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University elective course 'Digital and natural science methods in archaeology'

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Abstract

The article discusses a new transdisciplinary course 'Digital and natural scientific methods in archaeology', developed at the Department of Informatics of the Physical-Technical Institute of the Crimean Federal University and introduced into the educational process in the 2022/2023 academic year. Its relevance is shown, as well as its connection with one of the priority sectors of the economy - the tourism industry and related areas. The article describes the structure of the course, its content and topics. The importance of mastering this optional course for more effective teaching of students in the humanities and the introduction of digital methods in archaeological and cultural studies is noted. It is emphasized that the program of the interdisciplinary course was developed by an employee who has a second higher education - an historical/archaeological education, as well as experience in museums and archaeological expeditions, which made it possible to develop a course program that is maximally focused on actual practical tasks.

Keywords: transdisciplinary, methods, digital, humanities, natural sciences, archaeology, museum, software.

The transdisciplinary approach involves the integration of knowledge and methods from several disciplines to solve complex social, historical, etc. problems. In recent years, it has attracted significant attention in liberal arts research and liberal arts education. A transdisciplinary approach in the humanities is usually understood as the integration of social sciences, humanities, arts, etc. Within the framework of Digital Humanities, transdisciplinarity is understood as the integration of various humanities disciplines with computer science. The Digital Humanities are characterized by the application of computational methods in the humanities (Borodkin 2012; Volodin 2014), including history and archaeology according to some researchers.

However, in the modern information society, recently in various fields, including humanitarian research and humanitarian education, the role of complex digital and natural scientific methods has begun to increase. Advances in technology and access to large volumes of data, including through natural science, are creating new opportunities for research and understanding of humanitarian issues. The integrated use of digital and natural science methods allows expanding the boundaries of the humanities, enriching their analysis and providing new

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tools for the study of complex phenomena and problems. The integration of digital and natural science methods within the framework of humanities research generates a qualitatively new transdisciplinarity of Digital Humanities and opens up unique opportunities for a deeper understanding of the history and culture of our civilization.

Modern research of historical and archaeological sites and museum items is impossible without the use of both the latest digital technologies and natural science methods. With the help of modern equipment, large amounts of data are obtained that characterize various parameters of research objects, for example, archaeological finds and museum objects, which are classical objects of humanitarian research.

The obtained data needs to be processed and analyzed by digital methods. Thus, the digital humanities, which are related to history, archaeology and museum work, are in many cases simultaneously connected with natural science methods. Therefore, for more effective implementation of digital methods in archaeological and cultural studies, it is necessary to implement them simultaneously with natural scientific methods. Such an implementation requires a qualitatively different level of education for archaeologists and cultural anthropologists, who, having a large amount of humanitarian knowledge and, at best, a basic amount of knowledge in the field of mathematics and computer science, do not have sufficient training in the field of natural sciences.

The Republic of Crimea is a region with great tourism potential. Tourism activities and activities in the field of the tourism industry for the development of domestic tourism, which include the activities of libraries, archives, museums and other cultural facilities, are listed as priority sectors of the economy. A characteristic feature of the tourism sector of Crimea is the presence of a large number of historical and archaeological sites and museums on the peninsula. In total, there are about 400 museums in Crimea. The first largest group of museums is historical and historical-archaeological - about 70%, the second - about 20% - local history museums. Of these, 27 large state museums, of which 15 (8 reserves, 7 museums) are under the republican jurisdiction and 12 - in the municipal. Archaeological collections are stored in all historical and local history museums of republican jurisdiction. In addition, there are historical and archaeological museums-reserves in Crimea:

- The State Museum-Preserve Tauric Chersonese;
- The East-Crimean Historic-Cultural Museum-reserve;
- Sudak Fortress Museum Reserve;
- Historical and Archaeological Museum-Reserve "Scythian Neapolis"
- Historical and Archaeological Museum-Reserve "Kalos Limen",
- Bakhchisaray Historical, Cultural and Archaeological Museum-Reserve.

In V.I. Vernadsky Crimean Federal University trains highly qualified specialists-historians, archaeologists and cultural anthropologists to study these archaeological sites and work in museums, tour agencies and other organizations in the tourism sector of the economy. A good level of research of historical and archaeological monuments and museum items is in principle impossible without the use of natural scientific methods and the latest digital technologies. However, until recently, Crimean Federal University did not have a course in which students would study both digital and natural science methods in historical and archaeological research and museum work.

In order to familiarize students with the use of digital and natural science methods in the humanities and tourism, a new interdisciplinary elective course "Digital and Natural Science Methods in archaeology" was developed at the Department of Informatics of the Physical-Technical Institute of Crimean Federal University and introduced into the teaching process in the 2022/2023 academic year. It was intended both for students of the humanities and for students studying in natural sciences. The course program was developed by an employee of the Department of Informatics, who has a second degree in history/archaeology, experience in museums and archaeological expeditions.

To study the discipline ‘Digital and Natural Science Methods in Archaeology’, you need basic knowledge of computer technology and the basics of informatics obtained in high school, as well as in the discipline ‘Digital Practicum’. The discipline ‘Digital and Natural Science Methods in Archaeology’ forms a holistic view of the role of digital technologies in the humanities, in particular in archaeology, and introduces the main range of application software used in archaeological research and in archaeology-related areas related to study and protection of cultural heritage.

The course deals with the main tasks that need to be solved in the process of historical and archaeological research, as well as natural scientific methods and the corresponding instrumentation used in the process of solving these problems. Students are introduced to digital methods of processing information obtained using this equipment, as well as to the tasks of digital archaeology and the software used to solve them. Additionally, digital astronomical and geodetic methods in archaeological research are considered in more detail, as well as digital technologies and software used in museums and for the reconstruction of cultural heritage sites.

The course consists of the following sections:

1. Informatics and digital methods and technologies in humanitarian research:
    a. Informatics, its methods and technologies. Areas and sections of informatics. Applied informatics in specific scientific fields;
    b. Digital Humanities. Historical Computer Science and Digital History. Directions of historical informatics and digital history;
    c. Digital archaeology as an integral part of historical informatics and digital history;
2. Archaeological objects of research:
    a. Archaeology as a historical science. Chronological periods in archaeology;
    b. Types of archaeological sites. Underwater archaeological sites. Examples of Crimean archaeological sites of various archaeological periods;
    c. Archaeological sources. Types of material sources (artifacts);
3. Digital methods in archaeological research:
    a. Digital archaeology and digital technologies in archaeology;
    b. Main tasks of digital and computational archaeology;
    c. Software used in solving problems of digital and computational archaeology;
4. Natural scientific methods in archaeological research:

a. The relationship between modern digital and natural science methods. Types of natural scientific methods in archaeological research and the tasks that they solve with their help;

b. Field and laboratory research in archaeology using integrated-digital and natural science methods;

c. Equipment used in applied complex archaeological research;

d. Examples of studies of archaeological sites and artifacts using digital and natural science methods;

5. Digital methods in astronomical and geodetic studies of archaeological sites:

a. Software used in astronomical and geodetic studies of archaeological sites;

b. Examples of the application of astronomical and geodetic methods in the study of ancient monuments of the Northern Black Sea region.

The section 'Digital Methods in Archaeological Research' covers the following topics:

- Archaeological and museum databases;
- Image processing with the help of graphic editors in archaeology;
- Three-dimensional visualization and modeling in archaeology;
- Statistical analysis of massive archaeological finds using spreadsheets and statistical software packages;
- Preparation of archaeological documentation using text editors;
- Application of GIS - technologies in archaeological research;
- Mathematical modeling in archaeology.

The section 'Natural Science Methods in Archaeological Research' covers the following topics:

- Photo fixation of archaeological sources using digital equipment and digital processing of the obtained 2D images;
- 3D-scanning of archaeological artifacts and computer processing of the resulting 3D images;
- Analysis of images obtained using photogrammetry, aerial photography and satellite imagery;
- Analysis of digital data obtained by remote sensing and geophysical survey;

The section 'Digital methods in astronomical and geodetic research of archaeological sites' covers the following topics:

- Virtual planetariums;
- Programs for calculating magnetic declination;
- Databases of satellite and aerial photographs, digital globe Google Earth Pro;
- Programs for constructing a horizon profile;

- Spreadsheets.

Thus, within the framework of the developed course, students get an idea of the real problems in the field of archaeology and museum business, as well as modern digital and natural science methods and technologies used to solve them.

The successful introduction of this optional course into the educational process made it possible to start developing a course with a broader focus, focused not only on archaeological, but also on humanitarian research in various fields.

References

Borodkin, LI 2012, 'Digital history: primenenie tsifrovykh media v sokhranenii istoriko-kul'turnogo naslediya?' ['Digital history: the use of digital media in the preservation of historical and cultural heritage?'], *Istoricheskaya informatika [Historical computer science]*, vol. 1, no. 1, pp. 14-21.

Volodin, AYu 2014, 'Digital humanities (tsifrovye gumanitarnye nauki): v poiskakh samoopredeleniya' ['Digital humanities (digital humanities): in search of self-determination'], *Vestnik Permskogo universiteta. Seriya 'Istoriya'* [*Bulletin of the Perm University. Series 'History'*], Vyp. 3 (26), pp. 5-12.