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Liudmyla S. Shevchenko
PhD of Pedagogical Sciences, Assistant Professor Department of Innovative and Information Technologies
Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University, Vinnytsia, Ukraine
ORCID ID 0000-0003-4991-4949
lysi4801@gmail.com

Andrii I. Kryzhanovskyi
PhD of Pedagogical Sciences, Teacher of Information Technologies
Vinnitsia Humanities and Pedagogical College,Vinnytsia, Ukraine
ORCID ID 0000-0003-4108-9542
andylapatanoff@gmail.com

EXPERIMENTAL VERIFICATION OF THE EFFICIENCY OF FORMATION OF TRAINEE TEACHERS' PROFESSIONAL COMPETENCE WITH THE USE OF WEB TECHNOLOGIES

Abstract. The rapid pace of development of modern society, dynamism and continuous innovation processes lead to the fact that knowledge of the subject and possession of the method of teaching cannot fully characterize the current level of professional training of future teachers. The contents of the disciplines is constantly changing, new means and technologies of learning are emerging, and the flows of information that teachers should take into account in their professional activities are growing. Significant changes in the educational sector, in the first place, concern the use of Web technologies.
The purpose of the article is to highlight the methodology and results of research and experimental work aimed at the verification of the effectiveness of forming the professional competence of future teachers with the use of Web technologies.
In order to achieve the goal and check the tasks of the study, the selection, modification, development and testing of the theoretical and empirical complex (interviews, questionnaires and questioning of teachers and students, diagnostic methods) of research methods were carried out; qualitative and quantitative analysis of the results was carried out with the use of mathematical statistics methods. The empirical basis at the formative stage of the study included 315 students and 44 teachers of pedagogical institutes of Vinnytsia region.
The research and experimental verification of the motivational-value-based, cognitive and design-technological components of the formation of professional competence confirmed that the introduction of the developed methods of forming the professional competence of trainee teachers by means of Web technologies had the greatest impact on the motivation for educational, cognitive and professional activities using Web technologies, development of professional, communicative motives, motives of prestige, awareness and development of the need for collaboration with the use of Web technologies. The result of applying the methods is the formation of the ability of teachers and students to identify the pedagogically appropriate means of Web technologies, analyze and evaluate existing ones, develop and apply them in future pedagogical activities.

Keywords: teacher training; professional competence; innovative technologies; Web technologies; Web services.

1. INTRODUCTION

The current period of society development is characterized by the process of informatization – the use of information as a social product, which provides acceleration of scientific and technological progress, intellectualization of the main types of human activity, the democratization of society. One of the priority directions of informatization of society is the process of informatization of education, which involves the use of Web technologies for the implementation of ideas of developmental teaching, the intensification of all levels of the educational process, increase of its efficiency and quality, the formation of professional

competence of trainee teachers (theoretical and practical training, which is manifested in the nature of their professional activity, provides readiness and ability to pedagogical activity, desire and ability to create a new pedagogical reality). One of the major trends in the computerization of society is computerization of education in terms of goals, content, technologies, as well as understanding and vision of a holistic educational process that facilitates the preparation for innovative pedagogical activities (development, dissemination or application of educational innovations) in the conditions of society's informatization.

Web technologies are communication, information and other technologies and services which are the basis for the Internet activities. In order to form the professional competence of trainee teachers, it is appropriate to apply the informative and educational environment of the educational institution, electronic educational complexes, personal Web pages, Blogs, Web quests and Web services.

Based on the study of works by H. Ajjan, R. Hartshorne [1]; M. Atzori, N. Dessi, B. Pes [2]; S. Briggs [3]; V. Bykov, M. Leshchenko [4]; C. Costa-Sánchez, AI. Rodríguez-Vázquez, S. Direito-Rebolla [5]; J. Governor, D. Hinchcliffe, D. Nickull [6]; P. Lemoine, P. Hackett, M. Richardson [7]; Y. Liu, K. Kim [8]; O. Pinckhuk [9]; A. Shuen [10]; P. Tess [11] and my own research [12], we have identified a number of Web services that are most often used in education (Table 1), and the approaches to their use in the process of teacher training.

Table 1

The use of Web services in educational process of the pedagogical institutions

Social search system (Swicki, Quintura, Rollio)	Geoservices (Geographic mashup, Photographic mashup)
Creation and correction of documents (Blogs (Word Press, Blogger, My blog), Wiki)	Means to save bookmarks (Delicious, Moemesto, Memori, Social book-marking)
Multimedia resources saving and creation services	
Photos, schemes, pictures (Flickr, Photobucket, Panoramio, Flamber)	Presentations (Slideshare, SlideAware, Prezi, Media manipulation)
Video and Audio recordings (YuoTuve, Teacher, Podcard)	Books (Collaborative editing, Scribd)
Knowledge map (FreeMind, Mindmeister, Bubbls, Mindomo)	Educational resources (Draw.io, LearningAps, Socrative, Thinglink, Moovly, Appear.in, Mindmeistar, Online Test Pad, Make-test.ru, Kahoot)
Social networking websites (Facebook, Twitter, Instangram, Classmates, Linkedin, Google+1) and proffessional societies	Means to conduct Webconferences, Webinaris
Cloud computing (technologies)	
Gamification	

In the process of research and experimental work it was determined that the methods of building up professional competence of trainee teachers by means of Web technologies include the following: 1) integration of the content of professionally oriented academic disciplines and Web technologies; 2) implementation of pedagogical conditions in the educational process of higher educational establishments that contribute to effective formation of professional competence of trainee teachers with the use of Web technologies (updating of the developing potential of Web technologies; activation of resource support of trainee teachers using Web services; mastering the methods of using Web technologies in the educational process by teachers of pedagogical universities); 3) application of complex diagnostic and educational-methodical support (educational standards, curricula and programs, educational and teaching aids, methodical recommendations, laboratory workshops, technical means of training, etc.).

Based on the understanding of the methodology of forming the professional competence of trainee teachers using Web technologies as «concrete (private) didactics» (at the qualification and competence levels), we considered the integration task in direct relation with future innovative pedagogical activities as the students' dynamic ability to carry out professional tasks with the use of Web based technologies, through the allocation of essential system components that allow the description of the algorithm of educational activity. The method of achieving the educational goal (formation of professional competence of trainee teachers and their preparation for innovative pedagogical activities) was provided by the diagnostics of the initial level of preparedness of students, the formation of motivation to use Web technologies in both educational and future professional activities, definition of the content of training, organization of the educational process (forms, methods, technologies and teaching aids), control of learning achievements during training and assessment of the preparedness level at the end of the training. Accordingly, the system-forming components of the methodology of forming the professional competence of trainee teachers are the following:

– motivational-value-based (formation of motivation to future professional activity, to application of Web technologies, awareness of the personal and social value of the future profession, professional self-improvement, needs in self-education, self-revelation and self-expression, including, by means of Web technologies, mastering the technology of self-checking, self-education and self-development skills, ability to self-knowledge and self-realization; professional and personal self-determination of trainee teachers regarding the use of Web technologies in innovative educational activities);

– cognitive activity (mastering professionally significant knowledge; ability to: apply socio-pedagogical, methodological knowledge in practice; effectively use Web technologies for the processing, integration of multiformat information, creation of information products; identify pedagogically appropriate means of Web technologies, analyze and evaluate those that are currently available, develop and apply them in future innovative pedagogical activities);

– design-technological (the formation of goals, social settings, values orientations, interests, needs, inclinations, motives which enhance pedagogical activity and determine the professional orientation of the person; ability to carry out self-control and reflection (analyze, evaluate their own self-education, correct and develop new tasks, strive for professional development), including using Web technologies).

The purpose of the article is to highlight the methodology and results of research and experimental work aimed at verification of the effectiveness of the trainee teachers professional competence formation by means of Web technologies.

The objectives of the research are: to substantiate the methodology of formation of professional competence of trainee teachers by means of Web technologies; experimentally test the effectiveness of the motivational-value-based, cognitive-activity and design-technological components of the formation of professional competence.

2. METHODS OF RESEARCH

In order to solve the tasks, a complex of theoretical (analysis and synthesis of pedagogical, psychological, scientific and methodical literature with the purpose of comparing different views on the investigated problem) and empirical methods of research, qualitative and quantitative analysis of the results were carried out with the use of mathematical statistics methods.

Verification of the formation of the motivational-valuable component was conducted during interviews, surveys, questionnaires using the following diagnostic techniques: the study of the motivational sphere (N. Bakshaeva, O. Verbitsky [14]); diagnostics of educational motivation (A. Rean, V. Yakunin, edited by N. Badmayeva [13]). In order to monitor the formation of the cognitive-activity component, observations, surveys, determination of the level of professional knowledge, complex educational-professional and scientific-research tasks, rating were used; questionnaire for studying the problems of using Web technologies in the educational process. The verification of the formation of the design-technological component was carried out on the basis of a modified diagnostic map of pedagogical assessment and self-assessment of readiness for self-development; the methodology of diagnosing the level of development of reflexivity by A. Karpov, techniques of self-examination and self-determination; Questionnaire by SAMOAL (A. Lazukin) [15] and others.

3. ORGANIZATION AND THE RESULTS OF RESEARCH

The experimental verification of the effectiveness of forming the trainee teachers' professional competence with the use of WEB technologies is based on the requirements of the Ministry of Education and Science of Ukraine regarding updating the contents of pedagogical education; innovative approaches to the modification of forms, methods, means, techniques and technologies of teaching. 315 students and 44 teachers of pedagogical universities of Vinnytsia region participated in the study during the forming stage of the experiment.

To ensure the comparability of the pedagogical experiment data, students were divided into experimental (EG) (157 students) and control (CG) (158 students) groups. On the basis of the statistical check of the input control data using Student's t-criterion (for independent variables) it was proved that the CG and EG are homogeneous (torsr = 0,75 <tabl = 2,44 (df = 6, p = 0,05)).

The forming experiment was conducted within the educational process, taking into account non-changing conditions (studying in the CG and EG of the same disciplines, the use of identical forms of control), and changing conditions:

1) in the EG students worked in the informational educational environment using electronic teaching and learning complexes, Web services; in CG – students used traditional forms and methods of conducting classes using ICT (computer, projector, interactive board, presentations, electronic textbooks);

2) in EG as a means of resource maintenance of independent work, personal Web pages and Web quests were used, and in the CG – traditional materials (textbooks, manuals, presentations, etc.) were used;

3) in EG the training trajectory of the students was adjusted through the adaptive selection of the content of the training material using Web services, and in the CG this possibility was not provided.

At the beginning of forming experiment, the teachers were acquainted with its purpose, tasks, and the method of conducting. Everyone received a package of didactic materials and detailed recommendations for the introduction of a methodology for the formation of professional competence of trainee teachers by means of Web technologies.

The diagnosis of the formation of the motivational and value based component was carried out on the basis of a number of techniques: the study of the motivational sphere (N. Bakshaeva and O. Verbitsky [14]), data analysis showed that the motivation for studying activity (in the EG from 4,05 to 4,7 b., in CG from 4,1 to 4,55 b.), for cognitive activity (in the EG from 3,65 to 4,75 b., in CG from 3,95 to 4,6 b.) and professional activity (in EG from

3,4 to 4,65 b., in CG from 3,55 to 4,6 b.) has increased; the diagnosis of educational motivation (A. Rean, V. Yakunin, edited by N. Badmayeva [13]), the data review confirmed that the students of EG compared with the students of CG after the experiment had an increased average value of communicative motives (in the EG by 0,94 b., in the CG by 0,62 b.), motives of prestige (in EG by 0,98 b., in CG by 0,65 b.), professional motives (in EG by 0,83 b., in EG by 0,58 b.) and the average value of avoiding motives decreased by 0,44 b. in the EG compared to 0,3 b. in CG; almost equally grew motives of self-actualization, educational-cognitiving and social motives (Figure 1.).
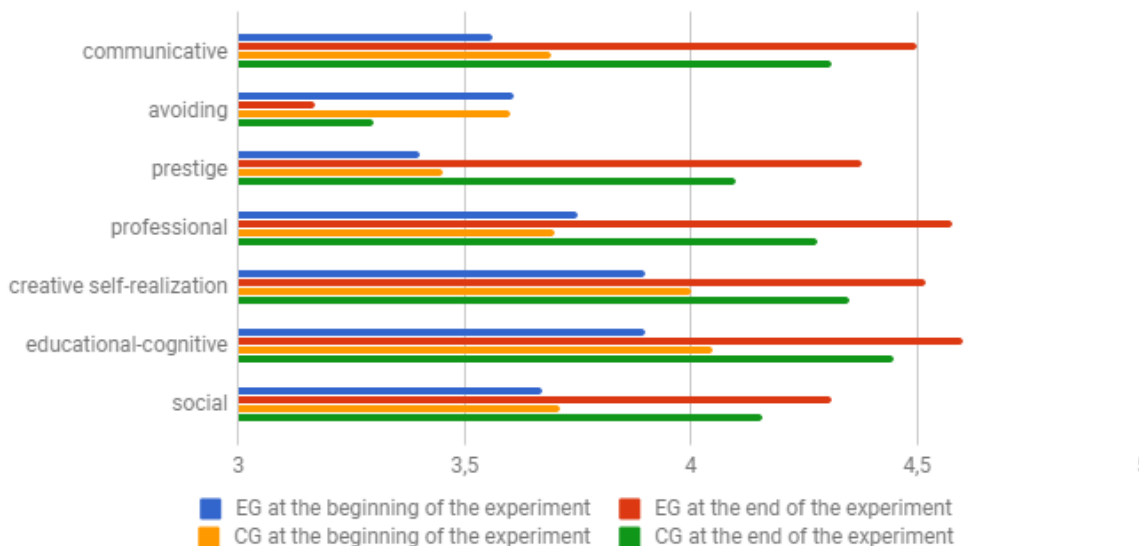

Figure 1. Diagnosis of educational motivation in EG and CG at the beginning and at the end of the experiment

The diagnostics of the level of formation of the cognitive-activity component included the definition of the level of professional knowledge of the theoretical and practical nature. The analysis of experimental data showed that, with a slight difference between the results of the entrance control, the students of the EG showed a significantly greater increase, for example, in the EG, the number of students with a high level of knowledge (from 9,3% to 17,6%), and the average level of knowledge (from 47,2% to 67,7%) has increased, and, accordingly, the number of students with a low level of knowledge has decreased up to 28,7% (in CG only 7,5%). Verification of the validity of the obtained EG results at the beginning and after the experiment (for dependent variables) was carried out using the t-criterion (1) of the Student:

$$t = \frac{\bar{x}}{\sigma_x / \sqrt{n}} \; ; \; t_{\exp} = \frac{56}{12.3\sqrt{3}} = 2{,}62 \qquad (1)$$

where $\bar{x}$ – average difference of means; σ_x – is the standard deviation of the differences.

The statistical verification confirmed that for df = 157, $t_{\exp}$ = 2,62, is between p<0,01 (2,62) and p<0,001 (3,38), the significance level is less than 1%. Consequently, the usage of the developed method contributes to the formation of a higher level of professional competence of trainee teachers.

At the beginning and at the end of the forming experiment, a questionnaire was conducted to study the problems of using Web technologies in the educational process. The analysis of the results confirmed the positive dynamics in the EG / CG (Internet – 92,5% / 86,5%; social networks – 81,5% / 64,5%; file storages – 74% / 46,5%; Web forums – 61,5% / 44,5%, social services for creation and editing the documents – 78,0% / 47,5%, social services for saving multimedia resources – 70,5% / 48,0%, Skype – 76,5% / 46,0%). Among the most important aspects of Web technologies' application in the educational process, the students of the EG and the CG noted more rational use of time (62,5% / 57,5%), the possibility of a detailed study of the new material (68,5% / 60,5%), the possibility of study taking into account individual characteristics and abilities (individualization of training) (64,5% / 58,0%).

The part of EG students, who were interested in study using Web technologies has increased by 24,5% (10,5% – in CG); 58,0% of students of the EG understood the content of the electronic resources of the Web quest (39,5% – CG), 52,5% of the students of the EG noted that the electronic methodological complex adequately features the content of the discipline (42,0% – CG).

At the beginning and at the end of the forming phase of the experiment, 44 teachers of pedagogical universities were questioned to identify issues that arise in the process of using Web technologies. Comparison of the obtained results made it possible to confirm that the implementation of the methodology contributed to the fact that teachers of educational institutions in the educational process began to often use the Internet (82%), file storages (45%), Web forums (38%); social networks (79%), tools for creating and editing documents (Blogs (67%), Wikipedia (48%)); develop and use personal Web pages (56%), Blogs (68%), Web quests (44%); 83% noted the need for examination and certification of pedagogical products, implemented on the basis of Web technologies.

At the beginning of the forming phase of the experiment many teachers noted the need for making instructions, methodological recommendations for students concerning work with the use of Web technologies (73,5%); teaching aids, recommendations and instructions for teachers on the development, content and use of Web technologies in the educational process of pedagogical universities (62%), conducting courses for teachers (84%).

The studying of the development of the design-technological component was carried out on the basis of a modified diagnostic map of pedagogical assessment and self-assessment of readiness for self-development (high level has increased in EG by 8,5%, in CG by 4,0%, the average level – in EG by 19,5%, in CG by 12,5%); A. Karpov's method of diagnosing the level of reflexivity development (high level has increased by 12,5% in EG and by 7,0% in CG, average level – (in EG by 15%, in CG by 10%), questionnaires of self-determination, the results of the questioning showed a significant decrease in the low level of self-examination and self-determination, in CG (by 14,5%) and in EG (by 20,0%) and the increase of high level – in CG by 14,5%, in the EG on 19,0%; the questionnaire SAMOAL (A. Lazukin) (66% of students of the EG showed a high level of self-actualization (CG – 51,5%), 31,5% – the average level (CG – 45,0%); 3,5% – low level of self-actualization (CG – 5,5%).

Summing up the results of experimental verification of the motivational-value, cognitive-activity and design-technological components of the formation of professional competence, we can state that the methodology of forming the professional competence of trainee teachers by means of Web technologies is an indicative basis for:

- implementation of innovative approaches to the organization of educational process in pedagogical universities;
- reorientation of teachers from the traditional transfer of information to the organization and management of innovative educational, cognitive and professional-practical activity of students using Web technologies;

- development of skills and abilities of informational activity; increasing the motivation of students to study disciplines, on the one hand, and the usage of Web technologies in teaching and future innovative pedagogical activities, on the other;
- definition of pedagogical expediency of using Web technologies and determination of motivational-value psychological and pedagogical aspects of their application.

4. CONCLUSIONS

It has been experimentally verified that the implementation of the methodology for forming the professional competence of trainee teachers using Web technologies in pedagogical universities contributes to:

- activating the educational process, as besides the classroom work, a significant place is allocated to independent work of students;
- formation of skills of self-education, activation of reflexive position, professional interest and development of pedagogical skills;
- the growth of motivation, the desire of students to learn the educational material and realize their knowledge through the system of self-control;
- students' mastering the new Web technologies and the methods of their use in future professional activities.

With the purpose of forming the ability to analyze and apply Web technologies in the future innovative pedagogical activity in trainee teachers, it is desirable to choose those that correspond to their personal pedagogical peculiarities and the level of their professional competence.

The analysis of the results of the forming phase of the experiment showed that all the components of professional competence in the experimental group of students have undergone significant changes. We confirm the effectiveness of the performed work by the results of the questionnaire of students and teachers, which confirmed that the implementation of the methodology allowed us to transfer students into active status, many of them, together with the teachers, began to act as Web technology developers. This allowed to change the role of teachers of pedagogical universities: their activity gave way to the activity of students, and the main task was the external management of the process of learning and development through cooperation and interaction, creating the conditions for the search of effective solutions of professionally oriented tasks and situations, the establishment of interconnection.

Defining the prospects for further scientific research, it should be noted that this study does not pretend to exhaustively solve all aspects of the problem under investigation. Further theoretical understanding and experimental confirmation require the creation and implementation of electronic resources of the informational educational environment; development of complex integrated training methods for trainee teachers to use Web technologies; development of criteria for the effectiveness of Web technologies. We also consider it necessary to further develop scientific and methodological support for the preparation of trainee teachers for innovative pedagogical activity, taking into account the prospective directions of Web technologies development.

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ЕКСПЕРИМЕНТАЛЬНА ПЕРЕВІРКА ЕФЕКТИВНОСТІ ФОРМУВАННЯ ПРОФЕСІЙНОЇ КОМПЕТЕНТНОСТІ МАЙБУТНІХ УЧИТЕЛІВ ІЗ ВИКОРИСТАННЯМ ВЕБ-ТЕХНОЛОГІЙ

Шевченко Людмила Станіславівна
кандидат педагогічних наук, доцент кафедри інноваційних та інформаційних технологій
Вінницький державний педагогічний університет імені Михайла Коцюбинського, м. Вінниця, Україна
ORCID ID 0000-0003-4991-4949
lysi4801@gmail.com

Крижановський Андрій Іванович
кандидат педагогічних наук, викладач інформаційних технологій
Вінницький обласний комунальний гуманітарно-педагогічний коледж, м. Вінниця, Україна
ORCID ID 0000-0003-4108-9542
andylapatanoff@gmail.com

Анотація. Швидкі темпи розвитку сучасного суспільства, динамізм та неперервні інноваційні процеси призводять до того, що знання предмета і володіння методикою його

викладання вже не можуть повністю характеризувати актуальний рівень професійної підготовки майбутніх учителів. Нині постійно змінюється зміст навчальних дисциплін, з'являються нові засоби та технології навчання, зростають потоки інформації, яку повинні враховувати вчителі у професійній діяльності. Значні зміни освітньої галузі, в першу чергу, стосуються застосування Веб-технологій.

Метою статті є розгляд методики та результатів дослідно-експериментальної роботи з перевірки ефективності формування професійної компетентності майбутніх учителів із використанням Веб-технологій.

Для досягнення мети та перевірки завдань дослідження було здійснено підбір, модифікацію, розробку й апробування комплексу теоретичних та емпіричних (бесіди, анкетування й опитування викладачів і студентів, діагностичні методики) методів дослідження; якісний і кількісний аналіз результатів здійснювався із застосуванням методів математичної статистики. Емпіричну базу на формувальному етапі дослідження склали 315 студентів та 44 викладачі педагогічних ВНЗ Вінницької області.

Дослідно-експериментальна перевірка мотиваційно-ціннісного, когнітивно-діяльнісного та проектувально-технологічного компонентів сформованості професійної компетентності підтвердила, що впровадження розробленої методики формування професійної компетентності майбутніх учителів засобами Веб-технологій найбільше вплинуло на мотивацію до навчальної, пізнавальної та професійної діяльності з використанням Веб-технологій; розвиток професійних, комунікативних мотивів, мотивів престижу; усвідомлення й розвиток потреб у співпраці з використанням Веб-технологій. Результатом застосування методики є формування у викладачів та студентів умінь визначати педагогічно доцільні засоби Веб-технологій, аналізувати та оцінювати наявні, розробляти та застосовувати їх у майбутній педагогічній діяльності.

Ключові слова: підготовка вчителів; професійна компетентність; інноваційні технології; Веб-технології; Веб-сервіси.

ЭКСПЕРИМЕНТАЛЬНАЯ ПРОВЕРКА ЭФФЕКТИВНОСТИ ФОРМИРОВАНИЯ ПРОФЕССИОНАЛЬНОЙ КОМПЕТЕНТНОСТИ БУДУЩИХ УЧИТЕЛЕЙ С ИСПОЛЬЗОВАНИЕМ ВЕБ-ТЕХНОЛОГИЙ

Шевченко Людмила Станиславовна
кандидат педагогических наук, доцент кафедры инновационных и информационных технологий
Винницкий государственный педагогический университет имени Михаила Коцюбинского,
г. Винница, Украина
ORCID ID 0000-0003-4991-4949
lysi4801@gmail.com

Крыжановский Андрей Иванович
кандидат педагогических наук, преподаватель информационных технологий
Винницкий областной коммунальный гуманитарно-педагогический колледж, г. Винница, Украина
ORCID ID 0000-0003-4108-9542
andylapatanoff@gmail.com

Аннотация. Быстрые темпы развития современного общества, динамизм и непрерывные инновационные процессы приводят к тому, что знание предмета и владение методикой его преподавания уже не могут полностью характеризовать актуальный уровень профессиональной подготовки будущих учителей. Сейчас постоянно меняется содержание учебных дисциплин, появляются новые средства и технологии обучения, растут потоки информации, которую должны учитывать учителя в профессиональной деятельности. Значительные изменения образования, в первую очередь, касаются применения Веб-технологий.

Целью статьи является рассмотрение методики и результатов опытно-экспериментальной работы по проверке эффективности формирования профессиональной компетентности будущих учителей с использованием Веб-технологий.

Для достижения цели и проверки задач исследования был осуществлен подбор, модификация, разработка и апробирование комплекса теоретических и эмпирических (беседы, анкетирование и опросы преподавателей и студентов, диагностические методики)

методов исследования; качественный и количественный анализ результатов осуществлялся с применением методов математической статистики. Эмпирическую базу на формировальном этапе исследования составили 315 студентов и 44 преподавателя педагогических вузов Винницкой области.

Опытно-экспериментальная проверка мотивационно-ценностного, когнитивно-деятельностного и проектировочно-технологического компонентов сформированности профессиональной компетентности подтвердила, что внедрение разработанной методики формирования профессиональной компетентности будущих учителей средствами Веб-технологий больше всего повлияло на мотивацию к учебной, познавательной и профессиональной деятельности с использованием Веб-технологий; развитие профессиональных, коммуникативных мотивов, мотивов престижа; осознание и развитие потребностей в сотрудничестве с использованием Веб-технологий. Результатом применения методики стало формирование у преподавателей и студентов умений определять педагогически целесообразные средства Веб-технологий, анализировать и оценивать имеющиеся, разрабатывать и применять их в будущей педагогической деятельности.

Ключевые слова: подготовка учителей; профессиональная компетентность; инновационные технологи; Веб-технологии, Веб-сервисы.