin, Medvedev, Sidorenko. When processing the experimental results, we used statistics of criteria  $\chi^2$  (khi-square) and G - criterion of signs.

The statistics of the % criterion for independent samples was calculated by the formula (1):

$$T = \sum_{j=1}^c \frac{n_j^2}{n}$$

where  $n_j$ ,  $n$  is the volume of independent samples of participants in the experiment;

$O_{li}$  - frequencies (number of students who have reached a given level of formation of pedagogical diagnostic skills);

$c$  is the number of categories into which the results of measuring the state of the studied property are distributed.

### Data Analysis

The statistics of the G - criterion of signs made it possible to determine which way in one sample as a whole the value of the studied characteristic changes during the transition from the first measurement to the second, as well as compare the shifts of the characteristic in independent samples.

The analysis of the content of tests, educational and research tasks was carried out by experienced teachers - university experts. The experts also determined the degree of difficulty of the task and, in accordance with this, assigned it a criterion score. Before the start of the examination, the content of the minimum set of knowledge and skills of the student who has mastered the educational material was discussed. We determined the criterion score ( $G$ ) in accordance with the method developed by Lyusin.

According to this technique, the significance index of each task was calculated -  $R$ ; it shows how the correct solution to the problem is important to determine the degree of assimilation of the material. The significance of the  $z$  task was determined on a five-point scale. The expert's assessment of this task: "absolutely required" - 5 points ( $z = 5$ ); "very desirable" - 4 points ( $z = 4$ ); "desirable" - 3 points ( $z = 3$ ); "preferred" - 2 points ( $z = 2$ ); "not required" - 1 point ( $z = 1$ ). The significance of the task  $z$  was transferred into the indicator of significance  $R$  according to the formula (2):

$$R = \frac{\sum z \cdot n}{n}$$

where  $n$  is the number of experts;

$z$ , is the significance assessment by the expert.

The criterion score  $G$  of the training assignment for each level (high, medium, low) was obtained by adding the significance indicators  $R$  for all tasks of this assignment.

$$G = \sum_{j=1}^k R_j$$

where  $k$  is the number of tasks (questions) in the task;

$j$  is the current task number.

Two threshold points are determined by experts:  $G_{low} < G < G_{high}$ . If the student scored less than  $G_{low}$  points according to the results of the assignment, then his knowledge and skills correspond to a low level of formation of the property being examined; if more than (equal to)  $G_{low}$ ,  $G_{high}$  less than  $G_{avg}$  - the average level; if more than (equal to)  $G_{high}$  - high level.

A summary of the participants and the timing of the pedagogical experiment is given in table №1.

**Table 1. Data on the participants and the terms of the experiment**

Type of experiment	Terms of the experiment		Group	Number of students in the group	
	beginning course	ending, course		Exper.	Contr.
Ascertaining	2005,2 c.	2005, 5 c.	P -21, P -22 P-511, P -521	25,25	22,21
Formative	2005,2 c.	2008, 5 c.	beg.: P - 21, P - 22 ending: P -512, P -522	25	25 22
Controlling	2008,5 c.	2008, 5 c.	P-511,P-521, P - 512, P-522 P -51, P -52	23 20	22,21 22 22

Designations: P - specialty: pedagogy and methodology of primary education, c-course,

## Results and Discussion

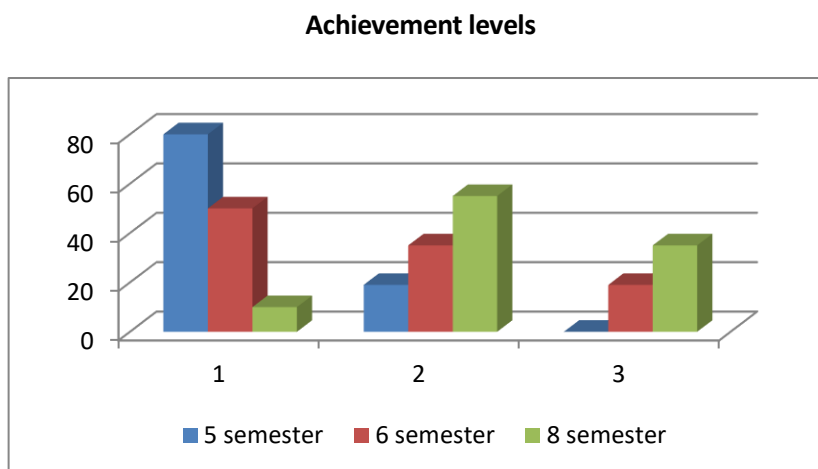
At the ascertaining stage of the experiment, the experimental and control groups were selected at KazNPU named after Abai: P - 21 - experimental, P - 22 - control groups of third year students (5th semester), who later participated in the forming experiment, and P -511 and P - 521 of 4-year students (7th semester), 2020 graduates, who later participated in the control experiment; third-year groups: P - 21, P - 22 and fourth-year groups: P - 511, P - 521 were compared, thereby determining the influence of the traditional methodology on the degree of formation of the diagnostic skills of the future primary school teacher.

At the formative stage, with the group P - 21, experimental work began on the formation of diagnostic skills, which lasted for 4 semesters in the 2018/2019 - 2019/2020 academic years. The control group P - 22 was trained according to the traditional method. Conventionally, two stages of the formation of students' pedagogical diagnostic skills were identified: general professional and special. At the beginning and at the end of each of the stages (5<sup>th</sup> semester, 6<sup>th</sup> semester, 8<sup>th</sup> semester) a "knowledge assessment" was conducted and the comparative results of the experimental and control groups were analyzed. Then, the experimental group indicators were compared: P - 512 (2019) and the control group: P - 511, P - 511, selected and tested in a stating experiment in 2018. This way the influence of the experimental methodology on the formation degree of the diagnostic skills of the future primary school teacher was determined and the contribution of the experimental technique was revealed. In addition, the results of the control group P - 522 (2020) and the control groups P - 511 and P - 121 (2018) were compared. This was necessary to ensure the sample representativeness of the participants in the forming experiment.

The control experiment was carried out in two stages: at the first stage, the degree of formation of the skills of technological pedagogical knowledge in groups P - 51 and P - 52 of Zhetysu State University (ZhGU) was determined. The results were compared with experimental P - 512 and control P - 522 groups of the Abai KazNPU, which made it possible to judge the samples representativeness of the the experiment participants in the Abai KazNPU. The second stage was carried out at ZhGU, where the group P - 51 was divided into two subgroups P - 51 - experimental and P - 51 - control of 10 people each. The experimental subgroup P - 51 was subjected to pedagogical influence, the control subgroup P - 52 was not subjected to additional exposure. For subgroups, the change in the studied trait was determined.



Formative experiment was carried out in two stages: general professional and special. Figure 1 shows the distribution of students from the experimental group according to three levels of pedagogical diagnostic skills formation in the 5<sup>th</sup> semester (2018), in the 6<sup>th</sup> semester (2019) and in the 8<sup>th</sup> semester (2020).



**Figure 1. The distribution of students of the experimental group by three achievement levels in 5<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup> semesters**

As it can be seen from the above data, the number of students who were at a low level (1) decreases from semester to semester. The number of students at the average (2) and high (3) levels is constantly growing, that is, there is a positive trend. This indicates the effectiveness of the special course on the topic “Formation of technological pedagogical knowledge skills in future primary class teachers” for the formation of technological pedagogical knowledge skills for future teachers of primary grades.

To determine whether these changes are statistically significant, the experimental and control groups of one (2020) year of production were compared. At the end of the second (special) stage of the formative experiment, in the 8<sup>th</sup> semester in the experimental P - 512 and control P - 552 groups, a "knowledge assessment" of the formation degree of pedagogical diagnostic skills was carried out. The results presented in Table 1 show that there are differences between student achievements in these samples. Let’s determine whether they are statistically significant. For this, we calculate the observed value of the statistics of the criterion  $\chi^2 - T_{obs}$ . It turned out to be equal to 7.484. The critical value of statistics is  $\chi^2: T_{cr} = 7.378$ , which are determined for the number of degrees of freedom  $\nu = 2$  and significance level  $\alpha = 0,025$ ,  $T_{obs} > T_{cr}$ . Therefore, we can reject the null hypothesis, which states that at the significance level  $\alpha = 0.025$  there are no statistically significant differences between the experimental and control groups. Konst & Kairisto-Mertanen, (2019) mentioned the importance of teacher education in the literature review she made from pedagogy education

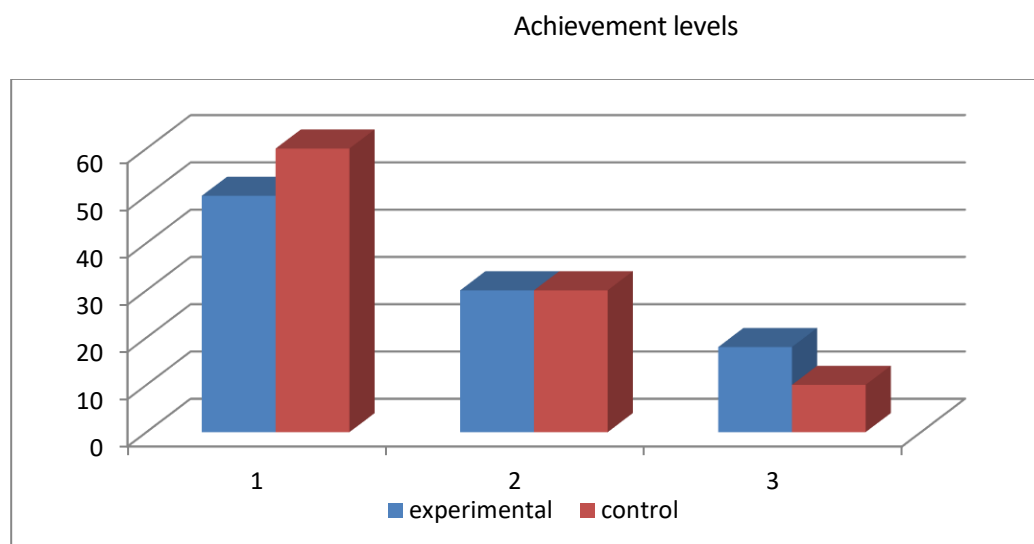
**Table 2 - Results of achievements’ comparing of 4<sup>th</sup> year students in experimental P - 512 and control P - 522 groups at the second stage of the forming experiment**

Groups	Levels			Number of students
	Low	Medium	High	
Experimental	Q11 = 2	Q12 = 13	Q13 = 8	23
Control	Q21= 10	Q22 = 9	Q23 = 3	22

Thus, the experimental methodology makes a more noticeable contribution (with a probability of 97.5%) than the traditional methodology in the formation of technological pedagogical knowledge skills in a future primary school teacher.

Comparing the formation degree of pedagogical diagnostic skills among graduates of the 2020 experimental group P - 512 and graduates of the 2019 control groups P - 511 and P - 521, we also obtained statistically significant differences (Figure 2).

It turned out that graduates of 2020 who studied using experimental technology are more prepared for work in primary school than graduates of 2019 who studied using traditional technology (with a 95% probability).



**Figure - 2. Distribution of 4<sup>th</sup> year students in the experimental and control groups according to the formation level of skills of pedagogical diagnostic skills at the end of the forming experiment.**

A comparison of the formation degree of pedagogical diagnostic skills among graduates of the 2020 control group P - 522 and 2019 graduates of the control groups P - 511 and P - 521, who were trained using traditional technology, showed the absence of statistically significant differences at the significance level  $\alpha = 0.1$ . This is one of the evidence of the sample representativeness of the participants in the forming experiment.

At the first stage of the control experiment, the formation degree of the skills of technological pedagogical knowledge in the groups P - 51 and P - 52 (ZhGU) was determined, the results were compared with the experimental P - 512 and control P - 522 (KazNPU named after Abai) group. It turned out that in the first case (with a probability of 95%) the differences are statistically significant, in the second - insignificant. In addition, this experiment made it possible to judge the samples' representativeness of the experiment participants in KazNPU named after Abai.

At the second stage of the control experiment, which was conducted at ZhSU, for the subgroup P - 51, the elective course was taught: "Formation of technological pedagogical knowledge skills in future primary class teachers" (18 hours), developed based on the materials of the author's textbook; practical classes were held (8 hours), saturated with professionally oriented tasks; for this group, the change in the studied trait was determined. We used a criterion of signs that is very sensitive to the slightest changes in the studied trait G - criterion of signs. This criterion made it possible to establish that, in general, the value of the sign of the motivational-value attitude of students in technological pedagogical knowledge in the experimental subgroup has improved. In the control subgroup, no such change was observed.

Comparing the results obtained at different stages of the pedagogical experiment, we observe positive dynamics. However, not all students achieved high indicators, as in one group there were students with

different abilities. Based on the results of the formative and control experiments, we were convinced that, during the implementation of a specially designed course over several academic semesters, it is possible for students to form effectively all the components of technological pedagogical knowledge skills we identified in the study for the future primary school teacher. Therefore, the experiment proved the validity of the hypothesis of the study.

Based on the study, the following main conclusions were made:

1. The process of designing the formation of pedagogical diagnostic skills for a future primary school teacher should be carried out at four successively implemented levels: general theoretical, technological, operational, implementation, each of which is characterized by its goals, objectives, conditions, methods and means.

2. Putting into practice the work of a pedagogical university, a system for designing the formation of pedagogical diagnostic skills will increase the efficiency of the educational process and solve the research problem at the modern level.

3. The ability to diagnose pedagogically is a personal characteristic of a future primary school teacher formed in the process of education that allows you to engage in professional activities with the necessary quality established by the State Social Protection Standards of the Republic of Kazakhstan and regulatory documents governing the process of training and education of primary school students.

5. Diagnosis of the professional training quality of future specialists at the Department of Pedagogy and Methods of Primary Education, including levels, criteria and indicators of the formation of technological pedagogical knowledge skills in a future primary school teacher, allows monitoring the quality of education at the pedagogical institute and managing this process.

It is consistent with other studies. The problem of the formation of pedagogical diagnostic skills and their components was considered by researchers in a holistic pedagogical process (Verbitsky (1991), Vorontsov (2001), Gorbunova (1999), Zimnyaya (1997), Tyunyaeva (1998), Slastenin (Slastenin, 2000), Smirnov (2001), etc.); in educational activities, during the formation of sensory control and evaluation, through forecasting and modeling activities.

As shown by a theoretical analysis of the literature on this issue, diagnosis is a necessary component of a consciously controlled human activity. This is a special type of cognitive activity aimed at correlating the theoretical level of knowledge with the properties of a particular object in order to control the diagnosed system, which is carried out in the process of preventing deviations of the object from the normal state and its transformation.

Diagnostics in the activities of the teacher is associated with the study of the process and the results of their own activities, the activities of the student and their interaction. The skills of technological pedagogical knowledge include actions such as monitoring, evaluating, analyzing, adjusting and predicting the process and results of activities. The pedagogical skills of a student in the educational activity of the pedagogical university educational process are represented by a set of skills that ensure control and assessment of the conformity of the result of its goal, analysis of the existing discrepancy causes, correction of deficiencies through the selected technology, prediction of further transformation of the activity result (Vlasova, Kirilova & Masalimova, 2015; Vedishenkova, Nikitina & Zhumabaeva, 2016).

This study reflects the content of the experimental work, which aimed to verify the formulated hypothetical conditions for the effectiveness of the formation of pedagogical diagnostic skills of a future teacher in the educational process at pedagogical university. Various types of analysis (system, level, comparative) of the data for the ascertaining and formative stages made it possible to identify quantitative and qualitative parameters of technological pedagogical knowledge skills and their formation levels. As a result, the positive dynamics for the pedagogical diagnostic skills' formation of the future teacher in the educational process of the pedagogical university was recorded. The experimental work showed awareness of the need for students to master the skills of pedagogical diagnosis, which was expressed in the desire to find out their performing abilities, to improve the process and the result of individual and collective activities; resolve the contradiction between proper and achieved quality (Konst & Kairisto-Mertanen, 2019).

In addition, students acquired the necessary knowledge for the implementation of technological pedagogical knowledge ; mastered the structure of the diagnostic process - controlling, evaluating, analytical,

corrective, prognostic stages; learned the principles of diagnosis - integrity, determinism, unity of analysis and synthesis; mastered the diagnostic algorithm as a set of control and evaluation, analytical, corrective, prognostic actions of a generalized level, subject to wide transfer.

Analysis of the data of the experimental work confirmed the assumption that it is possible to ensure the effectiveness of the formation of pedagogical diagnostic skills under the following pedagogical conditions: consideration of diagnostic skills as a set of , controlling, evaluative, analytical, corrective, prognostic actions; students' awareness of the need to master the skills of pedagogical diagnosis; organization of diagnostic activities on the basis of a personal-activity approach, which involves the selection of a student as a subject, the development of his individual capabilities and compliance with the principle of cooperation of subjects of education; introduction to the educational process of a set of educational tasks that are diverse in type, level and function and provide for the phased mastery of the required knowledge and skills; assessment of the formation of skills of technological pedagogical knowledge according to relevant criteria (awareness, generalization, independence), which determines the willingness of a future teacher to diagnostic activities in the professional field.

In the course of experimental work at the empirical level, the research hypothesis was proved; fairly reliable information was obtained on a statistically significant increase in the level of formation of technological pedagogical knowledge skills in a future primary school teacher. A hypothetical assumption was confirmed about the possibility of designing a pedagogical technology for the formation of technological pedagogical knowledge skills in a future primary school teacher.

## Conclusion and Recommendations

The practical significance of the research results lies in the possibility of using the developed methodological recommendations in the practice of training specialists in the field of primary education. Characteristics given to different levels of technological pedagogical knowledge skills formation can be used as criteria for assessing the readiness of pedagogical graduates for diagnostics in the professional field. The research materials served as the basis for the development of a special course "Formation of technological pedagogical knowledge skills in future primary class teachers.

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