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THEORETICAL, COGNITIVE, AND APPLIED ASPECTS OF TEACHER TRAINING IN METHODOLOGY AND STATISTICS

Abstract: This paper sets off from three research goals: (1) theoretical, i.e. examining the role of the courses *Methodology of pedagogical research* and *Statistics in pedagogy* in teacher training; (2) cognitive, i.e. awakening teachers' interest in and knowledge about the importance of pedagogical research; and (3) applied, i.e. influencing a change in the teacher's role in the educational process, so as to gain a more important role in both teaching and scientific research. In this study, we started from the assumption that teachers possess an intermediate level of knowledge in methodology. The number of correct answers to the questions in the test on pedagogical research methodologies and the facility index indeed showed that they possessed an average knowledge about pedagogical research methodology. Similarly, we started from the assumption that lower-grade teachers have an intermediate level of knowledge in the area of statistics, which includes the basic statistical terms, the selection of appropriate statistical procedures, and graphic representation of results in pedagogical research. The participants in the study were 390 lower-grade primary school teachers, all with a BA-level degree. The schools where the survey was conducted were selected randomly, and included primary schools in Vojvodina (Novi Sad, Subotica, and Sombor), Central Serbia (Belgrade, Kragujevac, and Užice) and Southern Serbia (Niš, Leskovac, and Vranje). The analysis of the number of correct answers in the test on educational statistics and the facility index showed that the participants' knowledge about pedagogical statistics was very modest. For this occasion, we constructed the following instruments: Test in Methodology of pedagogical research (TZ-1), and Test in Statistics in pedagogy (TZ-2). The tests determined the level of general methodological and statistical education of lower-grade primary school teachers.

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INTRODUCTION

The development of pedagogical methodology in our country has always been influenced by and parallel to the development of pedagogy in Europe and the world. Eminent Serbian educators, such as Vojislav Bakić, Ljubomir Protić, Stevan Okanović, Dušan Rajičić, Jovan J. Jovanović, Jovan Miodragović, Sreten Adžić, Miloš Milošević, and Vojislav Mladenović, in the 19th and early 20th century followed the pedagogical and methodological orientations that dominated the European university centres in which they themselves had been educated. Until the early 20th century, pedagogical research was dominated by the paradigm of understanding, based on hermeneutics as the basic research process, and not on empirical research, which left a strong mark on the methodology of pedagogy. During the second half of the 20th century, the development of educational thought in Serbia saw a significant progress, while the methodology of pedagogy was developed as an inseparable companion of pedagogical science and its foundation. The development of the program content in the *Methodology of pedagogical research* in teacher-training schools, educational academies for primary school teachers, as well as at faculties of philosophy, achieved full recognition in the last decade of the 20th century.

However, it was in the first decade of the 21st century that the necessary financial, institutional, and other conditions, including human resources, were fulfilled enough to guarantee a development of the methodology of pedagogical research in our country, and thus of the pedagogical science in general. The basis for this statement is the following: In Serbia today, there are two Pedagogical Research Institutes (*Institute for Educational Research* and the *Institute for Pedagogy and Andragogy*, Faculty of Philosophy in Belgrade); there are four Departments of Education at Faculties of Philosophy (Belgrade, Novi Sad, Niš, Priština - Kosovska Mitrovica); there are six teacher-training faculties in Serbia (Belgrade, Subotica, Novi Sad, Jagodina, Prizren-Leposavić and Vranje); there is the Centre for Educational Research at the University of Niš, as well as several research institutions engaged in studying the problems of education. Pedagogical problems are investigated by hundreds of professionals – teachers, psychologists, sociologists; a large number of teachers get

engaged in educational research to enhance their work and contribute to a further development of science.

Theoretical Context of the Needs for Methodological Competences of Teachers

The complexity of teacher profession permeates the needs for a teacher to be trained and professionally developed in a way that will in a better way address the essence and the level of profession complexity. It is possible to do so through the acceptance of a model according to which a teacher is a reflective practitioner, with reflectivity as a feature permeating the profession of a teacher; this is the imperative of the time we live in – postmodernism, a period in which radical pluralism has become more serious and has been accepted as a basic social order, with pluralistic patterns of thought and action prevailing in it, to the extent of creating a dominant and obligatory stand. If we explained pluralism as a mere manifestation of growth, its essence would remain beyond understanding. For many it is a positive vision, inseparable from real democracy... It is not possible, and it is not even necessary to go into details of the characteristic of postmodern thinking, but it is important to at least state its simplified paraphrasing, getting into the essence of teacher competences. So, free paraphrasing of the features of postmodern thinking would refer to the following:

- pluralism of perspectives, meanings, methods, values – everything!
- search for ambiguous meanings and the respect for them as well as for alternative interpretations, many of which are ironic and unintentional;
- criticism or negative attitude towards Grand narrations which should explicate everything. This refers to great scientific theories, as well as the myths in our religions, nations, cultures and professions which are to explain why things are as they are;
- the acknowledgement that – having in mind that there is a pluralism of perspectives and ways of gaining knowledge – there are also multiple truths (Gojkov, G. 2011: 21).

Having the above stated standpoints in mind, it seems necessary to consider the issue of the paper from the angle of meta-theory of pedagogy which is at the moment seen as a road towards more efficient consideration of the fact that there is no “real pedagogy”, but various conceptions, scientific standpoints and their hidden grounds, as well as their consequences for research methodology and pedagogic practice.

From the angle of teacher competencies this means a need for abilities, i.e. competencies of teachers to consider different pedagogic conceptions at the level of scientific theory, with the aim to precise and explicate the grounds for creating of different pedagogic theories, in order to more closely deal with the questions referring to the notional framework of various pedagogic theories, the systems based on certain pedagogic conception, differentiation between methodological movements and research methods within them, the effects that comprehension of science has on pedagogic practice (ibid, p. 23).

The teacher who is not capable of differentiating between the stated issues is left on his own, with his/her hands tied, wandering in the dark and trying to apply something (s)he has seen or heard, not knowing why and to what an extent it will be efficient. Teacher competence is also important in the sense of having one's own pedagogic theory built, as well as having one's own views on the issues of upbringing and education. Those already mentioned and other conditions have imposed the need for teacher competencies in the era postmodernism to be re-examined, together with the ways according to which pedagogy, i.e. education and its agents, i.e. teachers should help in introducing a change in the society, giving it, according to the assessment of critics a false scientific determination. Teacher competences implicitly imply reflections on the philosophy of the present moment, or, viewed from another angle, to what an extent the philosophy of postmodernism has influenced such a status of pedagogy; how much as the above-mentioned reduced the understanding of education, determining it merely according to usability and its powers to execute social tasks. Is this true and, if it is, to what an extent, and what are the practical consequences for teacher competences? Meta-theory of pedagogy is at the moment seen as a road towards more efficient consideration of the fact that there is no "real pedagogy", but various conceptions, scientific standpoints and their hidden grounds, as well as their consequences for research methodology and pedagogic practice. From the angle of teacher competencies this means a need for abilities, i.e. competencies of teachers to consider different pedagogic conceptions at the level of scientific theory, with the aim to precise and explicate the grounds for creating of different pedagogic theories, in order to more closely consider the issues of pluralism of pedagogic theories and possibilities of their application (Ibid, 78).

Therefore a reflective teacher, a professional has to be capable and sufficiently confident in his/her own research skills to undertake classroom

based enquiry that can effectively try out and evaluate the effectiveness of new ideas in his or her own classroom. These teachers will not simply adopt didactic models they meet in the literature, or the mentioned simplified presentations of a cognitive style, they will read further and search for answers to these questions to decide whether it is worth trialling the ideas in their own teaching, with possible adaptation and final adoption. The result would be a teacher professional, i.e. reflective practitioner, who will not only be searching, critically considering and comparing a whole range of resources, including, where available, the current research, but (s)he will, as a researching professional, be able to test and modify the approaches through the cycles of carefully evaluated (action, empirical) research he himself has undertaken in his own classroom. This proactive characteristic of a reflective teacher is a basis for the competences enabling a teacher understand the problems noticed in practice as a part of the complexity of teaching and learning phenomena, a detail in specific educational context which cannot be easily generalized and assumed relevant for other contexts. This, of course implies a sound methodological-theoretical grounds and the ability to transfer what has been researched into practice.

Pedagogical methodology plays an important role in the formation of the cultural profile of the teacher, since it facilitates communication, helps develop a culture of communication through the written word, and provides easier monitoring of scientific development (Kundačina, 2003: 221-235). Research practices and methodological qualifications include not only theoretical knowledge and methodological knowledge of measurement, but also a very specific knowledge of selecting and applying appropriate methodological and statistical procedures and data, and the presentation of research results at professional forums and gatherings. It involves a specific methodological competence, methodological skill, and methodological education of teachers. Unfortunately, similar studies in the region have not been found in the available sources; as a consequence, there was no an orienting-point for either research design or comparison of the findings, opening up possibility for an empirical research and leaving space for subsequent more certain grounding of the hypothesis and more serious research projects.

THE CONTENTS OF METHODOLOGICAL AND STATISTICAL TEACHER EDUCATION

Many weaknesses in achieving a more advanced training and education process result from, besides other adverse factors and

difficulties, an insufficient education of teachers in methodology and statistics. The fundamentals of statistical methodology should already be developed during pre-service teacher education, and should be further developed through subsequent in-service teacher training, to further enrich and develop the practice of educational work through different forms (institutional and individual) of expert pedagogical training.

It is true that successful engagement in scientific research in the field of education requires appropriate theoretical, methodological and pedagogical competence, a strict application of methodological procedures, as well as appropriate research training and creativity of teachers - researchers. The methodological competence of teachers is defined as a recognized ability and expertise to study and research the pedagogical reality and pedagogical practices (Kundačina, 2003: 221-235). A necessary prerequisite for the realization of a scientific-pedagogical research project is proper education methodology, which includes: the skill to analyze pedagogical reality, the ability to establish the theoretical object and purpose of research, and the ability to select appropriate methods, procedures and research instruments. Therefore, methodological and statistical education is important for both educational theory and pedagogical practice, and represents a necessary pre-requisite for the introduction of changes in education.

Teachers also need a broad statistical education, which would include being familiar with the vocabulary of statistics, understanding statistical concepts, tables, graphs, statistical parameters and statistical symbols, reading statistical tables, as well as understanding and applying statistical computer packages. In pedagogical research, it is necessary not only to be able to choose appropriate methodological and statistical procedures, but also to understand specific methodological paradigms and statistical formulas, and to interpret statistical results. The model of building methodological competencies in teachers should be based on their active pre-service research practice during their studies, and on learning through experience. This would arouse their interest in research and encourage them to learn and to form a methodological orientation as a component of their methodological competence. The contemporary teacher is expected to work in a better-planned way, to be more organized, rational, to achieve more, to be a researcher, developer, class-work organizer, consultant, pedagogical diagnostician, therapist, generation educator. This can be achieved only through continuous training and methodological and statistical education.

What methodological and statistical competences should be mastered by teachers in primary education? Based on previous discussion, we present a preliminary list that could offer an answer to this question:

- (1) Knowledge about the basic epistemological characteristics and scientific methods used to study education (Matijević, 2004; Mužić, 1986; Pejović, 1983).
- (2) Ability to use the results of other scientific studies conducted and reported by other researchers.
- (3) Ability to understand the language of the science to which the teacher's discipline or area belongs.
- (4) Ability to use the techniques of intellectual work that are universal for all sciences: studying the literature, writing in accordance with the rules of citation, providing bibliographic data and references to scientific sources, knowledge of the structure of written scientific reports (Mužić, Matijević and Jokić, 2003).
- (5) Knowledge of the basic methodological and logical rules of definition, classification and reasoning.
- (6) Knowledge of the scientific methods of data collection: observation, interview, survey, scaling, content analysis, case studies (Halmi, 2004; Mužić, 1986).
- (7) Knowledge of the scientific methods: descriptive, causal, comparative, historical (Mužić, 2004; Mužić, 1986).
- (8) Knowledge of the standards for classification and evaluation of scientific papers.
- (9) Knowledge of and respect for the ethical rules and norms of scientific work (Mužić, Matijević and Jokić, 2003).
- (10) Motivation for a permanent monitoring of the latest scientific achievements and results in the science of education.
- (11) Mastering the competencies that are important for participation in team research projects.
- (12) Acquiring a certain degree of scientific criticism, a critical approach to theories of education, as well as to the results of one's own professional work.

METHODOLOGICAL FRAMEWORK OF THE RESEARCH

The research subject refers to establishing of the level of teacher knowledge in *Pedagogic research methodology* and *Statistics in Pedagogy*. In accordance to the theoretical part of this paper, the research problem is the following: What is the level of knowledge acquired by teachers within the Methodology of pedagogical research and Statistics in pedagogy. According to this it could be indirectly concluded on the abilities of

teachers to acquire expected pedagogic roles, as well as on the level of their pedagogical competencies, at least within one's own practice research and reflective review of the applicability of certain pedagogic theories and ideas. Furthermore, what could also be indirectly considered is the role of the contents of pedagogical methodology in empowering of pedagogical competencies of teachers, i.e. them being equipped for the role of reflective practitioner that has for some time been advocated not only in pedagogic circles whose grounds are created in critical pedagogy, i.e. critical theory of society, but today also in philosophy of postmodernism.

Based on the defined subject of this research, the following research goal was defined: to consider the level of teacher knowledge within the courses *Methodology of pedagogical research* and *Statistics*.

The aims of this research were: (1) To identify the teachers' level of knowledge about the methodological program content, their level of awareness about methodological research, particularly on qualitative and action research; their level of familiarity with research projects, research methods, techniques and instruments. (2) To identify the level of teachers' knowledge about statistical programming, their familiarity with basic statistical terms, the analysis and processing of the data, with the proper selection of statistical procedures and graphical presentation of results in pedagogical research.

Our research hypotheses were: (1) Teachers in primary schools have an intermediate level of knowledge about pedagogical methodology, particularly about qualitative and action research; they are informed about the most significant research projects, methods, techniques and instruments. (2) Teachers in primary schools have an intermediate level of knowledge about pedagogical statistics, about basic statistical terms, the analysis and processing of the data, about a proper selection of statistical procedures and the graphical presentation of results in pedagogical research.

Given that there are no standardized instruments in this area and given the nature of the research problem, for this occasion we constructed the following instruments: Test in Methodology of pedagogical research (TZ-1) and Test in Statistics in pedagogy (TZ-2). In the construction of these knowledge tests, we relied on the collection of tests on methodology in pedagogy by dr. Grozdanka Gojkov and dr. Milenko Kundačina. The measured characteristics of the tests were determined after conducting a

pilot study on a sample of teachers. The tests were designed to determine the level of general methodological and statistical education of primary school teachers.

The research sample has a character of an intentional sample, including lower primary school teachers from certain towns who have attended lectures on action research, participated in these studies and who are familiar with the theory and practice of action research in schools. The survey involved 390 lower-grade primary school teachers, all with a BA degree. The schools where the survey was conducted were selected randomly, and included primary schools in Vojvodina (Novi Sad, Subotica, and Sombor), Central Serbia (Belgrade, Kragujevac, and Užice) and Southern Serbia (Niš, Leskovac, and Vranje).

The research was realized in 2009. We tried to ensure that in all the schools the course of research should be as balanced as possible. The professional staff in all the schools was of great help in this research, and without their support this research could not have been completed. Specifically, the teachers were individually administered the instruments, which they filled out during special classes and handed in to the members of the school's professional staff. It took each teacher 60 min. to complete both tests. In the implementation of this research, we experienced some expected difficulties, which, however, did not affect the reliability of the data. For instance, many teachers understood this research as a test checking their methodological and statistical knowledge (which was the target), and therefore expressed a negative attitude towards the research study.

DATA ANALYSIS AND INTERPRETATION

In the school aimed to change, teachers should take an active role in research as opposed to the current practice where they are at best only beneficiaries of the results of others' research. The results will be discussed in the order of our defined aims and research hypotheses.

The tests in the Methodology of pedagogical research and Statistics in pedagogy included the content provided by the curriculum of the *Methodology of pedagogical research* in the universities of teacher education (Faculty of Education in Belgrade, Faculty of Education in Užice, Faculty of Education in Jagodina, Faculty of Education in Vranje, Faculty of Education in Sombor and Faculty of Education in Prizren - Leposavić). The tasks in the achievement tests were given in the form of multiple choice

questions in which one of the answers was correct. All the questions in the test carried 1 point (incorrect answer – 0 points), and the total score was represented by the total number of points. What makes knowledge tests different from traditional oral and written presentations is that they exclude the impact of all the subjective factors of teacher evaluators who otherwise significantly affect the rating.

A test with multiple choice questions has significant advantages over other types of written tests, because scoring very easy, accurate and fair; it is possible to examine different cognitive levels of knowledge (according to Bloom (1956) these are the adoption of the facts, understanding, application of factual knowledge, analysis, synthesis and evaluation), the statistical analysis of the data is fast and simple, and individual items can be analysed.

The validation of metrical characteristics of the instrument has been carried out on the group of 30 final-year students at the Faculty of Education in Vranje and Leposavić – an informal Methodology of pedagogical research. The test validity is 0,76; discriminatory values range from 0,005 to 0,659. Measurement features have shown that the reliability of the text is satisfactory, which can be seen according to the tables that follow in the text below.

In this study, we started from the assumption that teachers possess an intermediate level of knowledge in methodology, particularly about qualitative and action research, that they are informed about the most significant research projects, methods, techniques, and instruments.

Based on the identified number of correct answers to the questions in the pedagogical research methodology test, and on their facility index, it can be said that the teachers showed an average knowledge of the research methodology in pedagogy. The facility index varies from question to question. The highest index was determined for the question about the optimal number of tasks in a knowledge MikroTest (67.95), and it is important that a high facility index was determined for the question about understanding the goal of action research (63.59). On the other hand, very low facility indices, just slightly higher than 20, were determined for some questions, for instance, the lowest index was determined for the question about the aim of experimental research (only 22.05). These figures are shown in the tables below.

Table 1: The number of respondents with correct answers and facility indices for questions in the *Methodology of pedagogical research* test

	Question (TC1-TC20)	Number of respondents with correct answers	Index of lightness
TM1	What is the purpose of action research?	248	63,59
TM2	The relationship between participants in the action research is:	196	50,26
TM3	What does quantitative research involve?	145	37,18
TM4	Which fundamental research procedure should be selected in order to get as valid data as possible in the investigation of students' workload?	94	24,10
TM5	Basic research techniques in the study of textbooks:	176	45,13
TM6	What research techniques dominate in determining the results of the educational and training work?	235	60,26
TM7	What is classified in the process of content analysis?	187	47,95
TM8	For the application of testing in the studies of the phenomenon of education the interpretation of results is of particular importance, but in the interpretation errors can occur. The sources of these errors should be sought in:	201	51,54
TM9	The hypothesis is:	119	30,51
TM10	The most reliable are those pedagogical researches and studies that use:	87	22,31
TM11	When applying placement tests, the testing should be over when the work is completed by:	223	57,18
TM12	When is the categorization of responses performed in a structured interview?	146	37,44
TM13	What is observation with participation?	194	49,74
TM14	The researcher conducting the interview should:	165	42,31
TM15	Which research techniques are the most appropriate to combine with observation?	177	45,38
TM16	The aim of experimental research is to:	86	22,05
TM17	Anecdotal notes have the character of:	199	51,03
TM18	Sociometric research results:	165	42,31
TM19	The optimal number of tasks in the knowledge MikroTest is:	265	67,95
TM20	A questionnaire which can be used to determine attitudes, opinions and judgments about a phenomenon, an event, or a process, is called:	213	54,62

Compared to the participants' results in the Statistics knowledge test (to be presented below), it can be said that the participants' achieved better results in this test.

Table 2: Statistical parameters of the scale of knowledge in *Methodology in pedagogy*

X	Variance	SD	number of questions on a scale
9,06	29,36	5,42	20

Compared to the scale of knowledge of *Statistics in pedagogy*, it is evident that the participants' success in the pedagogical methodology test was good, but closer to "satisfying" than to "very good" (9.06 ± 5.42), with the variance of 29.36.

Table 3: Reliability analysis scale – *Methodology in pedagogy* test

Cronbach alpha	number of questions on a scale
0,8856	20

The reliability of the scale was very good, with the Cronbach alpha 0.8865, although somewhat lower than the scale of pedagogical knowledge of statistics, as we shall see in the following tables.

Table 4: Analysis of the changes in scale reliability in the knowledge test in *Methodology in pedagogy* by the elimination of individual items (questions)

	The mean number of points on a scale if it eliminates the question	Scale Variance if it eliminates the question	Corrected total sum of correlation issues with other issues	Cronbach alpha if is eliminated the question
TM1	8,42	26,07	0,62	0,8764
TM2	8,56	25,46	0,72	0,8728
TM3	8,69	26,45	0,54	0,8790
TM4	8,82	27,61	0,35	0,8845
TM5	8,61	26,07	0,60	0,8770
TM6	8,43	26,30	0,53	0,8792
TM7	8,58	26,32	0,54	0,8788
TM8	8,54	26,75	0,45	0,8817
TM9	8,75	27,69	0,30	0,8861
TM10	8,84	27,74	0,33	0,8849
TM11	8,49	26,11	0,59	0,8772
TM12	8,68	26,80	0,46	0,8814

TM13	8,56	25,80	0,65	0,8752
TM14	8,64	27,40	0,33	0,8856
TM15	8,61	26,76	0,45	0,8817
TM16	8,84	27,90	0,29	0,8859
TM17	8,55	26,06	0,60	0,8771
TM18	8,64	26,23	0,57	0,8780
TM19	8,38	26,93	0,46	0,8815
TM20	8,51	26,59	0,49	0,8806

In the case of the scale test in *Methodology of pedagogical research*, and the scale of knowledge test in *Statistic in pedagogy*, the elimination of one of the 20 questions would not significantly reduce the value of Cronbach alpha (less than 0.70), and this indicates the important role of all the questions in the test in the formation of the overall assessment of knowledge in Methodology in pedagogy.

The biggest drop of Cronbach alpha was for the question "The relationship between the participants in action research?" and its elimination would reduce the reliability of the major scale.

The greatest increase of Cronbach alpha relative to its value with all the questions in the test would be achieved by omitting the questions "The hypothesis is?" and "The aim of experimental research is to...", so these two contribute the least to the overall reliability of the scale.

A group of 30 final year students in the Faculty of Education in Vranje and Leposavić were given an informal test of knowledge in *Statistic in pedagogy*, consisting of 50 questions. In this preliminary testing, we proceeded from the assumption that if students did not know the answer to some questions, teachers would not know the answer either. Therefore, after the preliminary test we eliminated those questions which were incorrectly answered by more than 75% of the students, and those that were correctly answered by more than 75% students. These questions were considered as "too difficult" i.e. "too easy" and were thus eliminated from the test. Too easy questions are acceptable in a diagnostic test, but it is, in fact, recommended that the first few questions in the test should be slightly easier (0.90). After this preliminary test, the instrument was re-evaluated and modified in the database for further use.

In this study, we started from the assumption that teachers possess an intermediate level of knowledge in *Statistics in pedagogy*, that they are

informed about the basic statistical terms, the data processing and data analysis, the proper selection of statistical procedures and graphical presentation of results in pedagogical research.

In the same manner as in the knowledge test in *Methodology of pedagogic research*, we designed the knowledge test for *Statistics in pedagogy* with 20 questions. Questions had the difficulty (facility) index of 0.30 to 0.70. The difficulty index of a test item represents the mean value of its scores, expressed in percentages, and calculated after the test as the % of correct answers. Questions below 0.30 are too difficult and the questions above 0.70 are too easy. The discrimination coefficient is a correlation between the scores at one item and at the whole test. The values of the discrimination coefficients for the tasks ranged from 0.005 to 0.659. The measurement properties show that the reliability of this test was satisfactory, as can be seen in the tables that follow.

Table 5: The number of respondents with correct answers and facility indices for questions in the *Statistic in pedagogy* test

	Question (TS1-TS20)	Number of respondents with correct answers	Index of lightness
TS1	Standard deviation is:	126	32,31
TS2	Selected levels of statistical significance with $t \geq 0.05$ tg means:	123	31,54
TS3	Mode is:	117	30,00
TS4	Which of the central tendency measures is used to determine success and status in a tested group group?	223	57,18
TS5	What does df represent?	167	42,82
TS6	School marks are:	177	45,38
TS7	The correlation coefficient shows:	147	37,69
TS8	χ^2 test is particularly suitable for:	78	20,00
TS9	To test the statistical significance of the difference between two arithmetical means we use:	198	50,77
TS10	The median is the value of:	135	34,62
TS11	What is meant by mass observation in statistics?	182	46,67
TS12	What is the score?	225	57,69
TS13	In which of the groups of students with the distribution of scores on knowledge MikroTest would the individualization of educational work be needed the most ?	87	22,31
TS14	When do we say that a measuring instrument is valid?	86	22,05
TS15	Test tasks are discriminative if:	201	51,54
TS16	What central tendency measure is used to determine the success and status in a group?	181	46,41
TS17	If subjects with a high success on the test fail to solve the task, while those with low achievement do succeed, it is because:	156	40,00
TS18	What is the symbol $cf\%$?	112	28,72

TS19	Standard grade is:	134	34,36
TS20	What are the usual levels of statistical significance?	216	55,38

Analyzing the number of correct answers to the test questions in the *Statistic in pedagogy* test and the facility indexes, it is evident that the pedagogical knowledge of statistics with the respondents was very modest: only 4 questions were answered by more than half the participants, and the facility index of these items was over 50. The highest facility index (57.69) was found for the question "What is the score?", while the fewest participants offered the correct answer to the question "For what is χ^2 test particularly suitable?", and this question has the lowest facility index (20.00).

Table 6: Statistical parameters of the scale of knowledge in *Statistic in pedagogy*

X	Variance	SD	number of questions on a scale
7,87	31,58	5,62	20

If we allocated grades from 1 to 5 for the success on this test by making a linear division of the scale of 0 to 20 points into 5 grades (grade 1 - 0-4 points, grade 2 - 5-8 points, grade 3 - 9-12 points, grade 4 - 13-16 points, grade 5 - over 17 points), then, based on the mean number of points achieved in the whole sample, it is evident that the overall success is barely satisfactory (7.87 ± 5.62), with the variance of 31.58.

Table 7: Reliability analysis scale – *Statistic in pedagogy* test

Cronbach alpha	number of questions on a scale
0,9020	20

To analyze the reliability of the scale Cronbach alpha was used and its value of 0.9020 (significantly more than 0.7, which is the lowest confidence limit of the scale) indicates that the scale obtained on the basis of the test in *Statistics in pedagogy* is very reliable.

By establishing the parameters obtained by eliminating one of the 20 questions from the test, it is important that the Cronbach alpha value never decreases below 0.70, which means that all the questions had an important role in determining the participants' overall estimated knowledge about *Statistic in pedagogy*. The biggest drop in Cronbach

alpha was observed for the question "Which of the central tendency measures is used to determine the success and status in a group?" which means that its elimination would reduce the reliability of the major scale. On the other hand, a small but still the largest increase in Cronbach alpha, relative to its value when all the questions are represented, was obtained for the question "When do we say that a measuring instrument is valid?", which means that it contributes the least to the overall reliability of the scale.

CONCLUSIONS

The research findings refer to a number of conclusions. Some of them are direct, arising directly from the findings, while others are to a greater extent implied, demanding a confirmation in some future studies. One of the implied conclusions refers to the statement that the complexity of teacher profession permeates the need for a teacher to be trained and professionally developed in such a way that will more appropriately address the essence and the level of profession complexity. This is in direct correlation with teachers being trained for the role of reflective practitioners, with reflectivity as a feature permeating the profession of a teacher; this is the imperative of the time we live in – postmodernism, a period in which radical pluralism has become more serious and has been accepted as a basic social order, with pluralistic patterns of thought and action prevailing in it, to the extent of creating a dominant and obligatory stand. If this is considered from the angle of the research findings and the essence of teacher competences, it is to be indisputably concluded that what is required of a teacher is more solid methodological grounds, i.e. his directedness towards the competencies of a reflexive practitioner, which is not possible without basic methodological knowledge. The findings have shown that a number of serious steps should be made in this direction. Direct conclusions in regard to validation of the hypotheses are the following: respondents knowledge of the basic contents of pedagogic methodology is average, while their knowledge in statistics could be only approximated as satisfactory. Finally, this leads to a conclusion that there is a great gap between the expectations of the time we live in, i.e. greater autonomy of upbringing-educational institutions and responsibility for one's obligations on the one hand, and real competence of teachers for the expected role of reflective practitioners.

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