The Results of the Summative Stage of the Experiment on the Development of the Informational and Communication Competence of Teachers in the System of Military Education

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Abstract – **The study presents the results of the statistical processing of data on the summative stage within the pedagogical experiment, in particular the empirical data on the levels (low, satisfactory, sufficient, high) of formedness regarding the informational and communication competence (ICC) of teachers in the system of military education (SME) with a breakdown by its components – axiological-motivational, intellectual, praxeological, informational-technological and subjectival. The analysis of the results of its formedness shows that 70,97% of teachers have the need to develop theoretical competence (knowledge) and practical ability (skills, experience and psychological readiness) in the field of ICTs and their application in scientific and pedagogical activity, which would ensure successful performance of their official duties as subjects of scientific and pedagogical activity.**

Keywords – **informational and communicative competence, summative stage, experiment, levels, formedness.**

1. Problem Statement

Currently, all fields of social production, including the national education system, are significantly influenced by information society factors, especially information and communication technologies (ICTs) which create favorable conditions and circumstances for provision of a wide range of educational services to citizens. It can be stated that these factors significantly upgrade it at all levels, including the system of military education (SME) as a component of the national education system that ensures training of officers in accordance with educational and qualification levels. It should be emphasized that the SME should ensure training of competent officers, and thus directly contributing to the combat effectiveness and combat readiness of the Armed Forces of Ukraine.

In the information society, networked educational data centers and modern ICTs can significantly improve professional training of the officers. Particularly important in this aspect is the ability of SME teachers (hereinafter "teachers") to apply these technologies comprehensively in accordance with the educational military and professional needs of cadets (trainees). In this regard, it should be emphasized that their informational and communicative training should meet, on the one hand, the requirements of the information society, and on the other hand, the requirements of the military utilizing the most up-to-date information technologies. Accordingly, the pedagogical process of the development and improvement of the ICC of teachers should be dynamic, continuous, information and technology-packed, since information technologies are constantly updated, improved and developed, especially in the military field.

In connection to this, teachers need to constantly improve their skills (professional and pedagogical

competence) in line with the changes that are taking place in the information society and the military sphere. In this regard, an urgent need arises to objectively determine the levels of formation of their ICC as subjects of scientific and pedagogical activity in the system of military education, namely, the qualitative and quantitative characteristics of its state of formedness.

2. Analysis of Recent Research and Publications

The analysis of scientific sources and thesis papers on ICC from different experts show that scientific research is conducted in the following problematic areas: ICC interpretation (V. Bykov, V. Vembr, A. Gurzhiy, N. Morze, O. Ovcharuk, O. Spirin, A. Ferarri [1], I. Gutierrez [2], M. Gisbert, F. Esteve [3], V. Larraz [4], R. Krumsvik [5] et al.) and its formation (I. Timofeeva, G. Fedoruk, D. Schneckenberg, J. Wildt [6] et al.) and development (P. Grabovskiy, G Degtyareva, A. Kocharyan, N. Soroko, F. Esteve [2], F. Carrera, J. Coiduras [7] et al.). Moreover, there are useful last researches of ICT in education [8], [9].

However, scientists pass over the problem of ICC specifically pertaining to teachers in the system of military education, in particular finding out the current state of its formedness and justification of the need for its development.

The purpose of this paper is analysis and generalization of the results on the summative stage of the pedagogical experiment regarding the formedness of the ICC of teachers in the system of military education and finding out its levels.

3. Findings of the Study

The immediacy of the problem of developing the ICC among teachers can be confirmed by experimental verification – the summative pedagogical experiment enabling empirical substantiation and accuracy verification of scientific direction of the research and elaboration a method of formative experiment for its development. Thus, a pedagogical experiment allows getting new theoretical and practical knowledge and empirical facts about the subject of study in conditions specially created and controlled by the researcher. Accordingly, causal relationship is established to capture changes in the subject of study by manipulating one or more experimental conditions and factors. In addition, the main purpose of the pedagogical experiment is to confirm or to refute the relevant scientific (statistical) hypothesis.

According to the conditions of conducting, a pedagogical experiment is categorized as natural and laboratory, and according to its purpose, as summative (diagnostic, control) and formative (transformative). [9].

A laboratory experiment is conducted in specially created conditions, and a natural one is characterized by real conditions of the process of being, pedagogical in particular. Therefore, a natural experiment is mostly used to achieve the goals of scientific and pedagogical research. It should be noted that there are also two ways of proving a hypothesis in an experimental study: parallel and consecutive.

A parallel experiment is organized on the principle of identical groups, which involves two or more identical (with normal distribution) training groups. One experimental group uses experimental conditions, while the other control group uses traditional conditions. After performance of the formative experiment, the results of these two groups are compared.

Sequential proving is organized according to the principle of a single research group, in which the state of formation/development of the studied pedagogical phenomenon in the traditional system is recorded and the effectiveness of new pedagogical innovations after their introduction as an experimental factor in the same group is compared.

In addition, summative (finding out the current state of the subject under study before implementation of experimental conditions, such as military training) and formative (implementation of experimental conditions of military training in the experimental group) stages of pedagogical experiment are distinguished.

In order to determine the current state of the teachers' ICC formedness during 2018-2019, a summative stage of the pedagogical experiment was conducted. The analysis of its formedness was carried out according to value-motivational, intellectual, praxeological, information-technological and subjectival components. [10]. By means of system-activity structuring of their ICC the basic criteria of its diagnosis are defined, and by specifying of its contents using system-functional approach, the content of each criterion is determined, that is, the corresponding indicators [11]. Accordingly, the integral significance of the results obtained with respect to its components allowed to determine the existing level of formedness of this competence.

The following research methods were used during the summative experiment: interview, questioning, questionnaire survey, observation, exercise method, method of written (test) control of knowledge, practical skills and abilities of using ICTs in scientific and pedagogical activity. In order to evaluate the current status of the ICC of teachers at the summative stage, a sample population of 333 teachers was used (see Tab. 1). The general population of teachers in the

system of military education is 1997, respectively, the dependence of the sample size on the total population size given the error tolerance of 5% (the confidence probability of 0.95) was determined by the summary table [13],[12].

Table 1. Composition of respondents to the summative experiment

No.	Higher military educational establishment	Number of teachers	Percentage ratio, %
1	The National Defense University of Ukraine named after Ivan Cherniakhovskyi	34	10.21
2	Hetman Petro Sahaidachny National Army Academy	30	9.01
3	Military Academy (the city of Odessa)	34	10.21
4	Military Institute of Tank Force of the National Technical University "Kharkiv Polytechnic Institute"	39	11.71
5	Ivan Kozhedub Kharkiv National University of Air Force	34	10.21
6	Naval Forces Institute of the National University "Odessa Maritime Academy"	32	9.61
7	Military Institute of Taras Shevchenko National University of Kyiv	33	9.91
8	Zhytomyr Military Institute named after S.P. Koroliov	31	9.31
9	Ukrainian Military Medical Academy	32	9.61
10	Military Institute of Telecommunications and Information Technologies named after Heroes of Kruty	34	10.21
	Total	**333**	**100**

In addition, the qualitative and qualitative characteristics of SME teachers give reason to claim that the sample population is representative for the general population (Tab. 2-6).

Table 2. Age of teachers in the system of military education

No.	Teacher's age	Number of teachers	Percentage ratio, %
1	up to 30 years old	59	17.72
2	30-39 y.o.	70	21.02
3	40-49 y.o.	93	27.93
4	50-59 y.o.	80	24.02
5	60 y.o. and older	31	9.31
	Total	**333**	**100**

Table 3. Years of experience of scientific or scientific-pedagogical activity of teachers

No.	Teacher's years of experience	Number of teachers	Percentage ratio, %
1	up to 5 years	63	18.92
2	6-10 years	71	21.32
3	11-15 years	88	26.43
4	16-20 years	78	23.42
5	21 -25 years and more	33	9.91
	Total	**333**	**100**

Table 4. Area of scientific and pedagogical activity of teachers

No.	Area of the teacher's activity	Number of teachers	Percentage ratio, %
1	technical unit of academic disciplines	111	33.33
2	social and humanitarian unit of academic disciplines	116	34.83
3	military unit of academic disciplines	106	31.84
	Total	**333**	**100**

Table 5. Scientific and pedagogical position of the sample

No.	Teacher's position	Number of teachers	Percentage ratio, %
1	head of department	20	6.01
2	deputy head of department	20	6.01
3	head of science division	25	7.51
4	head of scientific laboratory	9	2.7
5	department professor	41	12.30
6	department associate professor	52	15.62
7	department senior teacher	75	22.52
8	department teacher	91	27.33
	Total	**333**	**100**

Table 6. Presence of a scientific degree of teachers

No.	Teacher's scientific degree	Number of teachers	Percentage ratio, %
1	Candidate of Technical Sciences	45	13.51
2	Candidate of Pedagogical Sciences	40	12.01
3	Candidate of Philosophical Sciences	16	4.80
4	Candidate of Medical Sciences	7	2.10
5	Candidate of Physico-Mathematical Sciences	3	0.90
6	Candidate of Political Sciences	1	0.30
7	Candidate of Philological	7	2.10

	Sciences		
8	Candidate of Psychological Sciences	21	6.31
9	Candidate of Military Sciences	42	12.61
10	Doctor of Technical Sciences	9	2.70
11	Doctor of Pedagogical Sciences	1	0.30
12	None	141	42.34
	Total	**333**	**100**

It should be noted that the preliminary questionnaire survey was conducted for the teachers to find out their subjective opinion regarding their own level of ICC formation (Tab. 7).

Table 7. Attitudes of teachers regarding formedness of their ICC

No.	Teacher's ICC development level	Number of teachers	Percentage ratio, %
1	low	133	39.94
2	satisfactory	82	24.62
3	sufficient	62	18.62
4	high	56	16.82
	Total	**333**	**100**

The analysis of teachers' ICC formedness was carried out by its five components. Thus, to determine the levels of formedness of the value-motivational component, a testing was carried out, and the obtained results are represented in figure 1. The results of their analysis show that at the beginning of the experiment, this component in 30.63% (102 teachers) was low, 35,59% (119 teachers) – satisfactory, 18.47% (61 teachers) – sufficient, and 15.32% (51 teachers) – high, respectively.

Thus, given the low and satisfactory levels of teachers' ICC formedness by value-motivational component, we can state that 66.22% of them have the need to develop values and motivation of its development, to promote awareness of the need, on the one hand, to be a subject of the information society, and on the other hand, to apply ICTs in a purposeful and systematic manner in scientific and pedagogical activities.
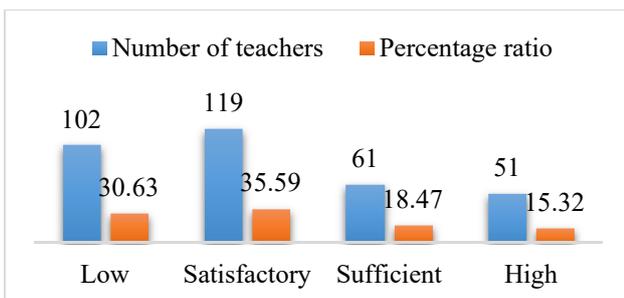

Figure 1. Levels of formedness of the value-motivational component of teachers' ICC

To evaluate the intellectual component of teachers' ICC, a test task of 154 questions was developed to determine the state of its formedness. In particular, this included the following knowledge of teachers: theory of ICTs; theoretical foundations for analysis and decision-making in the military field using ICTs; technologies of modeling of processes (phenomena) in teaching of general and special military disciplines; theoretical aspects of cybersecurity in the process of using ICTs in teaching of these disciplines; modern hardware and software; technologies of software development according to a specific teaching methodology.

Generalization of the obtained results (figure 2) makes it possible to conclude that the content of this component in 50.60% (169 teachers) was at low level, 20,42% (68 teachers) – satisfactory, 16.67% (55 teachers) – sufficient, and 12.31% (41 teachers) – high.

Therefore, given the low and satisfactory levels of formedness of the intellectual component of their ICC, we can state that 71.02% of them have an urgent need for purposeful development of knowledge concerning ICTs and actualization of this knowledge in scientific and pedagogical activities.
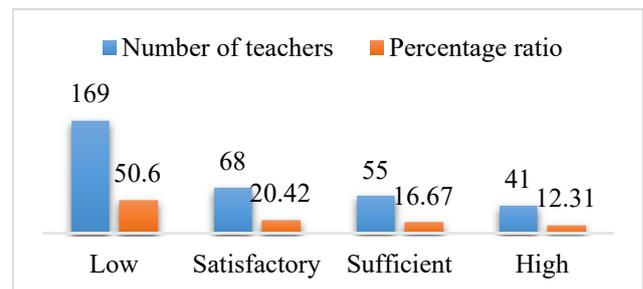

Figure 2. Levels of formedness of the intellectual component of teachers' ICC

To evaluate the praxeological component of the teachers' ICC, quasi-professional and professional practical tasks were developed allowing to determine the state of its formedness; in particular, following their capabilities: to apply ICTs in scientific and pedagogical activities; to develop and use modern hardware and software and to check it for cybernetic vulnerability. Analysis of the obtained results (figure 3) shows that this component is poorly developed in teachers, in particular, low level was observed in 44.29% (148 teachers), satisfactory – in 22.82% (76 teachers), sufficient – in 17.27% (57 teachers), and high – in 15.62% (52 teachers).

Therefore, given the low and satisfactory levels of teachers' ICC formedness by the praxeological component, it can be stated that 67.11% have the need to develop the skills and abilities of successful purposeful use of ICTs in their scientific and pedagogical activities.
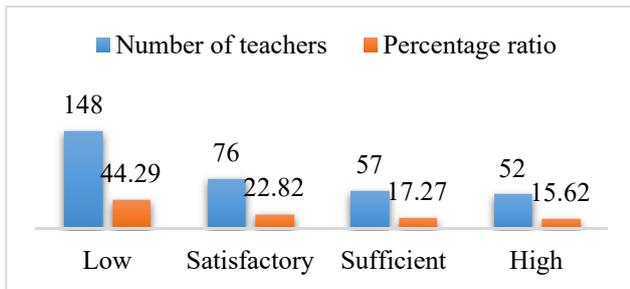
Figure 3. Levels of formedness of the praxeological component of teachers' ICC

To evaluate the formedness of the information-technological component of the teachers' ICC, quasi-professional and professional practical tasks were developed, in particular allowing us to determine the ability to use ICTs in scientific and pedagogical activities, to synthesize various software tools to enhance the teaching of general and special military disciplines, and to develop informational software tools for use in teaching these specific disciplines. The results of analysis (figure 4) show that the formedness of this component in teachers has the following levels: 46.15% (154 teachers) – low, 25,23% (84 teachers) – satisfactory, 16.62% (55 teachers) – sufficient, and 12.01% (40 teachers) – high.

Therefore, given the low and satisfactory levels of teachers' ICC formedness by the information-technological component, it can be stated that 71.38% have the need to develop the skills and abilities of use of ICTs in their scientific and pedagogical activities.
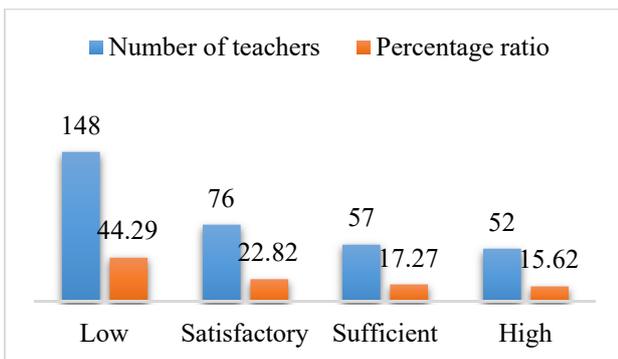

Figure 4. Levels of formedness of the information-technological component of teachers' ICC

To evaluate the subjectival component of the teachers' ICC, a testing was carried out that allowed us to determine the state of its formedness, in particular, the scientific and pedagogical subjectivity in the information society, the ability to self-assessment as a subject of information-analytical activities within the framework of implementation of the functions of a teacher of general and special military disciplines. Generalization of the obtained results (figure 5) makes it possible to conclude that there is a low level of formedness of this component in teachers (63.51% (212 teachers)), in 15.62% (52 teachers) this level is satisfactory, in 9.16% (30 teachers) – sufficient and only in 11.71% (39 teachers) – high.

Thus, given the low and satisfactory levels of formedness of the information-technological component of the teachers' ICC, we can state that 79.13% have the need to develop scientific and pedagogical subjectivity in the information society, and the ability for self-assessment as a subject of information-analytical activities within the framework of implementation the functions of a teacher within general and special military disciplines.
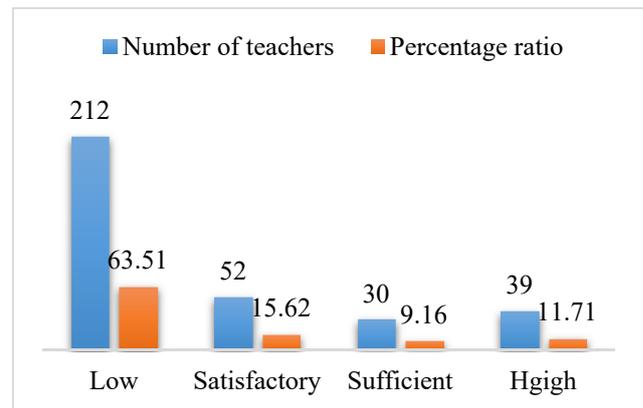

Figure 5. Levels of formedness of the subjectival component of teachers' ICC

Consequently, on the basis of processing of statistic data on the formedness of teachers' ICC components, the summarized results of their levels (figure 6) were obtained, in particular, the level of 47.04% (157 teachers) is low, 23.93% (80 teachers) – satisfactory, 15.64% (52 teachers) – sufficient, and 13.39% (44 teachers) – high.
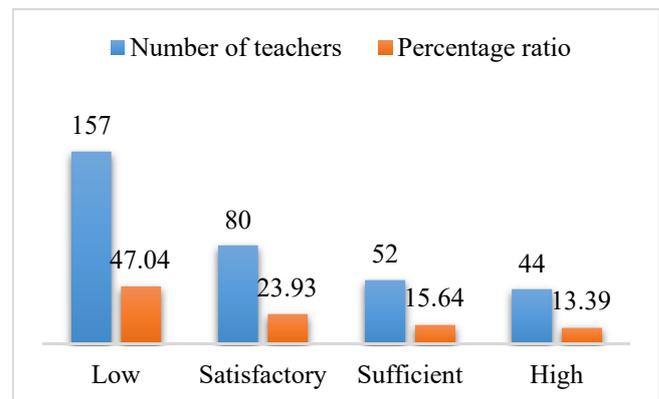

Figure 6. Levels of formedness of the teachers' ICC at the summative stage of the experiment

Therefore, given the fairly low and satisfactory levels of teachers' ICC formation, we can state that 70.97% of them have a need to develop theoretical competence (knowledge) and practical ability (skills,

experience and psychological readiness) to use ICTs, which will ensure successful fulfillment of their professional duties in scientific and pedagogical activities in the information society.

In addition, statistical data enable analysis of the subjective assessment of teachers regarding the formedness of their ICC after conducting the summative stage of the experiment (figure 7). The obtained data indicate that the teachers were unbiased enough in subjective assessment of the levels of its formedness.
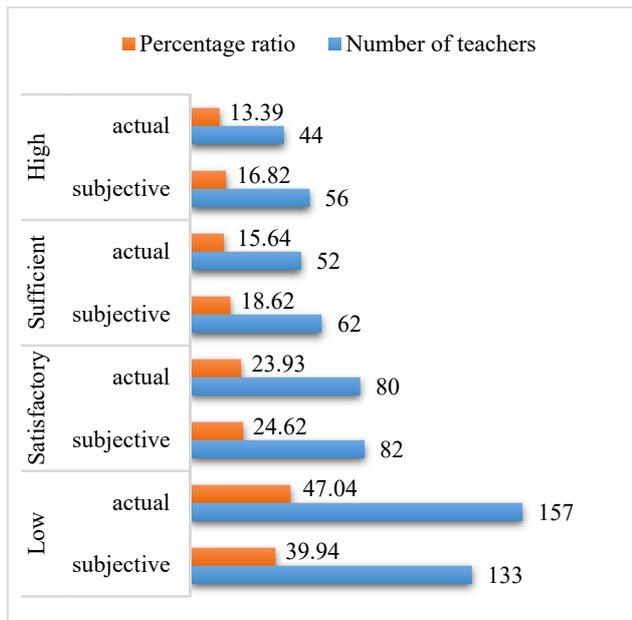

Figure 7. Comparison of the subjective and actual assessment of the levels of formedness of teachers' ICC

4. Conclusion

Thus, statistical analysis of the obtained data regarding formedness of the teachers' ICC confirms the relevance regarding the topic of scientific and pedagogical study. In particular, the following levels of its formedness were determined using empirical methods: 47.04% (157 teachers) – low, 23,93% (80 teachers) – satisfactory, 15.64% (52 teachers) – sufficient, and 13.39% (44 teachers) – high.

Therefore, given the quite large number of teachers having low and satisfactory levels of ICC formation, we can state that 70.97% of them have a need to develop theoretical competence (knowledge) and practical ability (skills, experience and psychological readiness) in order to use ICTs in scientific and pedagogical activities, which will ensure successful fulfillment of their professional duties as a subject of scientific and pedagogical activities in the information society.

Promising areas for further research: introduction into the pedagogical process of retraining and professional development courses of the profession-oriented model and methods of development of teachers' ICC in the process of remote learning; conducting a formative stage of the pedagogical experiment; analysis of the results of experimental training and confirmation or refutation of the relevant scientific (statistical) hypothesis.

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