

Digital Humanities Projects in Educational Process

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Abstract: The purpose of the study is to outline the main directions and prospects of digital humanities development; to find out the main principles of the scientific space transformation, caused by the implementation of digital humanities; to define the transdisciplinary ontology as digital humanities important tool.

Methodology of the article is based on implementation of principle of information systematicity and its further modeling in educational and scientific aspects. The information is being analysed for distinguishing its structural components and their semantic and functional coherence. According to the structural and semantic analysis of information, the modeling of information representation is performed. As the productive way of modeling is the transdisciplinary ontology, so principle of transdisciplinarity is one of the basal principle in the study.

Transdisciplinary ontology seems to be an important tool of digital humanities. Using ontology it is possible to perform educational information in structured form with all its components, organized in hierarchical construction, and their correlation depiction. Transdisciplinary ontology provides various forms of information graphical display, perception of which helps to understand essential causal factors, principles of information arrangement, its regularities

Recommendation for further transdisciplinary ontology application is based on the possible ontology extension by new elements adding according to the enrichment of educational material being learned.

Keywords: *digital humanities; digital resources; cognitive services; transdisciplinary ontology; transdisciplinary paradigm.*

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1. Introduction

The humanities at the present stage of development form an ideological paradigm to ensure the continuity of social and historical space and time, cultural and artistic achievements that contribute to the multidimensional transcendence of existence and determination of the main vectors of educational and scientific development.

The emergence of the phenomenon of digital humanities is associated with the possibility of transforming the humanities by expanding the scope of research with digital tools and tools that form the preconditions for creating various automated classifications based on linear and nonlinear relationships, non-obvious objects; to trace hierarchical connections, multilevel correlations, interactions between phenomena that are objects of humanitarian research; for the formation of interactive documents in which the objects of scientific analysis are reflected in the form of hierarchical structures.

The genesis of the digital humanities is associated with the work of R. Buza and J. Miles in the 1940s and 1950s, who applied methods of machine processing to literary texts. By the end of the twentieth century the usage of computer technology in the humanities took various forms: the form of automation of certain operations with texts aimed at finding specific elements, by studying intermediate components, by gradually forming the basis for literary and linguistic calculations, by defining the principles of digital editing, by using the capabilities of hypertext, creating digital archives, through the study of multimedia tools.

If the essence of the concept of 'digital humanities' crystallized in the 2000s as a result of a combination of different trends in the use of humanities methodology for the study of digital content and the use of digital tools and tools for analysis in the humanities, in 2010 - early 2020 digital the humanities are developing rapidly in many areas, which leads to the emergence of a significant number of scientific studies.

2. Theoretical Background

A successful attempt to synthesize important developments from the standpoint of the application of digital technologies in the humanities is the work "Digital Humanities" (Burdick et al., 2012). The authors of the scientific work pay attention to the study of the features of transmedia, the development of tools and platforms for the digital humanities; to the emergence of new methods of analysis and forms of scientific knowledge in

the digital environment, they examine digital models, which are becoming the most common. Researchers also study the impact of the digital humanities on modern society in the form of goals and values that are established in the process of its implementation, and consider possible prospects for development.

Theoretical principles of digital humanities and features of practical application are considered in the work “Digital Humanities: Knowledge and Criticism in the Digital Age” (Berry & Fagerjord, 2017). Researchers are studying the nature, methods and tools of the digital humanities in the context of the changes caused by the existence of big data, Google search capabilities, algorithms, automation, and computer thinking.

Problems of digital technologies application in the field of culturology are considered in the book “Digital Humanities in Practice” (Warwick et al., 2012). The book examines the creation and design of digital resources suitable for the study of cultural objects; dissemination of digital cultural resources through blogs, podcasts, social media; digitalization as a means of creating and preserving cultural values; creation, study and usage of digital images; application of 3D scanning in museum studies; formation of electronic texts and corpora, digital editing, etc.

Various views and approaches to the digital perspectives of the humanities are covered in the book “Debate on the problems of the digital humanities” (Gold & Klein, 2019). The authors of the research contained in the book draw attention to the controversial and paradoxical aspects of the possibilities and limitations of the digital humanities (problems of using video games, decoding, the contradictory nature of the digital humanities); to the methods of digital humanities and their practical application (usage of quantitative methods, videographic criticism, vector semantics), etc.

Many studies are devoted to understanding various aspects of digital technologies in the projections of the digital humanities, in particular, the research comprehends the problems of studying audio data and visual data (Arnold et al., 2021), metadata analysis (Hoyt et al., 2021), transdisciplinary analysis (Carrive et al., 2021), network topology (Gienapp et al., 2021), semantic networks (Hyvönen, 2019), machine learning (Dobson, 2021), etc. Productive research in the digital humanities includes understanding the problems of digitalization in the fields of cultural studies, literary studies, linguistics, pedagogy, anthropology and more.

Detailed innovative studies performed in scientific journal “Digital Humanities Quaterly”, which represent new scientific approaches to digital humanities, comprises different spheres of humanitarian research and expand spheres of digital humanities application. The scope of research is

rather wide as it comprises studies, devoted to important aspects of digital humanities research such as Semantic Web application to Italian medieval manuscripts (Belotto, 2020), methods of audio-visual and paper collections reunification (Sapienza et al., 2021), problems of machine learning application in humanities (Dobson, 2021), problems of interdisciplinary research in digital humanities (Sauer & Hagedoorn, 2022). Such studies shows digital humanities as an immense area of emerging innovations that demand almost simultaneous formation and usage of new methods of research.

Also the scientists pay essential attention to pedagogical aspects of digital learning implementation. They investigate peculiarities of mobile technologies in academic learning (Măță & Dobrescu, 2022), problems of visual literacy in the system of modern education (Dyak et al., 2022; Halchenko et al, 2021), transdisciplinary approaches to information and educational environment (Rostoka et al., 2021), platforms and tools of open study (Buinytska, 2019; Dzvinchuk et al., 2020), formation of students' digital competences (Havrilova & Topolnik, 2017; Nalyvaiko et al., 2022). All these studies proves trends for effective implementation digital humanities projects into educational process.

The purpose of the article is to define the “digital humanities” as the scientific concept, to outline the prerequisites for the emergence of digital humanities, the main directions and prospects of its development; to find out the main functional capabilities of digital humanities, the main principles of the transformation of the scientific space, caused by the implementation of digital humanities as an important component of modern scientific knowledge; to characterize the possibilities of interaction at the level of traditional humanities and information technologies; to define the transdisciplinary ontology as digital humanities important tool.

Methodology of the article is based on implementation of principle of information systematicity and its further modeling in educational and scientific aspects. The information is being analysed for distinguishing its structural components and their semantic and functional coherence. According to the structural and semantic analysis of information, the modeling of information representation is performed. As the productive way of modeling is the transdisciplinary ontology, so principle of transdisciplinarity is one of the basal principle in the study. Transdisciplinarity is considered to provide an integrative perception of scientific and educational problems.

3. Arguments of the paper

Since the concept of ‘digital humanities’ covers a wide range of humanities, transformed through the prism of information technology, in the general sense is the study of information in text, images, sound, video, with prospects for their further categorization, systematization with various digital tools. The use of innovative tools and methods of analysis in the digital humanities provides opportunities to study and interpret information reflected in traditional and modern forms. A significant role in the digital humanities is played by studies aimed at learning the specifics of scientometrics, problems of art history, library science, features of reference books, which changed the conditions of access to objects of study and, accordingly, significantly changed the conditions of humanities research.

Recent advances in the digital humanities are changing their shape, as previously formed transdisciplinary boundaries through the combination of culturology, philology, social sciences with information technology and the formation of new scientific approaches, tools and research methods due to the convergence of disciplines such as machine learning, artificial intelligence, data science. An important indicator of the productive development of the digital humanities is the creation of appropriate software for analysis, interpretation and conversion of information into digital form. Software required for usage in the digital humanities projects includes content management systems (platforms), coding and programming resources, general catalogs of digital tools and programs, project and process management services, simple animation services, mapping and geospatial analysis, services for storytelling, services for text analysis, resources for visualization.

Since storytelling is one of the most effective and versatile methods of designing digital projects in the humanities, which makes it possible to synchronize the delivery educational content with suggestive influence by creating appropriately designed audio and video stories, it is advisable to take a closer look at the types of software in the field of storytelling. Multimedia tools for storytelling include tools, applications, software (an example is the Omeka content management system, which is used to create a variety of stories, digital collections); resources for 3D modeling, augmented and virtual reality (such as the free 3D Blender package, which runs the entire 3D modeling process; the Kubity cloud cross-platform application, which allows you to share 3D files on a variety of devices, including computers, smartphones, tablets, augmented reality devices, virtual reality glasses); services for oral stories and podcasts (for example, Audacity audio editor);

open collections of images and multimedia (examples are the Internet Archive digital library, which provides access to books, movies and music, a large number of archived web pages); simple animation (such as the Animoto cloud service, which lets you convert photos and videos to HD video).

4. Arguments to support the thesis

Depending on the specific goals and objectives, projects in digital humanities can be implemented through the use of various digital tools, including the creation of space and time, visual projections, data processing in quantitative and qualitative parameters. The implementation of digital projects involves various forms of their presentation in the form of individual sites, applications, online search resources, various databases, user-created content, data visualization, immersive objects and spaces, interactive documents.

Among the new methods of research in the digital humanities, M. Berry (Berry & Fagerjord, 2017) rightly focuses on such methods as computer statistical analysis, search, thematic modeling, data visualization. Searching, processing and structuring data allows researchers to identify deep patterns, develop and analyze extremely large archives and collections, and carry out complex interdisciplinary projects to create dynamic spaces based on the use of multimedia content. Examples of the implementation of transdisciplinary strategies in the digital humanities are the projects “Shevchenko Portal” (<http://kobzar.ua/>), “Museum Portal” (<https://museum-portal.com/ua/>) of the National Center “The Junior Academy of Sciences of Ukraine”. The Shevchenko Portal project (Dovhyi et al., 2016) allows to use methods of system and ontological analysis, construction of information models for studying information about the life and work of the Ukrainian poet; tools for creating e-scenarios, for creating taxonomies and their graphic display, for creating interactive 3D-panoramas.

The digitalization of the humanities takes place in different directions: by integrating digital technologies into the humanities as an integral part of them, which in some way modifies them in social and cultural dimensions; by using digital technologies as tools to help to automate, unify certain elements of analysis, as well as certain types of information analysis in the humanities, to ensure the fullest coverage and systematization of the components selected for analysis. At the same time, the integration of digital technologies and the humanities emphasizes the transdisciplinary aspects of scientific thinking, which significantly expand the boundaries of scientific perception by creating new areas of research.

Transdisciplinary approaches in digital humanities provide the use of digital tools for the study of scientific problems from different angles, for the formation of a holistic view of a scientific phenomenon based on the combination and interaction of its individual components, as well as by studying their multidimensional projections. Transdisciplinarity contributes to the coordination of theoretical and practical aspects in the study of scientific problems.

The principle of scientific problems transdisciplinary consideration is a basic principle for creation of an informational and educational environment that forms a single research and educational space. In the context of transdisciplinarity, it is worth considering communication and cognitive platforms, on the basis of which it is possible to create transdisciplinary ontologies by analyzing, systematizing, and classifying the information. Information structured with the help of a transdisciplinary ontology is an important tool for carrying out various scientific and educational tasks, such as determining correlations and contexts, establishing species and categorical relations, relations of parts and the whole, etc. Ontology represents a set of concepts of a certain discipline (scientific problem, phenomenon, etc.), which have a significant semantic loading and are represented through multiple correlations.

With the help of transdisciplinary ontology, which is considered as a tool of digital humanitarianism, it is possible to solve a number of educational tasks, such as a clear arrangement of information, definition of key terms, graphic presentation of a set of concepts and their correlations. To construct such an ontology, it is necessary to analyze the given information, to highlight important concepts and contexts of their use, and create a document on this basis using an Excel table (Fig. 1). This table (Fig. 1) represents main concepts, necessary to understand while studying Ivan Franko's literary works in the course of Ukrainian Literature, such as poetry, prose, literary criticism etc.

	A	B	C	D	E	F
18	Титан духу і думки Іван Франко		Іван Франко	Лірика збірки «3 вершини і низини»	Поетична збірка «Зів'язле листя»	Філософська поезія
19	Іван Франко		Поетичні твори письменника	Діяльність І.Франка	Значення творчості громадського діяча	Творчість І. Франка в мистецтві перекладача
20	Діяльність І.Франка		Композиція збірки	Творчість майстрів Відродження	Концепція поступу людства	Мистецький контекст тема 7
21	Лірика збірки «3 вершини і низини»		Композиція збірки «Зів'язле листя»	Твори збірки «Зів'язле листя»	Любовна тема	Автобіографічність
22	Поетична збірка «Зів'язле листя»		Змістовий зв'язок	Драматизм стосунків	Очікувані результати навчально-пізнавальної діяльності учнів тема 9	
23	Філософська поезія		Проблематика твору «Мойсей»	Прозог до поеми	Теорія літератури тема 10	Мистецький контекст тема 10
24	Поема «Мойсей»		Ідеї, проблеми	Франко і модернізм	Новела «Сочине крило»	І.Франко і розвиток драматургії в театру
25	Проза І. Франка		Михайло Коцюбинський	Ольга Кобилянська	Василь Стефаник	Володимир Винниченко
26	Модерна українська проза					

Fig. 1. Formation of ontological descriptions using MS Excel spreadsheet (names of ontology concepts).
Source: Author's own conception

The representation of the transdisciplinary ontology is performed through the cognitive service “POLYEDR” (Stryzhak et al., 2020), which was created by the researchers of the Junior Academy of Sciences of Ukraine. With the help of the service, significant amounts of information are researched in order to organize and systematize them. The systemized information is the means for further learning of educational material with defining specific forms of its representation, showing important structural and semantic components as it can be performed in different variants such as ontograph (Fig. 2), object mapping ontology (Fig. 3), prism (Fig. 4)

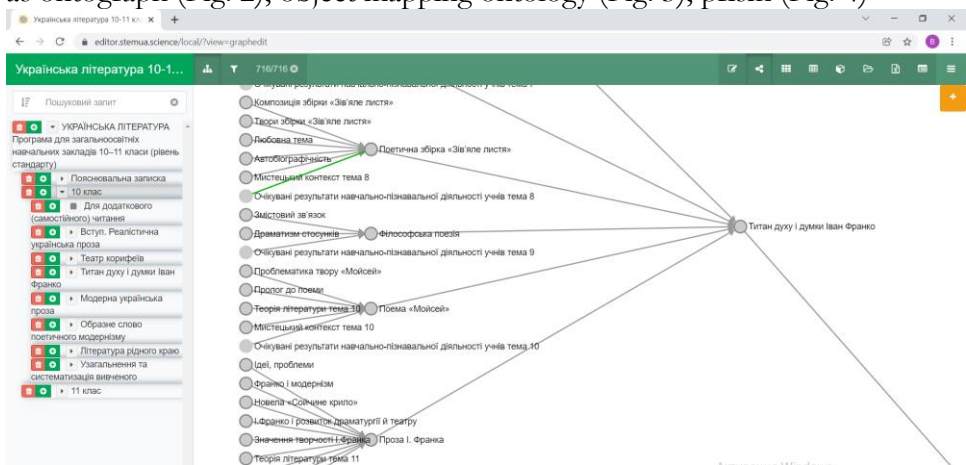


Fig. 2. A fragment of the ontology in the form of an ontograph
Source: Author's own conception

The advantages of using transdisciplinary ontology in Humanities, namely in studying Literature, may be defined as follows: transdisciplinary ontology represent information as a definite structure which is shown in the different visual forms; these visual forms (object mapping, form of a prism, etc) are useful for creating prerequisites for analyzing educational material from different points of view; different aspects reflected and analyzed with the help of transdisciplinary ontology are subsequently combined in the process of their integration, making the learning of material more thorough and systematic.

Transdisciplinary ontology in the form of object mapping represents a number of images of ontology components (Fig. 3). It is possible to distinguish certain ontology objects and their correlations which can be modified according to the definite educational tasks.



Fig. 3. Object mapping ontology
Source: Author's own conception

Transdisciplinary ontology in the form of prism helps to represent aspects of certain educational material. For example, activities of an Ukrainian writer Ivan Franko are shown according to affiliation to such spheres as literature, literary criticism, journalism, etc (Fig. 4).

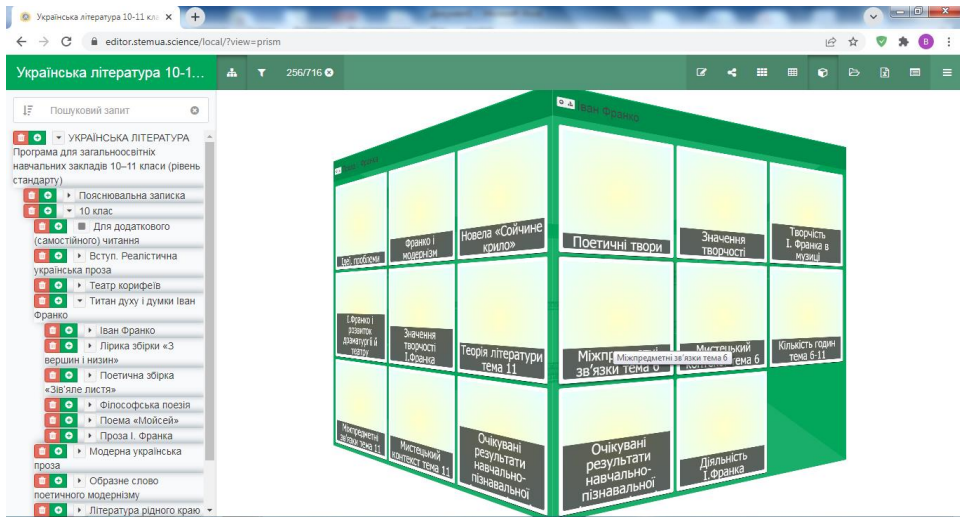


Fig. 4. Ontology in the form of a prism
Source: Author's own conception

Ivan Franko transdisciplinary ontology performs different aspects of writer's activities which are connected in various ways and show multifaceted talent of a prominent writer. Transdisciplinary ontology is helpful while structuring educational material, defining its components and their correlations which are necessary for not only for appropriate material perception but also for worldview formation as a result of transdisciplinary perception.

5. Conclusions

Digital humanities combine information studying and interpretation performed in traditional and modern forms. The digital humanities phenomenon comprises various digital tools implementation in humanities, which amplify the possible ways of information comprehension, analysis, its structural representation. Such possibilities expand humanities frameworks in the direction to their specific digital transformation because it implicates novel methods, means of research as well as outlines new transdisciplinary research areas in result of convergence of humanities with machine learning, artificial intelligence, data science.

Functional capabilities of digital humanities are defined by formation of convenient software which is essential for analysis, systematization of educational material and its digital conversion. Digital conversion of educational material could be performed with the help of content

management platforms, different digital tools and programs, project and process management services, services for text analysis, resources for visualization, etc.

Transdisciplinary ontology seems to be an important tool of digital humanities. Using ontology it is possible to perform educational information in structured form with all its components, organized in hierarchical construction, and their correlation depiction. Transdisciplinary ontology also provides various forms of information graphical display, perception of which helps to understand essential causal factors, principles of information arrangement, its regularities.

Recommendation for further transdisciplinary ontology application is based on the possible ontology extension by new elements adding according to the enrichment of educational material being learned.

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