Transdisciplinary Transformation of Digital Education: Emergency, Sustainability and Universality

Rusudan MAKHACHASHVILI
Germanic Philology Department
Borys Grinchenko Kyiv University, Bulvarno-Kudryavska-st., 18/2,
Kyiv, Ukraine

Ivan SEMENIST
Oriental Studies Department
Borys Grinchenko Kyiv University, Bulvarno-Kudryavska-st., 18/2,
Kyiv, Ukraine

ABSTRACT

Dynamic transformation of the knowledge economy, enhanced by Industry 4.0/5.0 development and rise of the networked society in the Digital Age, emergency digitization of all social communicative spheres due to pandemic measures have imposed dramatic changes onto transdisciplinary overlap in different areas of human knowledge and experience, induced by the cross-sectorial job market demands of university level education, curriculum design and learning outcomes.
The global pandemic and subsequent warfare in Ukraine induced amplified digitalization measures in the higher education sphere. This end-to end digital shift in the educational processes (communication, content, outcomes and outputs, skills) heralded the introduction of meta-disciplinary dimensions of learning – digital, hybrid and, blended. These meta-disciplinary dimensions can be considered conduits of vertical (endocentric) and horizontal (exocentric) transdisciplinary of digital education as a communicative system.
Applied trans-disciplinary lens of the phenomenological approach contributes to the solution of holistic modeling of processes and results of updating models and mechanisms of the highly dynamic communication system of education in the digital environment as a whole and its individual formats in dynamic sustainable and emergency digitization contexts.

Keywords: Transdisciplinary communication, Meta-framework, Digital Education

1. INTRODUCTION

Dynamic transformation of the knowledge economy, development of Industry 4.0/5.0 and elaboration of the networked society in the Digital Age, emergency digitization of all social communicative spheres due to pandemic measures have imposed dramatic changes onto transdisciplinary overlap in different areas of human knowledge and experience, induced by the cross-sectorial job market demands of university level education, curriculum design and learning outcomes.
The global pandemic and subsequent warfare in Ukraine induced amplified digitalization measures in the higher education sphere. This end-to end digital shift in the educational processes (communication, content, outcomes and outputs, skills) heralded the introduction of meta-disciplinary dimensions of learning – digital, hybrid and, blended. These meta-disciplinary dimensions can be considered conduits of vertical (endocentric) and horizontal (exocentric) transdisciplinary of digital education as a communicative system.
Applied trans-disciplinary lens of the phenomenological approach contributes to the solution of holistic modeling of processes and results of updating models and mechanisms of the highly dynamic communication system of education in the digital environment as a whole and its individual formats at the beginning of the XXI century in particular.
As a product of modern civilization, the digital reality has become an independent format of being. Accordingly, electronic media act not only as a means of transmitting information, but also reveal their own world-creating, meaning-making and, as a consequence, language-forming and communicative potential [46; 48; 50]. The global digital realm stands as an integral environment, demanding new cognition and perception ways via complex philosophic, cultural, social, linguistic approaches, providing unlimited opportunities for human intellect, language development and research.
Given the conceptual system of identification of onto-mental and linguo-mental complex formations to identify constructs of reality, the global digital realm (cyberspace) and its innovative communicative shell can be located in the transdisciplinary coordinates of such paradigms: 1) philosophy - as *a particular type of substance* – material and ideal reality in the multitude of its forms; a meta-negentropy (the term after Nagib Callaos [6]); 2) anthropology – as an environment for actualization of post-humanistic forms of anthropogenesis; 3) psychology – as psychosomatic and emotional plane of a personality functioning; 4) sociology – as a system of multi-tiered and multi-directional social and communicative relations; 5) in culturology - as a sphere of spiritual experience, 6) in the theory of communication - as a system of multilevel, multidirectional social relations and communicative interaction.
The emergency and sustainable digitalization changes in the higher education sphere heralded the introduction of pervasive dimensions of learning – digital, hybrid and, blended. These dimensions can be the considered the *3T coordinates ambient of digital education*: ***transformation, transcendence, transdisciplinarity***. These dimensions are conduits of vertical (endocentric) and horizontal (exocentric) transdisciplinarity of digital education as a cohesive system.

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Applied trans-disciplinary lens of the *synergetic approach* contributes to the solution of holistic modeling of processes and results of updating patterns and mechanisms of the highly dynamic self-sustainable and self-evolving system of education in the digital environment as a whole and its individual formats in particular. The transformative factors of the emergency and sustainable digitization in education are structured as attractors and repellents of educational development as a cohesive system.

Emergency digitization in education as a source of transformative end-to-end change is perceived through the lens of *calamity theory* that allows to identify and classify the ways in which education as a system can undergo sudden large changes as one or more of the variables that control it are changed continuously. Emergency digitization stages are perceived as *bifurcation points* of the educational system sustainable development.

The variables, that trigger and sustain systemic change in emergency digital education are connected to the concept of ***trans-disciplinarity***, perceived as a transcendent product of merging multiple interconnected knowledge domains. *Transdisciplinarity of emergency digital education* is, therefore, postulated in this study as a computational framework of interconnected types of disciplinnarities. ***Meta-disciplinarily*** *of emergency digital education is determined through the digital ambient, content and tools of its implementation.* The digital meta-dimension becomes the source of systemic structuring of innovative educational system on macro- and micro-levels. The ***meta-framework*** of education is, thus, approached as a *conceptual matrix of endocentric and exocentric transdisciplinarity of digtal tools, skills, content and interactive aims*.

The fundamental transdisciplinarity, that digital procedural transformations imposed on the system, process and results of education, this way, acquires the property of transcendence and informs the qualitative (evolutionary – for sustainable scenarios, revolutionary – for emergency scenarios) changes of the system as a whole. The integrity of the education as a system is preserved through the meta-disciplinary characteristics of digitization as a state and a process.

Therefore, it is stipulated in **the study design**, that the cognitive and ontological (framework) premise *of metatansformation of digital education* is informed by the following **dimensions**: 1) the *metadisciplinary dimension*, disclosed through the mutual transformative potential of information and modern technology, as "knowledge in a scientific sense can lag only slightly behind this world transformation because knowledge becomes transformed in the process" [17]; 2) *the universal dimension*, disclosed through the pervasive, ubiquitous nature of humanitarian and linguistic (especially multi-cultural) knowledge applicability, as "science and technology revolutionize our lives, but memory, tradition and myth frame our response" [32]; 3) *the interoperable dimension*, informed by the underlying anthropocentrism of linguistic knowledge and skills, providing the interface for development and application of skills and activities across different domains, as "a human is a nexus of existential horizons" [22].

The result of a fundamental Technosphere shift in the sphere of Education, induced by the pandemic development and enhanced by continuous iterative digitalization measures, was the need to take quick comprehensive action [29; 36] in order to achieve such desirable results: in order to achieve such desirable results: a) To activate comprehensive transdisciplinary domains and corresponding interdisciplinary skillsets, otherwise latent or underutilized in the educational process; b) To enhance the scope of communication skills beyond the domains traditionally reserved for Arts and Humanities education; c) To boost information and communication technological competence and digital literacy, to meet the requirements of (post)COVID-19 job market and workplace; d) to introduce digital meta-solutions for facilitation of formal and informal educational workflow and communication.

The **objective** of the study is to explore the modelling and profiling of meta-disciplinary framework of transformations in digital education, modified by the sustainable (pandemic) and emergency (wartime) digitization measures.

The study of groundwork principles of universality and transdisciplinary of educational communication in professional linguisitc training and linguistic education in general is a parcel of the framework project *TRANSITION: Transformation, Network, Society and Education* [28; 29; 30].

2. FINDINGS

Conceptual Groundwork of Meta-Disciplinarity in Digital Education

The following grid of groundwork concepts is applied to profile the Innovative Communication for Foreign Languages Education (FLE) in such disciplinary dimensions (Fig. 1):

- TRANSDISCIPLINARITY
- METADISCIPLINARITY
- UNIVERSALITY
- INTEROPERABILITY
- METAFRAMEWORK

The meaning of TRANSDISCIPLINARITY is synthesized for the purpose of this study as a transcendent agglomeration of two or more fields of knowledge into one scope/goal of study, inquiry or activity [6; 15; 18; 21].

UNIVERSALITY is generally understood as a property of object or state **to "exist** everywhere **(ubiquity), or involve everyone"** [7]. In the context of this study we suggest to attribute the property of universality/ubiquity to social activity, vocational activity and professional performance.

The concept of INTEROPERABILITY is disclosed across different approaches [20; 34; 35] as a characteristic of an object, product or system, that allows its interface to be comprehensible, to work with other objects, products or systems.

The concept of METAFRAMEWORK as applied to educational communication is derived from the target meta-status of its transdicsiplinarity.

As applied to transdisciplinary communication in digital education, the concept of interoperability represents the property of functional, dynamic interconnectivity between the source and target domains of linguistic content, linguistic theory content, related areas of scientific and universal knowledge, and domains of professional and social application. Degrees of interoperability help define the measure of interdisciplinary transcendence and universality of activities, skills and competence applications of FLE stakeholders.

Consequently, the metaframework of transdisciplinary communication can be conceptualized through a following grid of nested notions (Fig. 1):

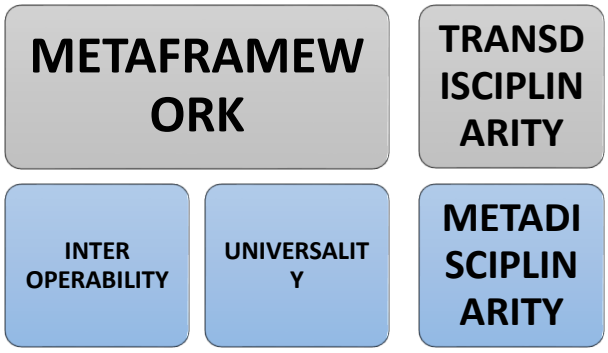

Figure 1: Conceptual Grid of Metaframework

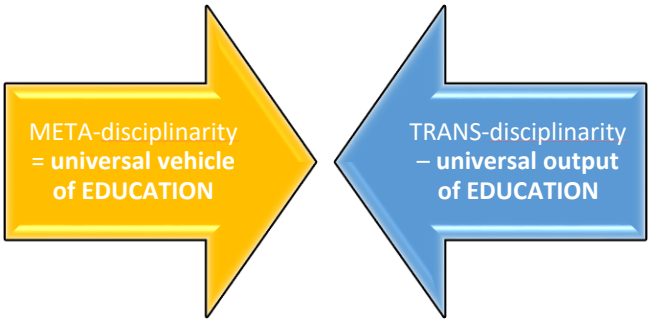

Figure 2: Disciplinary Circuit of Education

Meta-disciplinary Framework of Transdisciplinary Communication in Digital Education

The generic concept of multiple disciplinarity [1; 38] comprises, in its turn, of a framework of interconnected concepts: Multi-disciplinarity; Interdisciplinarity; Transdiciplinarity; Metadisciplinarity.

Multi-disciplinarity, thus, is understood as a multitude of fields of knowledge, that comprise the scope of understanding a certain object, problem or area of inquiry.

Interdisciplinarity in this respect is interpreted as the interconnectivity of multiple spheres of knowledge that comprised the content of a problem or area of inquiry.

Trans-disciplinarity, subsequently, is perceived as a transcendent product of merging multiple interconnected knowledge domains.

Transdisciplinarity of digital educational communication in general is, therefore, postulated in this study as a computational framework of interconnected types of disciplinarities.

Meta-disciplinarily *of digital educational communication is determined through the digital ambient, content and tools of its implementation.* The digital meta-dimension becomes the source of systemic structuring of innovative educational communication on macro- and micro-levels.

Multidisciplinary **input** into the education design and content in the form of data, information and facts across different source domains of human knowledge in order 1) to constitute the thematic content of language acquisition; 2) to constitute the semantic referents of linguistic units; 3) to constitute the vast framework of reference and contexts for communicative application.

Interdisciplinary connections of the educational **content** for FLE – internal interconnectivity of theoretical and applied disciplines, external interconnectivity of FLE content with non-related areas of human knowledge (computer science, physiology, anthropology, philosophy etc.).

Transdisciplinary **output** in the transcendent nature target knowledge domains and universal applicability of skills, training and outlook of the FLE professionals upon graduation.

Therefore, the framework correspondence of relevant complex skills constitutes a TRANSDISCIPLINARY META-FRAMEWORK of educational communication.

It is relevant to postulate, that interoperability of TRANSDISCIPLINARITY and METADISCIPLINARITY, thus, constitute a close circuit within the metaframework of digital education (Fig. 2.):

Interoperability for FLE skills ensured by the communicative nature of interdisciplinary skills. The core cross-sectorial domain that is referential for primary skills (social skills, emotional intellect, collaboration, communication, ICT-literacy), necessary for educational goals achievement, is COMMUNICATION.

Transdisciplinary communication in the global digital environment is, therefore, understood as an integrated at the macro and micro level set of cross-sectorial verbal referents, innovations and innovative communication practices and technologies, which by their specific characteristics are conditionally exhaustive phenomenological correlates of transdisciplinary elements of the digital environment.

The innovative nature of communication in the field of learning and education (formal and informal) in the global digital environment is determined by the phenomenological consolidation of substantive (ontological, pre-suppositional / cognitive [52]) characteristics of the macrostructure of communication in statics and end-to-end dynamic interaction of formal and semantic constituents and technological (digital) tools. The paradigm of innovation of educational communication in the digital realm (as a multidimensional, complex, dynamic system) is defined as the most comprehensive quantitative and qualitative terms of linguo-cognitive actualization of being, determined by a number of qualifying conditions of its emergence, existence and development. The inquiry results allow to provide a transdisciplinary synthesis of educational communication paradigm across communicative theory, information theory, philosophy, education and e-learning studies, semiotics, digital humanities.

Theoretical problems of holistic, transdimensional modeling of reality and its separate spheres are directed by the deterministic interaction of objects, signs of their reception and interpretation (in the field of individual and collective consciousness), embodiment, consolidation and retransmission of the results of interaction of these systems of features.

Conditions for the development of modern globalization civilization determine the expansion and refinement of the paradigm of views on the theoretical principles of determining the groundwork and characteristics of the consolidation of the world order, its perception in culture, collective social consciousness and natural language.

The transdisciplinarity of innovative educational communication in this respect is accessed through is the conceptual lens of the **logosphere**, synthetically perceived as 1) the plurality of language units, which are conditionally exhaustive phenomenological realizations of abstract and empirical elements of different spheres of life [4; 23]; 2) the zone of integration of thought, speech, and experience continuums of

cultures [5; 16; 26]; 3) the plurality of culturally relevant universal meanings and signs - **semiosphere** [27]; 4) a plurality of transcendent spiritual meanings – **pneumatosphere** [14].

Foreign Languages Acquisition on university-level major programs is a rigorous process that involves different stages and a regimen of communicative educational activities, communication types and competences across interconnected domains [24; 25]. Transdisciplinarity and ubiquity (universality) of innovative communication for Foreign Languages Education (FLE) in the 21st century, therefore, is informed, in crucial ways, by intellectualization and amplified information capacity of human activities in general. Thus, the intellectualization of modern global culture determines a qualitatively new approach to understanding the processes of parallel development of human activities, cognitive (intellectual), and communicative experiences. That is the origin and methodological premise of the concept of "noosphere". Noosphere is the unity of "nature" and culture, especially from the moment when the intellectual culture reaches (by force of influence on the biosphere and geosphere) the power of a peculiar "geological force" [40].

The noosphere is defined as the current stage of development of the biosphere, associated with the emergence of humanity in it [16; 40], and is interpreted as part of the planet and planet ambient with traces of human activity.

The integral real component of the Noosphere is identified as the Technosphere - a set of artificial objects (technologies) created by the humankind, and natural objects changed as a result of technological activity of humankind [28]. In turn, Computer Being (computer reality, cyberspace) is a complex, multidimensional sphere of synthesis of reality, human experience and activity mediated by the latest digital and information technologies; technogenic reality, a component of the technosphere of existence [17; 28].

The digital dimension of communicative interoperability of FLE stems from the structure of Noosphere [40] and content of its components: ANTHROPOSPHERE - a set of people as living organisms, their activities and achievements; SOCIOSPHERE - a set of social factors characteristic of this stage of society development and its interaction with nature; TECHNOSPHERE - a set of artificial objects created by man, and natural objects, altered as a result of human activity.

Given the nature of increasingly digitalized context of foreign languages education and communicative application ("the Technospheric shift" [30]), it is suggested to consider the different types of information source and information destination (human and machine/computer/program, accordingly) in the structure of the groundwork Communication model (Cf. Claude Shannon [33]), when communication is approached as the core factor of interoperability of source and target knowledge and application domains in FLE.

Thus, the fundamental transdisciplinarity, that pandemic and warfare emergency digital procedural transformations imposed on the educational process in the area of Foreign languages acquisition, is verified by a unified framework of correspondence between the components of a crucial communicative competence [19], comprising of a diverse skillset, and various aspects of digital competence in Arts and Humanities [3; 12; 13; 39], utilized in the educational process, elaborated for the purposes of this study (Fig. 3):

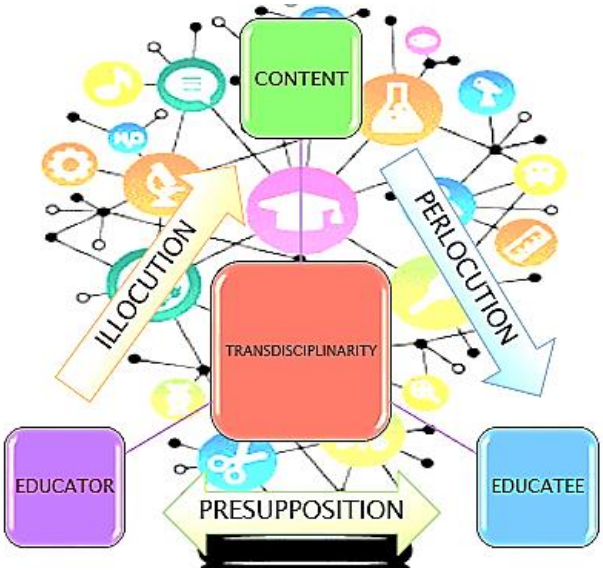

Figure 3: Communicative Act Model for Education

Trans-disciplinary and cross-referencial integration between the corresponding skillsets, henceforth, constitutes a meta-framework of digital educational communication (Fig.4). The transdisciplinary integration of communication in digital education could be referred to the following key interdisciplinary domains [30]: DIGITAL EDUCATION; DIGITAL CONTENT; INTEROPERABLE DIGITAL MEDIA; DIGITAL COMMUNICATION; DIGITAL SKILLS; DIGITAL OUTCOMES.

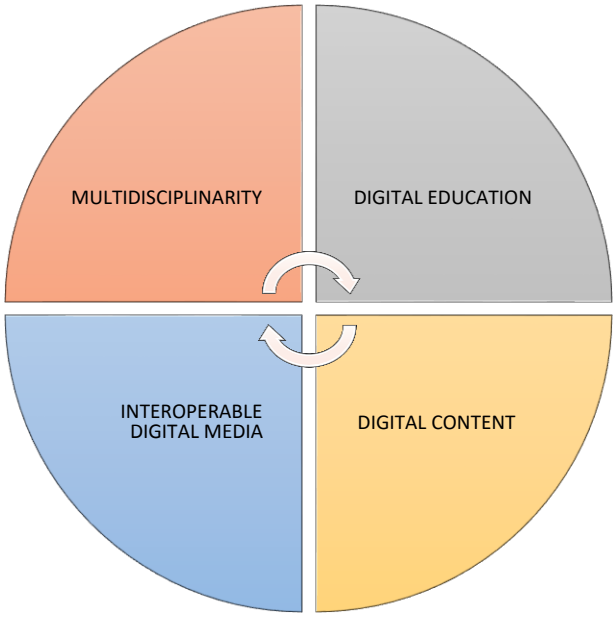

Figure 4: Meta-Framework of Digital Education

Taking into account the nature of suggested modelling of educational communication across frameworks of complex skills, it is stipulated that *META-disciplinarity* has become the universal vehicle or framework of education in the digital realm, whereas *TRANS-disciplinarity* can be perceived as a universal output of educational communication in the digital realm.
Consequently, the communicative dimension of education proper in the post-pandemic timeframe acquires a meta-digital and trans-digital (transcendent digital) properties (Fig.5). The trans-digital characteristics of educational communication is ensured through the interoperability of such framework parameters as: Interaction, Disciplinarity, Learning.

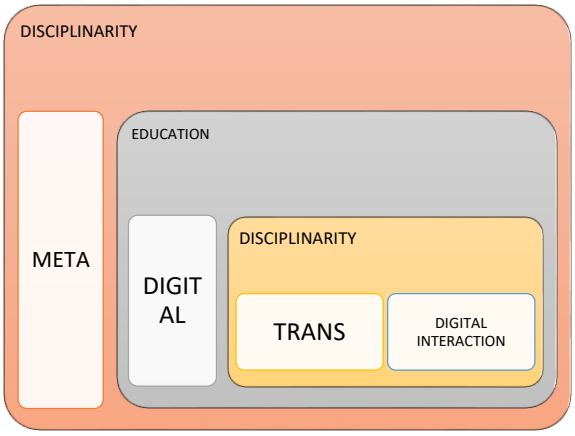

Figure 5: Trans-digital Modelling of Educational Communication

As a communicative macro-system, the transdisciplinary communication in digital education is distinguished by the functional, dynamic interoperability of linguistic, cognitive (presuppositional) and communicational parameters (the source and target domains of linguistic content, linguistic theory content, related areas of scientific and universal knowledge, and domains of professional and social application). Degrees of interoperability help define the measure of metadisciplinary transcendence of communicative activities, skills and competence applications of education stakeholders.

3. CONCLUSIONS

The study findings as to the systemic nature and paradigmatics of transdisiciplinary educational communication in the digital environment allow to disclose the following key conclusions: the integrative theoretical and methodological bases of research of educational communication are defined; the methodological framework of modeling of transdisiciplinary educational communication in the digital environment in the ontological, linguistic and cognitive planes is introduced; the macrostructure of transdisiciplinary educational communication is identified as a set of linguistic-communicative and digital instrumental innovations in the systemic semantic unity of their reference correlation with trans-disciplinary and cross-refenrential (ontological, epistemic, anthropological, technological) dimensions and elements of the global digital environment, the manifestation of which determines the phenomenological originality of the studied communicative sphere; experimental verification of the effectiveness of innovative educational communication in the global digital environment during the period of emergency quarantine restrictions are implemented; the principles of universality of interdisciplinary modeling of educational communication in the digital environment are identified; the anthropocentric bases of communication innovation in the field of acquiring new knowledge in the global digital environment are determined; the instrumental mechanisms of transdisciplinary educational communication in the digital environment are systematized.
This sustainable and emergency digital shift in the educational processes (communication, content, outcomes and outputs, skills) heralded the introduction of meta-disciplinary dimensions of learning – digital, hybrid and, blended. These meta-

disciplinary dimensions can be considered conduits of vertical (endocentric) and horizontal (exocentric) transdisciplinary of digital education as a communicative system.

Applied trans-disciplinary lens contributes to the solution of holistic modeling of processes and results of updating models and mechanisms of the highly dynamic communication system of education in the digital environment as a whole and its individual formats in the emergency digitization measures of different types.

The findings of the comprehensive framework research project 'TRANSITION' disclose a wide scope of generalized issues, permeating the social and educational context worldwide: global event horizon and paradigm shifts in the multi-disciplinary trends and meta-dimensions of digital education in the emergency digitization timeframes and beyond; transformative changes and avenues of development of the network society and education as a socio-cultural institution in the digital coordinates; global experiences, universal/generic challenges, technical advances and specific national gains in quality assurance of digital and hybrid learning in the emergency and wartime digitization paradigm.

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