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## **On the importance of the formation of skills to use methods of mathematical statistics in the formation of analytical competence of future masters of education**

**Abstract.** *The article deals with the problem of the importance of the formation of skills to use methods of mathematical statistics in the formation of analytical competence of future masters of education.*

*The ability to analyze a certain type of activity or pedagogical process to solve a range of professional tasks using a variety of methods of mathematical statistics is the essence of analytical competence. Analytical competence is necessary for solving qualification professional tasks as one of the key components of professional competence of masters of education. It is the main component of the ability to theorize, to find cause-effect relations between phenomena. It is the basis of general abilities and is necessary for the successful development of the student-master of various types of activities.*

*In conducting pedagogical research future masters of education should use the methods that can show a deep and comprehensive description of the phenomenon under study. That is why the formation of analytical competence of masters of education is an urgent problem in the modern educational space and requires further research.*

**The aim of the article** *is to prove the relevance of the problem of analytical competence formation through the analysis of qualifying works.*

**Methods:** *theoretical analysis of scientific sources regarding the interpretation of the term “analytical competence”; empirical – for quantitative analysis of methods used in pedagogical research.*

**Main outcome of research.** *It is proved that the future specialist needs to master various methods of analysis, including methods of mathematical statistics, in order to choose the correct and effective methods for checking the effectiveness of their own scientific-pedagogical research and evaluation of the reliability of the experimental results.*

*The analysis of master’s works in the field of study “Education” and qualifying scientific works of the last years of specialty 015 “Professional education” testified to the presence of such works, in which it was not used the methods of statistical processing of the results of experimental studies. Therefore there is a reason to doubt the effectiveness of the proposed ideas. Therefore, the problem of formation of analytical competence at the master’s level becomes relevant.*

**Conclusions and prospects of further research.** *We see prospects for further research in the development of guidelines for the formation of future masters’ of education analytical skills for the use of methods of*

*mathematical statistics to confirm the reliability of the results of scientific-pedagogical research.*

**Keywords:** *methods of analysis, methods of mathematical statistical processing, future master of education, pedagogical research.*

**Problem statement.** In the context of education informatization, integration of science and industry, the requirements for graduates of pedagogical institutions of higher education are increasing. The most required are not just highly qualified specialists, but specialists who are able to independently orient in the flow of information that changes, able to compare, analyze, summarize, find the best solutions, that is, to conduct research in specific fields of knowledge [13].

Nowadays the system of higher education should be aimed at the formation of not just a professional performer, but a professional researcher, able to easily adapt to rapidly changing conditions, to find solutions to emerging problems through the possession of research skills.

In addition, the presence of self-conducted pedagogical experiment and the correct use of modern statistical criteria for the analysis of experimental data are significant signs of the quality of the pedagogical research [2; 6; 7; 12].

All this puts forward fundamentally new requirements for the preparation of the future master of education as a creative, competent person, able to innovative activity, to solve non-standard professional problems [4; 9].

That is why the problem of formation of analytical competence in future masters of education is an urgent problem, which is preconditioned by the probabilistic nature of pedagogical processes and the need to improve the reliability of the conclusions formed by the results of the study.

**Analysis of modern research.** The question of the use of statistical processing of the results of pedagogical research was put for the first time by S. I. Arkhangelskyi, M. A. Danylov, F. F. Korolev, E. H. Yudin. The importance of this approach to the analysis of research activities was applied by I. I. Andreev, L. H. Viatkin, V. S. Iliin, L. B. Itelson, N. V. Kuzmina, V. S. Lednov, M. I. Makhmutov, V. A. Poliakov, V. A. Slastonin, N. F. Talyzina, etc. [1; 3; 10]. At the same time, a preliminary analysis of educational programs for masters of education, doctors of philosophy in the field of education show the absence or point the study of methods of mathematical statistics for the evaluation of pedagogical research [5]. Therefore, this problem requires updating and solving during the preparation of master's works in the field of education.

Analytical generalization of the problem allowed us to identify contradictions arising between the need for specialists capable of effectively solving scientific and pedagogical problems with the use of mathematical statistics and modern imperfect practice of professional training of future scientists in the field of pedagogy.

**The aim of the article** is to prove the relevance of the problem of analytical competence formation through the analysis of qualifying works.

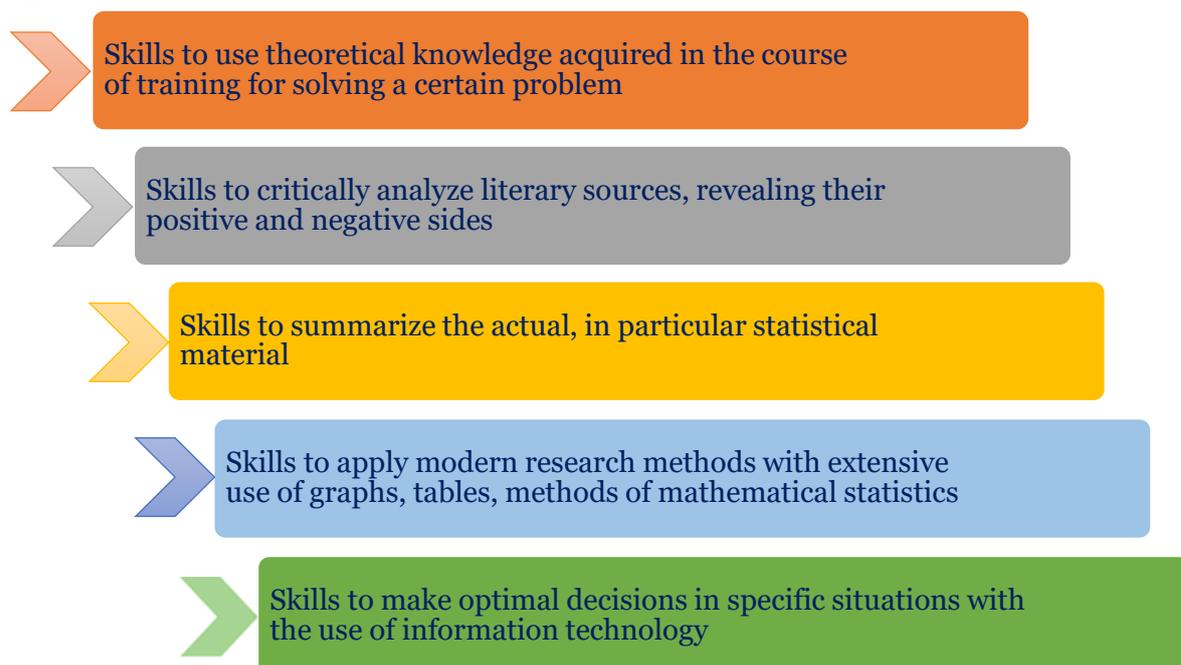
**Presentation of the main material.** Professionalism of the future specialist of the higher educational institution is determined by his ability to set research tasks, plan research, perform research activities, analyze initial data,

by readiness to apply various new methods and techniques for processing the results of pedagogical research and further in his work.

This problem has led to the search for our dissertation research related to the formation of analytical competence of future masters of education. We understand it as an integrative professional quality of the individual, which reflects, on the one hand, his ability to organize research, search for appropriate techniques, to work effectively with them using the processes of analysis and synthesis, the ability based on the analysis of activities to obtain common indicators and to carry out evaluation findings, the ability to systematically investigate and assess the situation, the ability to use computer technology and telecommunication technologies as tools for analytical research and their application in the pedagogical experiment and in professional activities in order to make the right decisions. Such competence necessarily implies the ability to apply mathematical statistics methods to confirm or disprove hypotheses.

Analysis of psychological and pedagogical research and scientific developments shows that the result of gaining the analytical competence of a specialist is the mastery of relevant knowledge, skills, experience and the development of appropriate professional qualities and type of thinking [13].

To prepare and conduct experimental research future masters must possess a number of skills (Fig.1), which provide the use of different research methods:



**Fig.1.** Skills which are necessary for future masters' of education pedagogical research

Methods are an ordered system in which their place is determined in accordance with a specific stage of research, the use of techniques and realisation of operations with the theoretical and factual material in a given sequence. There can be several methods in the same scientific field (complexes of methods), which are constantly improved in the course of scientific work [4;

6; 7]. The most difficult is the method of experimental research, which uses questionnaires, testing, scaling, but the goals and methods of their implementation are different [9; 10].

However nowadays, with the general increase in the average level of education and the progressive development of scientific knowledge (the number of defended qualifying works of the EL “Bachelor” and “Master”, PhD and doctoral dissertations, the mass publication of new monographs, etc.) the culture of scientific thinking and the level of research decrease [2], which is confirmed by the results of our research [5], [11].

Practice and results of scientific research indicate that the level of readiness formation before the pedagogical experiment and processing of its results of students-masters does not always meet modern requirements. A significant part of graduates of the master’s degree, have difficulties in the organization of their experimental activities, in the use of methods of scientific knowledge, and in the ability to represent their scientific developments, to process the results of their research. These disadvantages are the result of the low level of formation of the graduate readiness for the experiment and operating methods of processing the experimental data.

At first we studied the content of qualification researches in various specialties of training masters of education. According to these results it was recorded that a small proportion of them contains an experimental part supported by statistical calculations or other analytical methods [5]. In particular, only 36% of master’s qualification works (QW) had an experimental part. And of these 36% only more than half (56%) contained detailed results of the study.

Thus, the analysis of qualification works, as the results of pedagogical research, confirmed the insufficient level of masters of education possession of statistical techniques, formed skills to process the preliminary and final results of pedagogical experiment, which determines the relevance of the formation of future masters of education analytical competence.

The analysis of the content of dissertation research in the specialty “13.00.04 – theory and methods of professional education” has fixed that also not all works contain experimental part supported by statistical calculations or other analytical methods. Thus, out of 97 analyzed qualifying scientific works over the past 5 years (resources of 8 higher educational institutions were studied), only 85% had an experimental section, and 78% of them contained detailed results of the study [5]. There are references to methods of statistical processing of results in 7% of dissertations in the introduction to theses and abstracts, which are not used in the work and are not confirmed by mathematical calculations.

A detailed analysis of the application of general mathematical and statistical methods has shown that most often future scientists use in their scientific and pedagogical research: sociometry, registration, ranking, scaling; arithmetic mean, variance are investigated; factorial, regression, correlation analysis are conducted.

Different methods of mathematical statistics for the analysis of the data obtained in the qualifying scientific works were used, but if we generalize them,

among the most common will be: t-criterion of Student (45%), Pearson criterion (35%), Fisher criterion (11%), Kolmogorov-Smirnov criterion (9%). Other methods (36%) include one- and multivariate correlation analysis, regression analysis, Shapiro-Wilk criterion, Cramer-Welch criterion, Mann-Whitney U-criterion, sign criterion, Kruskal-Wallis criterion, Friedman criterion, etc. [5].

Thus, the analysis of qualifying scientific works has confirmed that not all results of scientific and pedagogical researches are checked by statistical methods. We assume that such a situation is due to the unformed future scientists' skills to use such methods, and therefore motivated preparation of future scientists to use methods of analysis becomes relevant, including methods of mathematical statistics for processing the results of experimental studies.

This requires the formation of skills to analyze, synthesize, compare, abstract, summarize, draw conclusions, as well as formulate hypotheses and verify their validity.

Conscious use of statistical processing methods of the results of experimental studies also requires mastering the following skills:

- to measure the empirical data;
- to analyze the primary distribution of empirical indicators;
- to correctly select the methods of mathematical statistics and statistical analysis;
- to formulate, evaluate and test statistical hypotheses;
- to interpret the results.

The formation of these skills can begin at the II educational and scientific level of the master and continue in graduate school.

**Conclusions and prospects for further research.** Thus, modern conditions of higher education development in Ukraine provide for improving the quality of training of future teachers of higher education institutions in terms of the organization of the educational process, and in the conduct of research with the formulation of reliable conclusions and recommendations. One of the factors of improving the professional training of future teachers is not just the study of research methods, but also the formation of practical skills of experimental data processing, which will provide broad prospects for the theory and practice of pedagogical science in terms of confirming the reliability of the research results and their acceptance by the scientific community.

Analysis of qualifying scientific works of recent years confirms the presence of master's works and dissertations without mathematical processing of experimental data. We believe that this is due to the lack of future specialists' formed skills to analyze and use statistical methods to test the effectiveness of pedagogical hypotheses. Therefore, the problem of formation of analytical competence at the master's level is relevant.

We see the prospects for further research in the development of guidelines for the formation of future masters' of education skills analysis for the use of methods of mathematical statistics to confirm the reliability of the results of scientific and pedagogical research.

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