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THE ROLE AND PLACE OF THE DISCIPLINE “HISTORY OF MATHEMATICS IN THE 21st CENTURY”

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The key to the success of educational reform is a comprehensive and thorough training of future specialists in any field, with a broad scientific worldview and a high level of culture. For high-quality training of future professionals, a new stage has begun, characterized by the emergence of innovative technologies in the educational process. In higher educational institutions that train future specialists, there is an interest in the modernization of the educational process. The XXI century is a time of differentiation of sciences, earlier integral science was divided into smaller parts, new branches appeared, scientists specialized, individual researches give way to collective efforts. In such a whirlwind of events, the desire to study in detail and deeply any initial discipline, especially the history of its formation and development, is lost. In the absence of time, historical and mathematical information gradually becomes secondary, and should be consistent, clear, complete and arouse students' interest in the subject.

That is why it is important to emphasize some historical aspects of development, problems of teaching and learning, and possible ways to solve it in the discipline of "history of mathematics".

The research used methods of scientific knowledge: systematic and comparative analysis of literature, work programs, syllabi, pedagogical process on the problem of research, generalization and systematization.

It was found out, that the methods of teaching and learning have changed, although we have the opportunity to work with the latest computer technologies, but the role as an effective means of learning and the place as an integral part of the universal scientific heritage remain unchanged.

It is shown, that the history of mathematics will continue to serve as a discipline that is a kind of link between humanitarian, technical and natural sciences, contributes to the development of a scientific worldview and forms erudition

Keywords: *history of mathematics, history of science, scientific worldview, academic discipline, innovative technologies, educational process, higher education*

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1. Introduction

At the current stage of the development of science, the volume of various easily accessible information increases, at the same time, the desire to study in detail and in depth any elementary discipline, especially the history of its formation and development, is lost. The relevance of this problem determined the choice of the topic of the article.

Scientists claim that knowledge of the main facts of the history of the origin of basic concepts, the main historical incentives for development, biographical information about outstanding mathematicians, knowledge of the state of mathematics problems has an impact on the attitude of students and pupils to the subject, on the motivation of their educational activities [1].

From the analysis of syllabi and work programs for the past 10 years, it is clear, that in most universities the discipline "history of mathematics" is selective, taught to senior students, and the total volume of the discipline does not exceed three credits. In most cases, the form of assessment is credit, these condi-

tions do not contribute to the popularization of the subject.

Currently, there is practically no methodological support for the implementation of the principle of historicism in the educational process of modern higher and general educational institutions. Mandatory program material is quite dense and oversaturated, therefore, only a few minutes can be devoted to the presentation of historical material in classes on mathematical disciplines. Although such materials are most relevant at the beginning of studying a program topic, or at the motivational stage of any lesson.

The author of the work [1] determines that in society there is a need for the formation and development of knowledge and skills in students of higher pedagogical educational institutions and students of schools, positive motivation for learning, value orientations and other personal qualities that determine their ability to self-realize in life and future professional activity. One of the ways to achieve this is better use of historical and mathematical material during education.

In the work [2], the author emphasizes that the history of mathematics course is useful for every student, and for the future teacher it is necessary both for the formation of a holistic worldview and for work at school. Knowledge of the ways and conditions of formation of basic mathematical sciences increases the level of mathematical culture of the future teacher and improves his/her professional skills.

Mathematics, or rather its development, is also subject to social influence. The history of education is undoubtedly methodologically important, as it allows us to see the general laws that form the basis for events in mathematics education [3].

The relationship between the history of mathematics education and other disciplines is two-way. The history of mathematics helps historians to reconstruct the events of the past, in general. The life of society is reflected in many different spheres of its activity, and for a long time mathematical education was considered one of the most important such spheres [3].

2. Literary review

The history of mathematics education is a field of study that is both old and new. According to [3], scientific works in this field began to appear more than 150 years ago. The first mathematical works, in which the history of mathematics was also studied, were published in Germany in the 19th century, and in the USA the first dissertations on the mathematics of education were written specifically on its history in 1906.

Mathematics is constantly in motion, problems are solved and new questions arise. Mathematics is alive and therefore an important part of human culture, it has its own history. At the same time, it is also an art form, in which logical rules form the basis, but creativity and ingenuity are crucial [4].

Knowledge of historical aspects helps teachers find a successful solution to an important problem - where to start the presentation of the mathematical discipline and what should be the sequence of the presentation of the entire educational material. Famous mathematicians and methodologists emphasized the great educational and upbringing importance of the history of science in the teaching of mathematics [5].

The historical-genetic method is important for practical application, it assumes that learning should repeat the historical path of the emergence of concepts, mathematical theories, and methods of proving statements. The role of the history of mathematics in the professional training of students is highlighted in historical terms, it is learned better, deeper and easier [6]. Research on how the history of mathematics can be used in teaching and learning mathematics seems limitless [7].

Mathematical concepts and ideas are considered in the process of their emergence and development. This contributes to students' understanding of how school knowledge of mathematics is related to the theories, studied in higher education [6]. Biographies of great scientists of the past, their scientific and moral deeds influence the processes of self-improvement and self-education of young people. The author is sure that historical material "humanizes" mathematics [8].

In the literature available for analysis, there are no systematized and elaborated research results on the role and place of the educational discipline "history of mathematics" in the 21st century, and there are only fragments of its importance at different times from the point of view of different researchers. In this work, the further development of the research, as well as the justification of the role and place of the educational discipline "history of mathematics" in the 21st century took place, presented its path from the first mathematical treatises to the influence of innovative processes on this discipline.

3. Research aim and tasks

The aim of the study is to determine the role and place of the educational discipline "history of mathematics" in the 21st century, from the point of view of its teaching and through the prism of its importance for the effective implementation of future professional training.

To achieve the goal, the following tasks were set:

1. To show how multifaceted the history of mathematics is and from what different points of view it can be considered and examined.

2. To show the path of development of the discipline, the process of adaptation of the discipline to changing conditions, its role and place in the 21st century.

3. To identify still unresolved issues, related to the discipline "history of mathematics".

4. Research methods

To achieve the goal, a set of methods of scientific knowledge was used: systematic and comparative analysis of literature, work programs, syllabi, pedagogical process on the research problem, generalization and systematization in order to obtain a complete picture of the current state, role and place and opportunities for improving the teaching of the history of mathematics.

5. Research results and their discussion

According to [9], the higher school modernizes the educational process of future specialists in the direction of the need for them to synthesize knowledge, the unity of science and culture. The history of science and technology shapes thinking, reflects not only their actual development, but also how they influence the satisfaction of social needs, meet interests and preserve values for posterity, relationships between people.

There is a gap between the formed subject competences and the lack of functional literacy and this is one of the main problems of mathematics education. It turned out that students do not know how to apply mathematical knowledge in real life situations [10]. According to the author, by using the history of mathematics, it is possible to implement the educational process in such a way as to reveal the interpenetration of scientific ideas, concepts, and laws, included in the content of each mathematical discipline, so that students understand the complex structure of mathematics.

Like no other science, mathematics is a collective science: every mathematical result that has ever been correctly proven remains part of mathematics and does not contradict new knowledge. Thus, the history of mathematics is of particular importance for understanding its content [4]. Formation of motivation to study

mathematics is an important problem of pedagogical theory and practice. It can be solved in various ways, techniques, methods, but one of the most effective is the use of elements of historicism [11].

The author of the work [1] defines that the purpose of teaching the educational discipline "History of Mathematics" is the formation of a general idea of mathematics as a science in its historical development in students.

In such a small course, in terms of volume, detailed historical reviews and the presentation of certain areas of the development of the science of mathematics are generally not given enough time and attention. Teachers and future teachers of mathematics have a need: to learn details from the history of mathematics, problems of old times, interesting stories that can make their work brighter, more interesting, rich and pleasant. The main aspect of selection is, of course, what can be well and practically integrated into the practice of school mathematics.

The first important mathematical treatise, related to the history of ancient mathematics, is the work of Euclid "Elements", first printed in Venice in 1482 (the most successful and influential of all books ever written, second only to the Bible in the number of reprints), an important memory of not only the history of mathematics, but also the history of language and literature. "Elements" proved to be important in the development of logic and modern science.

The most comprehensive work on the history of medieval mathematics is the works of Professor Yushkevich, and they are complemented by biographies of prominent figures of Islamic science in the work Dictionary of Scientific Biography. Modern mathematics was analyzed by Vekerdi László in several of his studies, which were published in 2010 [12].

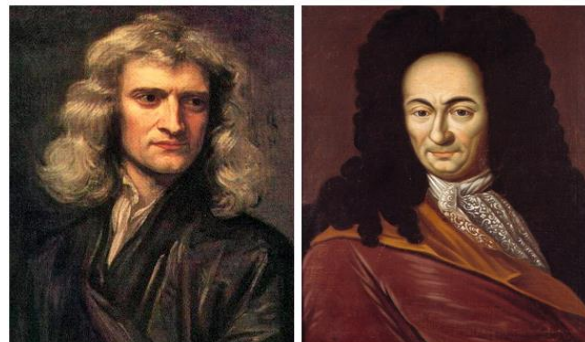
The history of science confirms again and again that most of the development took place in small steps, and as a rule, geniuses were behind big steps or revolutions in science [13].

Undoubtedly, the emergence of new professions and a growing economy will affect the mathematics education system. It is clear, that economic growth and technological achievements are connected – this creates opportunities for the development of mathematics education. The economy forms the demand for mathematics education and at the same time supports its activity [3].

The computer has changed the content, meaning, understanding, sense of education [6]. Nowadays, a new pedagogy is being formed, the characteristic feature of which is innovation, the ability to update, to discover new things, and the use of innovative technologies, which contributes to the improvement of the quality of professional training of the future specialist [14]. Now, with the advent of e-learning, opportunities for learning and teaching have expanded. The originality of the presentation of the material makes it possible to influence the motivation to study and activate the cognitive activity of students, because a bright visual presentation

of information helps students easily remember the educational material, awaken imagination and creative thinking [15].

Fig. 1. shows a fragment of the presentation on the topic "Integral and differential methods in mathematics of the 17th century." Isaac Newton and Gottfried Wilhelm Leibniz are on the slide, this presentation makes it easier for the student to remember visual information, in this case, prominent scientists.



Isaac Newton Gottfried Wilhelm Leibniz


Fig. 1. Fragment of the presentation

Fig. 2. Presents a fragment of a test task in the Google Classroom service, here its possibilities of placing pictures are used, in this case it helps the student to find his/her way more easily and successfully cope with the test tasks.

The role of the history of mathematics in human culture and the history of science is huge, it should be noted, that mathematical science is a constituent part of philosophy, which served as a means of learning about the world. The discipline "history of mathematics" is a part of the cultural heritage of mankind, an integral unit among the history of various sciences in the integral history of science, it studies the main stages of the development of mathematical science in its historical section, the regularities of the formation of mathematical theories, biographies of prominent figures of mathematics; contributes to the development of a scientific worldview, the development of intelligence, appropriate mathematical culture and the achievement of the necessary general cultural level, teaches to correctly establish cause-and-effect relationships, forms general erudition in students and is an integral component of the process of forming the readiness of future mathematics teachers for pedagogical activities.

Mathematical education today is much more widespread than half a century ago, new approaches and methodological views are constantly emerging, but elements of the history of mathematics can and should still be used for better learning of mathematics. Examining the place and role of the discipline "history of mathematics" is a prospect for further research, as mathematics develops and thereby creates its own history.

The term "mathematics" comes from the Greek word "μάθημα", which means:




Calculations, measurements
 Knowledge, science
 Teaching to count
 Nature
 Literacy, intelligence

Who invented cuneiform?

Sumerians
 Pythagoreans
 Egyptians
 Homer

The founder of non-Euclidean geometry is...



Euclid
 Nikolai Lobachevsky
 René Descartes
 Galileo Galilei
 Democritus

When did Babylonian mathematics reach its peak?

in the 19th century BC
 in the 19th century AD
 in the 21st century BC

Fig. 2. Fragment of a test task in the Google Classroom service

6. Conclusions

1. The formation of the "history of mathematics" discipline over time and the preservation of its significance until the 21st century are shown. Due to its versatility and importance, it has adapted to changing conditions, and this is the most important factor in its value. The history of mathematics is so multifaceted that it can be considered and examined from different points of view and it will show a rich past and a bright and promising future.

2. It is shown, that the discipline of "history of mathematics" in the 21st century, even in the conditions

of digitalization, occupies an important place among the history of sciences, because the means of education have changed, not its role and place.

3. Some unsolved questions, related to the discipline "history of mathematics", are clarified, which serve as the object of further research, because when using innovative technologies, it is worth knowing what served as the basis of their development.

Conflict of interests.

The authors declare that they have no conflicts of interest.

References

- Panova, S. O. (2017). Purpose and objectives of the educational discipline «history of mathematics» as a propaedeutic course in the professional preparation system of future teachers of mathematics. *Visnyk Cherkaskoho universytetu*, 12, 54–61.
- Hodovaniuk, T. L. (2009). *Metodyka individualnoho navchannia istorii matematyky studentiv pedahohichnykh universytetiv*. Kyiv: NPU. im. M. P. Drahomanova, 20.
- Karp, A., Furinghetti, F. (2018). History of Mathematics Teaching and Learning Achievements, Problems, Prospect. *IC-ME-13 Topical Surveys*. Springer Nature, 48. doi: <http://doi.org/10.1007/978-3-319-31616-1>
- Brückler, F. M. (2018). *Geschichte der Mathematik*. Berlin: Springer Spektrum, 164. doi: <http://doi.org/10.1007/978-3-662-55574-3>
- Diachuk, M. V. (2017). Znachennia istoryko-matematychnykh znan dlia vchytelia ta vykladacha matematyky. Available at: <https://vseosvita.ua/library/znacenna-istoriko-matematichnih-znan-dla-vchytela-ta-vkladacha-matematiki-21144.html>
- Sverchevska, I. A. (2017). Istoryko-henetychnyi pidkhid u fakhovii pidhotovtsi maibutnykh uchyteliv matematyky. *Fyzyko-matematychna osvita*, 4 (14), 82–86.
- Clark, K. M. (2019). History and pedagogy of mathematics in mathematics education: History of the field, the potential of current examples, and directions for the future. *Eleventh Congress of the European Society for Research in Mathematics Education*. Utrecht: Utrecht University, 28.
- Puzyrov, V. Ye. (2015). Vykorystannia istorychnoho materialu pry vykladanni vyshchoi matematyky – ody z chynnyktiv rozvytku piznavalnoho interesu studentiv. *Naukovi zapysky Kirovohradskoho derzhavnogo pedahohichnoho universytetu im. V. Vynnychenka*, 8, 47–52.

9. Besov, L. M. (2004). *Istoriia nauky i tekhniky*. Kharkiv: NTU, 382.
10. Roslova, L. O., Bachurina, M. A. (2019). Mathematical education content in the context of mathematical literacy. *EEIA 2019. Education Environment for the Information Age*, 673–681. doi: <http://doi.org/10.15405/epsbs.2019.09.02.77>
11. Shestopal, O. V. (2014). *Istorychni khvylynky yak diievyi zasib motyvatsii do vyvchennia matematyky*. Available at: http://acup.poltava.ua/?page_id=84
12. Gazda, I. (2013). Hungarian literature of the universal history of mathematics. *Journal of History of Culture, Science and Medicine*, 4 (6), 134–141.
13. Suntola, T. (2018). The short history of science– or the long path to the union of metaphysics and empiricism. *CreateSpace*, 256.
14. Kyslenko, D. P. (2018). Place and role of innovation technologies in professional training of future guarding expert. *Naukovyi visnyk UzhNU*, 1 (42), 96–100.
15. Mesarosh, L. V. (2021). Research of the online technologies influence on the perception of visual information in physics. *Pedagogical Sciences Reality and Perspectives*, 1 (79), 206–210. doi: <http://doi.org/10.31392/npu-nc.series5.2021.79.1.44>

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