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DEVELOPMENT OF METHODICAL SYSTEM OF "HISTORY OF INFORMATICS" COURSE IN PEDAGOGICAL UNIVERSITIES

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Abstract

Despite the considerable amount of work on the course of history of science interest in their improvement is not currently weakened by the need to take into account the particular Z generation of students. The aim is to design and modernization of the course of methodical system of "History of science" in the preparation of future teachers, promoting the formation of their readiness for the digital school. Updating the objectives, content, means, methods and forms of teaching undergraduate courses is based on cognitive and projective-recursive approach, ensuring their motivation, better storage and deep knowledge of historical issues of informatics. A scientific-methodical idea of perfection of methodical system of the course "History of science" by updating its components with new cognitive and personalized methods and means of learning (temporal concept maps; "inverted" time belt) is proposed. It stimulates a highly motivated student to learn in a gamification with international collaboration pedagogical institutes. The main components of the course updated methodical system of "History of science" to train future teachers. Its modernization is carried out by transforming subject knowledge into meta-subject results and the cognitive qualities of the student. The advantages are: the implementation of the principles of student-centered learning; the recursive nature of training - “I create a project myself, according to which I study myself and will train others”; innovative and exploratory learning. The materials of the work are of practical value for teachers of pedagogical universities and employees of teacher training institutes.

Keywords: “History of Informatics” course, temporal concept map, inverted time tape, international collaboration of pedagogical universities.

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1. Introduction

The significance of history in general and the history of science in particular is well known. The history of science often depends on the subjective attitudes of researchers. This factor especially holds true for relatively young sciences, such as computer science.

From the point of view of Vernadsky (1988), for long periods, the development of science in one part or another of the world could be paused and stopped altogether, but scientific thought can revive in other regions and at the same time reach the previous level of development. In his opinion, at the beginning of the XX century one should expect the development of science in the form of geometric progression, "an explosion of scientific creativity".

In some countries of the world, studies on the history of computer science are quite active. Periodically, monographs on the history of cybernetics, the history of the development of computer technology, the biographies of prominent scientists and engineers in the field of information technology appear. In the United States, a special journal, IEEE Annals of the History of Computer Science, is published. It is dedicated to publications on historical studies of cybernetics and computer science. International conferences on the history of cybernetics and computer science are held annually, for example, International congresses on cybernetics (Namur, Belgium), conferences on the history of computers (Nixdorf Forum in Paderborn, Germany). Important work is being done in the museums of the history of computer science: "Charles Babbage Institute" (Minneapolis, USA), "Computer Museum" (Boston, USA), "Science Museum" (London) and many others.

It should be noted that virtual museums in Russia are dedicated to this topic: (http://www.computer-museum.ru, http://informat444.narod.ru, http://old.ihst.ru). In Ukraine, there is the Museum of Computer Science (http://www.icfcst.kiev.ua), the materials of which mainly reflect the history of Soviet computer engineering. A similar situation is reflected in the books of Malinovsky (1995), for example, in "The history of computer technology in persons".

Academician Yanshin said that the development of science was impossible without studying its history, which opened up wide prospects for the specialist in his professional work, allowed one to avoid mistakes thus improving his activities (as cited in Sokolov, 2005).

However, at present, there is a severe deficit of research on the history of Russian and Kazakh computer science; and there is practically no corresponding educational literature. It should be noted that European and American publications practically do not reflect the history of computer science in Russia, Kazakhstan and other republics of the former Soviet Union.

The study of the history of computer science, the collection, processing and storage of data on the most important events and personalities must begin with the school bench. A special role in the education and dissemination of high moral principles for young people is played by acquaintance with biographies of prominent scientists and engineers. Motivating and patriotic factors in teaching students can arise when considering the national and regional aspects of the history of science (Abdulkarimova, 2016; Pak, 2012).

Despite the importance, the educational process in the history courses of specialized sciences does not motivate students to study them deeply, it has a secondary role for them. At the same time, courses in the history of sciences have a philosophical and fundamental character, a system and methodological

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scientific and educational platform, which requires serious and responsible attitude of teachers and students to them.

In this regard, the thorough preparation of future teachers on the history of computer science in pedagogical universities seems relevant.

2. Problem Statement

Analysis of teaching students history of exact sciences (mathematics, physics, informatics) showed different approaches to the selection of teachers and the content of the training methods. As a rule, they address issues of chronological ordering of knowledge and success in a particular field of science, the causes and consequences of the progressive development of scientific ideas and technologies, biographical details of individuals who have contributed to the formation and development of science. The modern course in the history of science should be aimed not only at the systematization and knowledge of the historical aspects of the scientific field, but also at the formation of the student's personal and cognitive abilities. At the same time, it is important to increase the student's motivation to research and understand the cause-and-effect patterns of discoveries and the development of scientific ideas and technologies, which is especially important for the new generation of young people with clip thinking.

In this regard, a scientific and methodological problem arises of finding the most appropriate approaches to organizing the educational process on the history of science in modern conditions of digitalization of education to significantly improve the quality of training for future teachers.

3. Research Questions

Many years of experience in teaching the "History of Computer Science" course at pedagogical universities have revealed difficulties and a drop in students' motivation to learn it for a number of reasons, among which are dominant (Bidaibekov et al., 2019):

- The need to memorize a large number of dates, personalities and events, which causes a high load and stress on the learner's memory;
- The need for systematization and systematic formation of all computer science as a scientific field, which requires knowledge of all computer science disciplines.

In this regard, the main objective of the study is to update the components of the methodological system of the history of computer science course:

- Expanding the objectives of the course, taking into account modern requirements of the digital society and challenges;
- Selection of course content taking into account national and regional factors;
- The choice of means and methods of teaching students adequate to Z generation and having a high coefficient of efficiency.

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4. Purpose of the Study

Computer science and its history have significant scientific, educational and educational potential in the preparation of a future computer science teacher. With a reasonable course in the history of computer science, one can achieve high educational results not only in the field of historical events, but also in the development of computer science itself.

The purpose of this work is to justify the updating of the components of the methodological system of the "History of Computer Science" course from the standpoint of cognitive and projective-recursive approaches that ensure the effective achievement of new planned learning outcomes for future computer science teachers at pedagogical universities.

5. Research Methods

Hattie (2008) indicates the so-called effect size (d) - a value that shows how much the parameter under study changes the average indicators of educational effectiveness. The author draws attention to those factors whose effects are more than 0.4. For example, one of the methods of cognitive visualization is the use of concept cards in learning, representing the graphic conceptual structure of the educational material (effect> 0.7). The advantages of concept cards, in contrast to intelligence cards or memory cards (Busan, 2007), are associated with the fact that students themselves must participate in the compilation process. At the same time, cognitive visualization is aimed not only at studying mastered material, but also at developing cognitive abilities, analytical and critical thinking of students.

When designing the methodological system of the course "History of Computer Science" we will use cognitive visualization methods and a projective-recursive approach (Bazhenova & Pak, 2016) based on the following points:

1. The objectives of the course are transformed from subject to meta-subject and personal learning outcomes. The course is aimed not only at the knowledge of the historical aspects of the formation and development of computer science, but also at the formation of the student's personal and cognitive abilities, in particular such as:

- evolutionary logical thinking;
- analytic-synthetic thinking, providing concentricity and system-structural folding / unfolding of historical information.

2. The selection of content, the choice of tools and teaching methods are determined taking into account the paradigm of student-centered learning (Weimer, 2002).

3. The information interaction of the participants in the educational process is based on subject-object-subjective relations (Bazhenova & Pak, 2016).

4. The activity component (practice) should use the project method and be personified and recursive, to ensure the student's maximum motivated attitude to the implementation of an individual or team project on the principle of "I create a learning tool that I learn by myself and will train others" (Bazhenova & Pak, 2016).

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For science history courses, the technique of compiling concept cards should be upgraded from a flat two-dimensional format to a three-dimensional one by introducing a third time dimension. Let us call the spatial representation of the concept map, which changes in time, temporal. The temporal concept map for the history of science has the following advantages:

1. Allows you to visualize the chronological systematization of success in any field of science;

2. Helps to isolate the origin of the main scientific idea and see the patterns of occurrence and development of scientific knowledge and related technologies;

3. Improves understanding of the mechanisms of the progressive development of scientific ideas and problems, summarize the main ideas of educational material.

Let us give an example of a temporal concept card on the topic "the history of computer technology" (Figure 01).

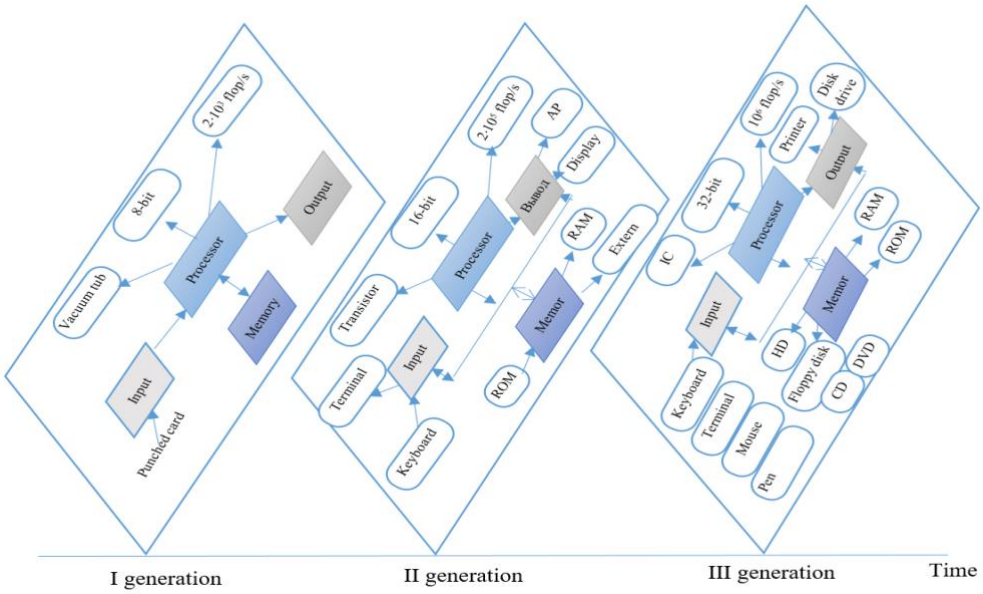

Figure 01. Temporal concept map on the history of computer technology

Unfortunately, there are currently no special tools for developing such concept cards. The authors hope that software developers will soon pay attention to the concept of temporal mental maps under consideration. So far, in their absence, it is possible to recommend the construction of temporal maps using graphical editors.

In some works (Khegay, 2014; Pak, 2019) it was shown that the structure and content of the new generation of information tools should reflect the cognitive characteristics of the student and be personified as much as possible.

For science history courses, increased motivation is possible through the use of: the student-centered approach (Crumly, 2014), the Socratic method (from questions and tasks to learning) (Nazarov, 2004), and the "inversion" of educational material (Pak et al., 2020).

The essence of the inverted tape of time in the history of science is to change the chronological presentation of educational material to a question-and-answer format. Examples of inverted time tapes on topics in the history of computer science are shown in Figure 02.

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Figure 02. Inverted time ribbon on the history of computer science

Inverted time tapes in the history of science can serve as a means and subject of instruction and have the following advantages:

- structuring and presentation of educational information in the format of chronological answers to questions and tasks in an inverted form, corresponding to the cognitive characteristics of the digital generation Z;
- compilation by students themselves of inverted time tapes on the studied topics of the history of science in the framework of design tasks and with final certification.
- the student is given not only the necessary information, but also the opportunity to search for answers to questions and pose problems for the teacher;
- interactivity and the ability to work with a teacher remotely due to cloud technology services.

6. Findings

Analysis of the experience of Russian and Kazakh researchers in the field of integration of educational systems, the creation of international educational clusters, laboratories (Akkassynova et al., 2018; Bidaibekov et al., 2017; Oshanova et al., 2019) revealed the possibility of collaborating in educational disciplines with invariant content. The greatest synergistic effect of such mega-educational activities of several single-profile universities can be achieved using gamification technologies. An example of a game situation: students of KSPU named after V.P. Astafyev encode (with historical codes) answers for students to solve at KazNPU named after Abay invented a crossword puzzle in the form of a specific route through virtual museums of the history of computer science; KazNPU students are developing a rebus for KSPU students to decipher the names of Kazakh scientists who have contributed to the history of computer science.

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The basis of practical and independent work of students on the course is the project method. Recommendations for the implementation of the research educational project are as follows**:**

1. Historical educational lines are distinguished: the history of the transmission of information (communication), the history of VT, the history of programming languages, etc.

2. For each line, a temporal concept map and an inverted time tape are built. For example, you can use on-line time feed editors, Web-programming, procedural language Pascal, Python.

3. On an inverted tape of time, information material is selected: essay, task, test.

Here is the form for the implementation of control measures when students study at the pedagogical universities (KSPU and KazNPU) of the course “History of Informatics” in 2017-2019.

The test or examination forms of control are based on a rating system. Each student forms his own study portfolio for the course. The set of test tasks includes:

- Attendance at lectures and preparation of electronic lecture notes;
- Work at seminars and participate in discussions;
- Creation of own site "History of Computer Science";
- Creation of a multimedia exhibit for the virtual museum of the history of computer science;
- Creation of a set of test tasks at the rate.
- Implementation of a research project on the topic of the course in the form of inverted time tapes and temporal concept cards.

Conversations and a questionnaire of students, the supervision of teachers, as well as the results of the success of students passing the course showed the following:

- the majority of students (98%) expressed satisfaction with the educational process;
- high activity and interest in teaching students the course is associated with the implementation of individual creative projects, competition with students of another university, the conditions for personifying training, as well as with the professionally-oriented (projective-recursive) nature of training.

7. Conclusion

The proposed methodological system for training future informatics teachers in the course “History of Informatics” has a high degree of personification, has a student-centered character. The modernization carried out taking into account modern realities touched almost all of its components: targeted and informative, educational and methodical resources, teaching aids and methods, and monitoring the effectiveness of training.

The use of temporal concept cards, inverted time tapes, gamification in the context of an international collaboration of the educational process on the history of science are aimed primarily at satisfying the learner’s self-educational needs, developing their cognitive abilities using the motivational elements embedded in these tools that are characteristic of the digital generation Z.

To increase interest and reduce the complexity of teaching a course, it is necessary to take into account the following didactic conditions for the organization of the educational process:

- The choice of teaching aids is determined by their ability to memorize a large amount of information by utilizing all the sensory and cognitive abilities of a person;
- The historical reconstruction method is applied on the basis of temporal concept cards, inverted time tapes, providing an evolutionary-logical and analytical-synthetic systematization of computer science knowledge in historical aspect;
- The use of a projective-recursive approach to the implementation of research and development projects by students provides a professionally oriented character of instruction.

Thus, the article proposes the modernization of the methodological system of the course “History of Computer Science” by transforming subject knowledge into meta-subject results and cognitive qualities of the student, and having the following advantages:

- Increasing students' interest in the course due to the principles of student-centered learning;
- The use of cognitive learning tools that contribute to the development of cognitive abilities of students to remember and master historical dates and events in the history of computer science;
- The recursive nature of training: “I create a project according to which I study myself and will train others”.
- The innovative and research nature of learning.

The materials of the work can be of practical value for teachers of pedagogical universities that train students in the history of sciences.

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