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DIAGNOSTIC APPARATUS OF RESEARCHING THE RESULTS OF PREPARING TEACHERS TO USE VIRTUAL VISIBILITY TOOLS IN PROFESSIONAL ACTIVITIES

Abstract. To define the pedagogical system effectiveness, it is necessary to develop the criteria and indicators of its effectiveness and characterize the learning subjects by levels. The article aim: to develop criteria and indicators for teachers' readiness to use virtual visualization tools in professional activities. Theoretical analysis of scientific sources was used to clarify the possible diagnostic apparatus of the study, generalization of scientific approaches to define essential criteria and indicators, structural and logical analysis of the concept of "teacher's readiness to use the tools of virtual visibility in professional activities" to clarify the links between the components of readiness, the criteria and indicators of their formation, comparison for characterization teacher's readiness levels to use virtual visibility tools in professional activities. To determine the effectiveness of the system of training future teachers of mathematics and computer science to use the means of virtual visibility in professional activities, the criteria and indicators have been developed: value-orientation criterion (indicator – value orientations on virtual visibility use in professional activities); cognitive criterion (indicator – digital awareness in virtual visual aids); technological criterion (indicator – skill use virtual visualization tools to create didactic materials); professional activity criterion (indicators - the ability to develop lessons using tools; the ability to critically evaluate the means of virtual visibility, involving the needs of the educational activities organization); personal criterion (indicators – the ability to critical analysis, self-education, reflection). The developed diagnostic apparatus allows to empirically confirm the effectiveness of the developed pedagogical system for training of future mathematics and computer science teachers to use virtual visibility in professional activities.

Key words: diagnostic apparatus, criterion, and indicators, teacher's readiness, means of virtual clarity, teacher training, teacher of mathematics, teacher of computer science.

Formulation of the problem. Conducting any pedagogical research involves its implementation in the practice of the educational process. However, it may only sometimes have the desired effect on learning outcomes. A pedagogical experiment confirms the call sign dynamics in a specific characteristic, involving the preliminary diagnostic apparatus development. In other words, to determine the effectiveness of any innovative methodology, it is necessary to develop/ assess its effectiveness criteria and indicators and give the characteristics of the student learning level.

We researched the issue of professional training of future mathematics and computer science teachers and determined the contradiction between society demand for the trained teachers of mathematics and computer science, focused on teaching the generation of visual learners, and the need to create visual content to accompany educational activities. The limited theoretical ideas on the models of their appropriate professional training have been recorded. The solution to the contradiction highlighted the need for anticipatory training of future mathematics and computer science teachers to use virtual visibility tools (VVT) in their professional activities. P.Mulesa et al. [1; 17] provide the theoretical model of training future mathematics and computer science teachers to use VVT in professional activities. At the same time, the theoretical model requires empirical confirmation, so developing a diagnostic apparatus to test its effectiveness has become relevant.

Analysis of current research. Criterion makes allows to assess a certain quality or result. An indicator is a marker that allows to talk on the quantitative measure of a result. Requirements for criteria and indicators are presented in Fig.1. [14].

The analysis of the criteria and indicators that characterize the future teachers training for various aspects of professional activity or the formation of readiness for a specific type of activity revealed the following.

According to I.Dychkivska [13], the teacher training is to involve the presence of motivational attitudes for activities. According to A.Fedorchuk [22] and O.Semenikhina [19], the main criteria of teachers' readiness are the motivation for pedagogical activity and professional knowledge, skills, and means of pedagogical activity. The importance of motivation,

CRITERIA AND INDICATORS			
must be objective	include the most essential aspects of the object or phenomenon under study	must be formulated briefly, clearly, and accurately	must measure what needs to be tested exactly

Fig.1. Requirements for criteria and indicators

theoretical training, technological-analytical skills for the teacher's readiness to use dynamic mathematics programs is topical.

In the study [21], the design, constructive, organizational, communicative, and gnostic criteria are substantiated for external evaluation of the effectiveness of the methodological system of basic professional training of computer science teachers.

The article authors have generalized scientists' approaches to characterizing teachers' readiness for a specific type of activity:

– Training a mathematics teacher at a specialized school [8];

– Preparing mathematics teacher for innovative educational activities [9; 12];

– Training of teachers of natural and mathematical courses to use visualization technologies in subject-professional activities [10];

– Training of teachers of computer science in pedagogical universities [16];

– Training of teachers to visualize in the professional activities [4; 5];

– Training of computer science teachers to use the specialized software [3];

– Preparing future teachers to develop of mathematical abilities in high school [18];

– Preparing teachers to use social media [2; 23];

– Preparing physics teachers to use virtual physics laboratories [6; 7; 20].

– The criteria for the quality of pedagogical activity, are described in [15].

However, the generalization of the criteria and indicators proposed by scientists, which characterized the levels of readiness for a specific type of activity, and presented in the work [11, p.434–435] the criteria and indicators of the quality of pedagogical activity did not give us a systematic idea of the criteria and indicators of mathematics and computer science teachers' readiness to use VVT in their professional activities. Therefore, this article **aims** to develop criteria and indicators for determining teachers' level of preparedness to use VVT in professional activities.

Materials and methods. To achieve the goal, a theoretical analysis of scientific sources – to clarify the possible diagnostic apparatus of the study, a generalization of scientific approaches to identify essential criteria and their potential indicators, a structural and logical analysis of the concept of «teacher's readiness to use VVT in professional activities» to clarify the links between the components of readiness and the criteria and indicators of their formation, comparison and comparison to characterize the levels teacher's readiness to use VVT in professional activities.

Results. The readiness of future mathematics and computer science teachers to use VVT in their professional activities is understood as their personal quality, which is characterized by a complex structure (Fig.2).

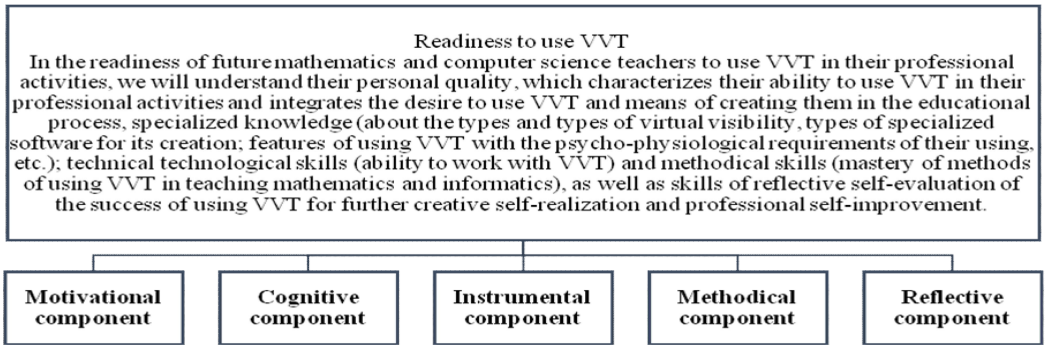

Fig.2. Structure of readiness of future teachers of mathematics and computer science to use VVT in professional activities

Considering the structure of readiness of a mathematics and computer science teacher to use VVT in professional activities, we distinguish criteria and indicators.

The value-oriented criterion allows to study the interest of students in future professional activities and motivation to organize the educational process using virtual visibility. Prospective mathematics and computer science teachers have an idea of personal and social value of future professional self-disclosure using knowledge of future professional activity. The formation of positive motivation to use virtual visibility, the ability to self-knowledge and self-realization, and the usage of VVT in professional activities. Professional and personal self-determination of future teachers is essential for the preparing for professional activities and the ability to use virtual visibility in their work. Therefore, the indicator of the value-oriented criterion for the readiness of future teachers to use VVT in professional activities was chosen: «Value orientations on the use of VVT in professional activities».

The cognitive criterion allows you to test the knowledge of future teachers of mathematics and computer science about the means of virtual visibility and the ability to use them in practice, understanding of the essence of information technologies, the specifics of their application in the general educational process, knowledge of the advantages and disadvantages of their use, knowledge of the technical characteristics of VVT, knowledge of the peculiarities of the use of visualization tools in mathematics and computer science lessons, as well as their and its impact on the activities of teachers and students in the classroom. Assessing the existing and acquired theoretical knowledge of future mathematics and computer science teachers determines the general awareness of the importance of using

digital technologies, the desire for self-knowledge, and the formation of general professional competence. It involves the creation of prerequisites for self-education, which should stimulate an increase in digital literacy and positive motivation to use digital means of supporting the educational process. Therefore, as an indicator of the cognitive criterion for forming the professional readiness of a future mathematics and computer science teacher to use VVT in professional activities, we have chosen «Digital awareness in VVT».

The technological criterion of readiness characterization is the ability of future mathematics and computer science teachers to create computer visualization and apply the necessary professional skills and abilities in production activities in the context of the rapid technological development of society and digital technologies in it. In the context of training future teachers of mathematics and computer science, readiness is characterized by professional skills, skills in the use of digital tools and resources, and the ability and need to systematically supplement and expand the scope of involvement of these tools and resources, their own professional (teaching and learning) activities, including visualization. It means the ability to rationally select materials, tools, and devices (equipment) and possess the basic techniques (operations, techniques) of creating virtual visibility in applying high-level skills for their professional needs. Therefore, the criterion indicator is the «Ability to use virtual visual aids to create visual didactic materials».

The professional activity criterion is determined by the professional skills that teachers of mathematics and computer science should have:

- ability to use visualization tools to organize students' learning effectively.
- ability to determine which visualization tools are best suited for use in the classroom according to their content, purpose, and implementation method.
- ability to create your virtual tools and constantly improve them to move to higher levels of pedagogical excellence and demonstrate initiative, independence, and creativity in learning organization.

This criterion a priori assumes that students know that future mathematics and computer science teachers should acquire successful visual support in their professional activities (Fig.3).

Knowledge

- professionally significant knowledge (professional, psychological-pedagogical, managerial, scientific-methodical, subject, technological);
- scientific and practical knowledge about the pedagogical activity of a secondary school teacher in general and the specifics of its implementation in the process of learning in primary, secondary, and higher school in particular;
- knowledge of the methodology of teaching mathematics and informatics based on the involvement of IT;
- knowledge of psychological and didactic regularities and laws, didactic principles of learning using VVT;
- knowledge about the effective use of VVT in the educational process, about the creation of information products;
- knowledge about the pedagogical expediency of VVT, etc.

Skill

- the ability to organize the process of teaching mathematics and informatics using VVT;
- the ability to improve virtual visual content for one's own needs, the ability to use individual and group forms of learning with the involvement of VVT;
- the ability to use frontal work with VVT in organizing educational activities in mathematics and computer science classes, mastering the technique of using various VVT in the educational process by the topic and conditions of the lesson;
- abikity to give a comprehensive assessment of the means of virtual visibility from the standpoint of social-educational, artistic-aesthetic, technological, functional-applied (utilitarian) orientation;
- ability to search, select, and analyze the necessary information of a project-technological, educational-methodical nature regarding the means of virtual visibility and their use in mathematics and computer science lessons;
- ability to outline the problem, form the goal and task of using VVT, select rational methods and means of achieving the final result;
- ability to use VVT in professional-pedagogical activities;
- simulate pedagogical situations in the process of teaching mathematics and informatics based on the involvement of VVT;
- carry out the design and development of VVT, revealing the ideological and thematic basis of the project idea;
- ability to the classification of VN means;
- organize creative activities using virtual visibility tools, and arrange individual workplaces in compliance with sanitary and hygienic requirements and safe work rules using virtual visibility tools.

Fig.3. Knowledge and skills to provide visual support for professional activities

We have chosen "Ability to develop lessons using VVT" and "Ability to critically evaluate VVT, taking into account the educational activities organization needs" as indicators of professional activity criterion of future mathematics and computer science teachers readiness to use VVT in the professional activities.

The personal criterion allows us to characterize the qualities and abilities of the teacher that will contribute to the successful organization, implementation, and analysis of educational activities using VVT with students in mathematics and computer science lessons, the ability to self-study and self-assessment, teaching students using VVT in mathematics and computer science lessons and finding personal guidelines for future teachers in resolving contradictions in the educational process through the proper organization of activities. It also includes the ability to exercise control for further self-improvement, self-management, and recognition of the results of one's performance. Therefore, we have chosen "Ability to Critical Analysis", "Ability to Self-Education," and "Reflection"

as indicators of the personal criterion of professional readiness to use VVT in professional activities.

Criteria and indicators of readiness of future mathematics and computer science teachers to use VVT in their professional activities allow us to characterize the levels of such readiness (Fig. 4).

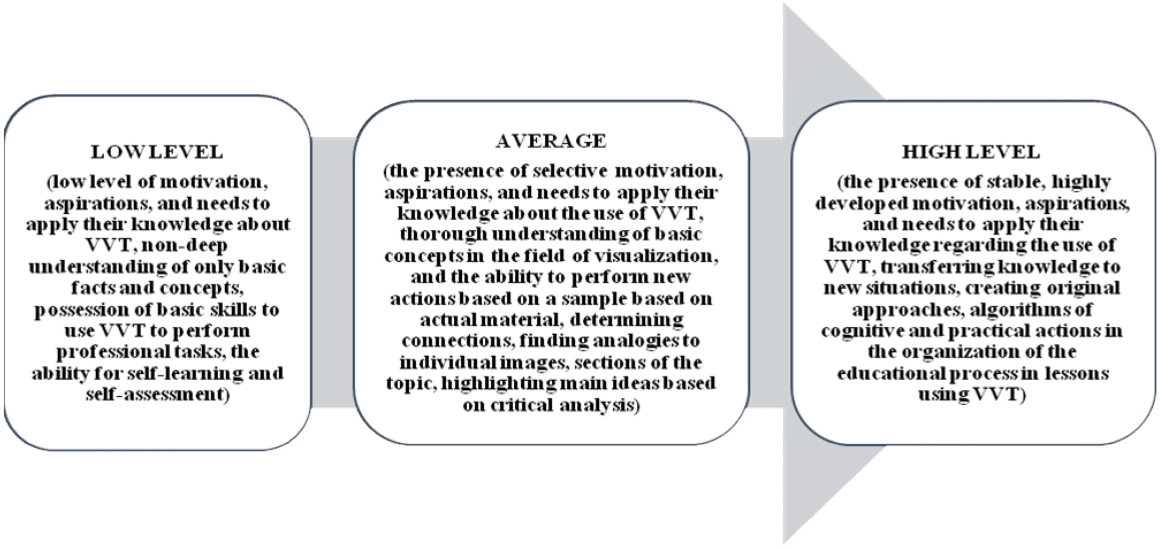

Fig.4. Levels of teacher's readiness to use virtual visual aids in professional activities

Conclusions. To determine the effectiveness of the system of training of future teachers of mathematics and computer science for the use of VVT in professional activities, we developed the criteria and their indicators: value-oriented criterion (indicator – value orientations on VVT in professional activities); cognitive criterion (indicator – digital awareness of VVT); technological criterion (indicator – skills use VVT to create didactic materials); professional and activity criterion (indicators – the ability to develop lessons using tools; the ability to critically evaluate VVT, taking into account the needs of the organization of educational activities); personal criterion (indicators – ability to critically analyze, ability to self-education, reflection). The developed diagnostic apparatus makes it possible to empirically confirm the effectiveness of the pedagogical system for training future mathematics and computer science teachers to use VVT in professional activities vis a pedagogical experiment.

Список використаної літератури

1. Mulesa P., Momot R., Semenikhina O. Conceptual foundations for preparing mathematics and computer science teachers for the use of virtual clarity means. *Pedagogy and Education Management Review.* 2022. Vol.4. P.13–23.
2. Ostroha M., Drushlyak M., Shyshenko I., Naboka O., Proshkin V., Semenikhina O. On the use of social networks in teachers' career guidance activities. *E-learning in the Time of COVID-19 Scientific Editor Eugenia Smyrnova-Trybulska «E-learning»*, 13, Katowice–Cieszyn, 2021. P.266–277.
3. Semenikhina E., Drushlyak M., Shishenko I., Zigunov V. Using a praxeology approach to the rational choice of specialized software in the preparation of the computer science teacher. *TEM JOURNAL – Technology, Education, Management, Informatics*. 2018. Vol.7, No.1. P.164–170.
4. Semenikhina O., Kudrina O., Koriakin O., Ponomarenko L., Korinna H., Krasilov A. The Formation of Skills to Visualize by the Tools of Computer Visualization. *TEM Journal*. 2020. Vol.9, No 4. P.1704-1710.
5. Semenog O., Yurchenko A., Udovychenko O., Kharchenko I., Kharchenko S. Formation of Future Teachers' Skills to Create and Use Visual Models of Knowledge. *TEM Journal.* 2019. Vol.8, No 1. P.275–283.
6. Shamonia V., Semenikhina O., Drushlyak M., Lynnyk S. Computer visualization of logic elements of the information system based on Proteus. 15th International Conference on ICT in Education, Research, and Industrial Applications (ICTERI 2019). Kherson, June 12-15, 2019. P.459-463
7. Yurchenko A., Khvorostina Yu., Shamonia V., Soroka M., Semenikhina O. Digital Technologies in Teaching Physics: An Analysis of Existing Practices. 2023 *45th International Convention on Information, Communication and Electronic Technology, MIPRO 2023* – Proceedings, 2023. P.666-671.
8. Акуленко І.А. *Компетентнісно орієнтована методична підготовка майбутнього вчителя математики профільної школи (теоретичний аспект)* : монографія. Черкаси: видавець Чабаненко Ю., 2013. 460 с.
9. Ачкан В. Готовність вчителя математики до інноваційної освітньої діяльності: теоретичний аспект. *Наукові записки. Серія: Проблеми методики фізико-математичної і технологічної освіти*, 2018. Вип.5. С.13–18.
10. Білоусова Л., Житєньова Н. Компоненти готовності майбутніх учителів природничо-математичних дисциплін до застосування технологій візуалізації у предметно-професійній діяльності. *Наукові записки Тернопільського національного педагогічного університету імені Володимира Гнатюка. Серія: Педагогіка.* 2018. №3, С.80–87.
11. Бондарчук О.І., Єльнікова Г.В. Критерії і показники якості навчальної діяльності. Енциклопедія освіти / Акад. пед. наук України; гол. ред. В.Г.Кремень. Київ: Юрінком Інтер, 2008. С.434–435.
12. Гавриш І.В. *Теоретико-методологічні основи формування готовності майбутніх учителів до інноваційної професійної діяльності*: Дис... д-ра пед. наук: 13.00.04 / Харківський національний педагогічний ун-т ім. Г.С.Сковороди. Х., 2006. 579 с.
13. Дичківська І. М. *Інноваційні педагогічні технології*: підручник, 2-е видання, доповнене. Київ: Академвидав, 2012. 352 с.
14. Дьяченко М.И., Кандыбович Л.А. *Психологические проблемы готовности к деятельности*. Мн.: Изд-во БГУ, 1976. 176 с.
15. Єльнікова Г.В. Критерії якості педагогічної діяльності. Енциклопедія освіти / Акад. пед. наук України; гол. ред. В.Г.Кремень. Київ: Юрінком Інтер, 2008. С.435–436.
16. Морзе Н. В. *Система методичної підготовки майбутніх вчителів інформатики в педагогічних університетах*: дис... д-ра пед. наук: 13.00.02 / Національний педагогічний ун-т ім. М.П.Драгоманова. К., 2003. 605 с.
17. Мулеса П. Моделювання педагогічної системи підготовки майбутніх учителів математики та інформатики до застосування засобів віртуальної наочності у професійній діяльності. *Освіта. Інноватика. Практика.* 2022. Т.10, №6.

С.31-37.
18. Семенець Л. М. *Формування професійної готовності майбутніх учителів до розвитку математичних здібностей у старшокласників*: дис. … канд. пед. наук: 13.00.04 / Житомирський державний університет імені Івана Франка. Житомир, 2013. 247 с.
19. Семеніхіна О.В. *Професійна готовність майбутнього вчителя математики до використання програм динамічної математики: теоретико-методичні аспекти* : монографія. Суми: ВВП «Мрія», 2016. 268 с.
20. Семеніхіна О.В., Юрченко А.О., Удовиченко О.М. Формування умінь візуалізувати начальний матеріал у майбутніх учителів фізики: результати педагогічного експерименту. *Фізико-математична освіта.* 2020. Вип.1(23). С.122–128.
21. Спірін О. М. *Теоретичні та методичні засади професійної підготовки майбутніх учителів інформатики за кредитно-модульною системою*: монографія / За наук. ред. акад. М.І.Жалдака. Житомир: Вид-во ЖДУ ім. І.Франка, 2007. 300 с.
22. Федорчук А.Л. Критерії та показники готовності майбутнього вчителя інформатики до роботи в класах фізико-математичного профілю. *Вісник Чернігівського національного педагогічного університету. Серія: Педагогічні науки*, 2015. Вип.130. С.223–227.
23. Юрченко А, Мулеса П., Лобода В., Острога М. Соціальні сервіси як майданчик для супроводу освітнього процесу і навчання інформатики. *Фізико-математична освіта,* 2022. Том 34. №2. С.63–70.

References

1. Mulesa, P., Momot, R., & Semenikhina, O. (2022). Conceptual Foundations For Preparing Mathematics And Computer Science Teachers For The Use Of Virtual Clarity Means. *Pedagogy and Education Management Review, 4*, 13–23.
2. Ostroha, M., Drushlyak, M., Shyshenko, I., Naboka, O., Proshkin, V., & Semenikhina, O. (2021). On the use of social networks in teachers' career guidance activities. *E-learning in the Time of COVID-19 Scientific Editor Eugenia Smyrnova-Trybulska «E-learning», 13*, Katowice–Cieszyn, 266–277.
3. Semenikhina, E., Drushlyak, M., Shishenko, I., & Zigunov, V. (2018). Using a praxeology approach to the rational choice of specialized software in the preparation of the computer science teacher. *TEM Journal – Technology, Education, Management, Informatics, 7*(1), 164–170.
4. Semenikhina, O., Kudrina, O., Koriakin, O., Ponomarenko, L., Korinna, H., & Krasilov, A. (2020). The Formation of Skills to Visualize by the Tools of Computer Visualization. *TEM Journal, 9*(4), 1704–1710.
5. Semenog, O., Yurchenko, A., Udovychenko, O., Kharchenko, I., & Kharchenko, S. (2019). Formation of Future Teachers' Skills to Create and Use Visual Models of Knowledge. *TEM Journal, 8* (1), 275–283.
6. Shamonia, V., Semenikhina, O., Drushlyak, M., & Lynnyk, S. (2019). Computer visualization of logic elements of the information system based on Proteus. *15th International Conference on ICT in Education, Research, and Industrial Applications (ICTERI 2019)*. Kherson (June 12-15), 459-463.
7. Yurchenko, A., Khvorostina, Yu., Shamonia, V., Soroka, M., & Semenikhina, O. (2023). Digital Technologies in Teaching Physics: An Analysis of Existing Practices. *45th International Convention on Information, Communication and Electronic Technology, MIPRO 2023* – Proceedings, 666-671.
8. Akulenko, I.A. (2013). *Kompetentnisno oriientovana metodychna pidhotovka maibutnoho vchytelia matematyky profilnoi shkoly (teoretychnyi aspekt)* [Competence-oriented methodical training of the future mathematics teacher of a specialized school (theoretical aspect)]. Chabanenko Yu. (in Ukrainian).
9. Achkan, V. (2018). Hotovnist vchytelia matematyky do innovatsiinoi osvitnoi diialnosti: teoretychnyi aspect [Mathematics teacher readiness for innovative educational activity: theoretical aspect]. *Naukovi zapysky. Seriia: Problemy metodyky fizyko-matematychnoi i tekhnolohichnoi osvity, 5*, 13–18. (in Ukrainian).
10. Bilousova, L., & Zhytienova, N. (2018). Komponenty hotovnosti maibutnikh uchyteliv pryrodnycho-matematychnykh dystsyplin do zastosuvannia tekhnolohii vizualizatsii u predmetno-profesiinii diialnosti [Components of readiness of future teachers of natural and mathematical disciplines to use visualization technologies in subject-professional activities]. *Naukovi Zapysky V.Hnatiuka Ternopilskoho Natsionalnoho Pedahohichnoho Universytetu. Seriia: Pedahohika, 3*, 80–87. (in Ukrainian).
11. Bondarchuk, O. I., & Yelnikova, H. V. (2008). Kryterii i pokaznyky yakosti navchalnoi diialnosti [Criteria and indicators of the quality of educational activity]. *Entsyklopediia osvity – Encyclopedia of education*. Yurinkom Inter. (in Ukrainian).
12. Havrysh, I.V. (2006). *Teoretyko-metodolohichni osnovy formuvannia hotovnosti maibutnikh uchyteliv do innovatsiinoi profesiinoi diialnosti* [Theoretical-methodological foundations of formation of readiness of future teachers for innovative professional activity]. Unpublished doctoral dissertation. Kharkivskyi natsionalnyi pedahohichnyi un-t im. H.S.Skovorody. (in Ukrainian).
13. Dychkivska, I.M. (2012). *Innovatsiini pedahohichni tekhnolohii* [Innovative pedagogical technologies]. Akademvydav. (in Ukrainian).
14. Dyachenko, M.I., & Kandybovich, L.A. (1976). *Psikhologicheskiye problemy gotovnosti k deyatelnosti* [Psychological problems of readiness for activity]. BSU Publishing House. (in Russian).
15. Yelnikova, G. V. (2008). Kryterii yakosti pedahohichnoi diialnosti [Quality criteria of pedagogical activity]. In V.H.Kremin (Ed.). *Entsyklopediia osvity – Encyclopedia of education*. Yurinkom Inter. (in Ukrainian).
16. Morze, N.V. (2003). *Systema metodychnoi pidhotovky maibutnikh vchyteliv informatyky v pedahohichnykh universytetakh* [System of methodical training of future informatics teachers in pedagogical universities]. Unpublished doctoral dissertation. M.Drahomanov Natsionalnyi pedahohichnyi Un. (in Ukrainian).
17. Mulesa, P. (2022). Modeling of the pedagogical system of training future teachers of mathematics and computer science for the use of virtual visualization tools in professional activities. *Education. Innovation. Practice, 10* (6), 31–37.
18. Semenets, L.M. (2013). *Formuvannia profesiinoi hotovnosti maibutnikh uchyteliv do rozvytku matematychnykh zdibnostei u starshoklasnykiv* [Formation of professional readiness of future teachers for the development of mathematical abilities in high school students]. Unpublished candidate dissertation. I.Franko ZhDU. (in Ukrainian).
19. Semenikhina, O.V. (2016). *Profesiina hotovnist maibutnoho vchytelia matematyky do vykorystannia prohram dynamichnoi matematyky: teoretyko-metodychni aspekty* [Professional readiness of the future mathematics teacher to use dynamic mathematics programs: theoretical and methodological aspects]. VVP «Mriia». (in Ukrainian).
20. Semenikhina, O.V., Yurchenko, A.O., & Udovychenko, O.M. (2020). Formation of skills to visualize educational material in future physics teachers: results of a pedagogical experiment. *Physics and Mathematics Education, 1* (23), 122–128.
21. Spirin, O.M. (2007). *Teoretychni ta metodychni zasady profesiinoi pidhotovky maibutnikh uchyteliv informatyky za kredytno-modulnoiu systemoiu* [Theoretical and methodical principles of professional training of future computer science teachers by the credit-module system]. I.Franko ZhDU. (in Ukrainian).
22. Fedorchuk, A.L. (2015). Kryterii ta pokaznyky hotovnosti maibutnoho vchytelia informatyky do roboty v klasakh fizyko-matematychnoho profiliu [Criteria and indicators of the readiness of the future computer science teacher to work in physical and mathematical classes]. *Visnyk Chernihivskoho Natsionalnoho Pedahohichnoho Universytetu. Seriia: Pedahohichni nauky, 130*, 223–227. (in Ukrainian).
23. Yurchenko, A., Mulesa, P., Loboda, V., & Ostroha, M. (2022). Sotsialni servisy yak maidanchyk dlia suprovodu osvitnoho protsesu i navchannia informatyky [Social services as a playground for support of the educational process and teaching computer science]. *Fizyko-matematychna osvita, 34* (2), 63-70. (in Ukrainian).

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ДІАГНОСТИЧНИЙ АПАРАТ ДОСЛІДЖЕННЯ РЕЗУЛЬТАТІВ ПІДГОТОВКИ ВЧИТЕЛІВ ДО ВИКОРИСТАННЯ ЗАСОБІВ ВІРТУАЛЬНОЇ НАОЧНОСТІ У ПРОФЕСІЙНІЙ ДІЯЛЬНОСТІ

Анотація. Мета статті: розроблення критеріїв та показників для визначення рівня готовності вчителя до використання засобів віртуальної наочності у професійній діяльності. Використано теоретичний аналіз наукових джерел для уточнення можливого діагностичного апарату дослідження, узагальнення наукових підходів з метою виокремлення суттєвих критеріїв та їх можливих показників, структурно-логічний аналіз поняття «готовність вчителя до використання засобів віртуальної наочності у професійній діяльності» для уточнення зв'язків між компонентами готовності та критеріями і показниками їх сформованості, порівняння і зіставлення для характеристики рівнів готовності вчителя до використання засобів віртуальної наочності у професійній діяльності. Для визначення ефективності системи підготовки майбутніх учителів математики та інформатики до використання засобів віртуальної наочності у професійній діяльності розроблено критерії та їх показники: ціннісно-орієнтаційний критерій (показник – ціннісні орієнтації на використання засобів віртуальної наочності у професійній діяльності); пізнавальний критерій (показник –цифрова обізнаність у засобах віртуальної наочності); технологічний критерій (показник – уміння використовувати засоби віртуальної наочності для створення дидактичних матеріалів); професійно-діяльнісний критерій (показники – уміння розробляти уроки з використанням засобів; уміння критично оцінювати засоби віртуальної наочності з урахуванням потреб організації освітньої діяльності); особистісний критерій (показники – здатність до критичного аналізу; здатність до самоосвіти; рефлексія). Розроблений діагностичний апарат дає можливість емпірично через педагогічний експеримент підтвердити ефективність розробленої педагогічної системи підготовки майбутніх учителів математики та інформатики до використання засобів віртуальної наочності у професійній діяльності.

Ключові слова: діагностичний апарат, критерій і показники, готовність вчителя, засоби віртуальної наочності, підготовка вчителя, вчитель математики, вчитель інформатики.