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EdTech: Concept And Connections

Natalia Burlacu [1], ORCID: 0000-0003-3281-3834
[1] Technical University of Moldova, Department of Informatics and System Engineering, Faculty of Computers, Informatics and Microelectronics, 9/7 Studentilor street, Chișinau city, Republic of Moldova, MD-2045, natalia.burlacu@iis.utm.md, https://fcim.utm.md/

***Abstract*— The present article turns out to be theoretical research in the field of Educational Sciences with an emphasis on educational technologies widely used in general didactic; and also specific didactics as instruments of interaction with the learner; of diversification and customization of the teaching-learning-evaluation process, bringing an added value in the transfer of knowledge to the new generation of learners, digital natives.**

The given paper includes the analysis of the scientific literature related to the EdTech theme; the presentation of the core domains in the development, and application of EdTech; the reflection on the typology of EdTech environments, as well as Hi-Tech components.

The author determines and describes the connections of the EdTech concept in the pedagogical, psychological, and technical context in this work, after which in the final phase he formulates recommendations regarding the possibilities of integrating and expanding EdTech in the educational process of local pre-university and university institutions. (Abstract).

Keywords*— *EdTech Concept; EdTech Connections; Hi-Tech Components, General Didactics; Specific Didactics

I. INTRODUCTION

For several decades, the technologies and digital environments have been ambassadors of a new innovative breath for several fields of human activity, including the field of education.

Currently, the organization and conduct of the didactic process but, in particular, of the didactic act in any discipline of studies, whether it runs in the form of a magisterial lecture, a practical seminar lesson and/or a laboratory, regardless of whether we are talking about hours of direct teacher-student contact or about the individual work of the learner, all of its is inconceivable without using of educational technologies/environments that add value in the teaching-learning-evaluation process.

Thanks to the possibility of diversifying teaching-learning-evaluation methods, but also the flexibility of presenting educational content, increasing the degree of comprehension of the subject matter studied through digital educational technologies and environments; these have become essential at all levels of education: from pre-university up to the university level.

The opportunity to implement digital educational technologies and environments exists for almost any discipline, form, and/or level of studies.

Thus, the idea of the current research emerges from the need to present, within a theoretical, analytical and descriptive study, the dynamics of the transfiguration of educational technologies, and also of teaching-learning-evaluation environments, determined by the technical-scientific progress of recent years, in accordance with the unique concept of EdTech.

The approach of the current investigation includes: (1). Analysis of the scientific literature regarding the key notions used in this article; (2). Staged and descriptive presentation (2.a). of the Basic Domains of EdTech Field for the EdTech development and application; (2.b). typology of EdTech environments, (2.c). the Hi-Tech component in the structure of the typology of EdTech environments; (3). Determining and describing the connections of the EdTech concept in a technical and psycho-pedagogical context; with (4). The final exposition of the recommendations and perspectives arrived at as a result of the research, but also of the conclusions related to the study at the current stage.

II. THE REVIEW OF THE SPECIALIZED LITERATURE

A. From the concept of educational technologies to EdTech

There are actually a lot of studies comparing learning by "technology" (where "technology" normally means anything: some knowledge, facts, information, and skills acquired through experience or education which conduct to the theoretical or practical understanding of a subject, given in any format - printed, projected, electronic, and technological in a broad sense) and without, have (on average) revealed less or no significant difference in outcomes and in the field of educational researches (cronologicaly made by: Russell, 1999 [1]; Chen, Lambert, & Guidry, 2010 [2]; Tamim, Bernard,

Borokhovski, Abrami, & Schmid, 2011 [3]; Means, Toyama, Murphy, & Baki, 2013 [4]; Pei & Wu, 2019 [5]).

Later, the semantics and content of the concept of **educational technology** were amplified by notions and educational phenomena such as *programed instruction and learning theories.*

Therefore, the initial dimension of educational technology has been expanded by introducing new approaches such as the systemic approach to the teaching process, micro-teaching, human-computer interaction analysis, and also computer-assisted training etc.

Without equivocation, we can affirm that in the last decade the extension of computer-assisted training to **technology-assisted training is already valid, where the computer is only the tool that presents itself as a single possibility or provides access to one or several of the options of interconnection with other technological products.**

B. Presentation of EdTech Core Domains

Being an acronym, EdTech represents a fusion of the lexemes Education and Technology; it retains the initial segments of the words from which it comes.

In our opinion, the **EdTech concept** refers to new technological implementations in the didactic process and *involves the adoption of* **hardware and software** *solutions with the aim of perfecting the teaching-learning-evaluation process and the didactic act, directly, for subjects in most scientific fields and curricular areas in various study levels.*

Thus, the innovative aspects of specific didactics originate at the intersection of EdTech with various school and/or academic study objects.

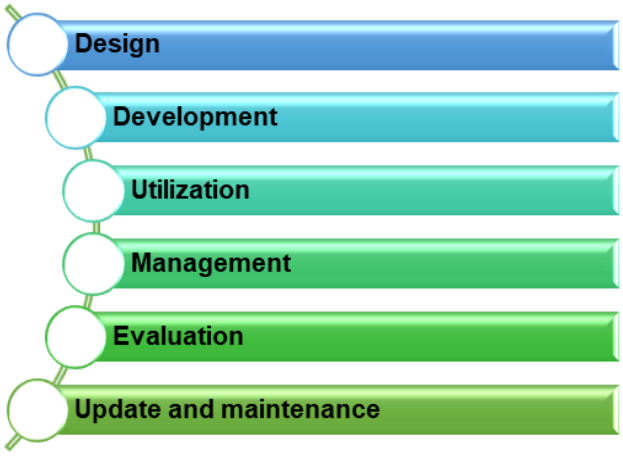

Figure 1. Core Domains of EdTech Field

EdTech profile specialists, either those who can be so called or those in the making, can be considered the people with completed university studies, at the bachelor's and master's cycle, in the field of Educational Sciences who, along with the knowledge of their field of specialization, (Computer Science & Mathematics; Chemistry & Biology, Physics & Mathematics; History & Geography, Linguistic & Literary Education, Primary Classes etc.) *have prominent digital skills that enable them to achieve educational goals, being assisted by digital/innovative technologies in their activity in accordance with the five basic EdTech directions,* which include the items shown in Figure 1.

The purpose of EdTech's core areas is to intervene and positively affect the efficiency of the didactic process; as well as facilitate and motivate learning; to transform the educational environment through original, creative, and innovative teaching-learning-evaluation methods and strategies into a stimulator of progress at the level of learning objectives, but also of the quality of the skills formed and developed.

Thus, the core EdTech domains (see Figure 1) can be described as follows:

- **Design** is the process of specifying learning conditions. The purpose of the design stage is to devise strategies and products to be applied at the macro level (for example, study programs, curriculum, and subject sheets) and at the micro level (for example: determining the approach of lessons and / or content and / or consecutive ness them in modules).
- **Development** is the process of transposing the content developed at the design stage into a tangible format that could have one of the following forms: hardware, software, visual (printed or digital), auditory and augmented materials, as well as programs or packages that integrate various types of formats. The form and/or degree of use of the technologies included in this field represent technological changes over time. At the given stage, in the context of EdTech, early technologies are updated by overlapping with new ones, predominantly, without excluding and completely replacing old technologies.
- **Utilization** is the stage that has the longest history that far exceeds humanity's concern for creating educational environments. In our opinion, using, by definition, is the act of implementing didactic processes and resources and being responsible for producing changes through educational innovation.

  At the given stage, the designer of the didactic act (set of actions planned and realized for the teaching-learning-evaluation process) with / or without his assistants deals with:

– creating educational materials; feedback (at various stages: initial, intermediate, and/or final);

- preparation of didactic instructions for students' interaction with the given materials (students will be taught how to use and how to practice and/or learn from the developed materials);
- outlining assessment strategies, measuring learning outcomes, marking, and providing feedback (at various stages: initial, intermediate, and/or final).

  Although not all teachers show the same level of enthusiasm, dexterity, and creativity in the integration of EdTech in the educational process, currently that field is also assisted by technologies.

- The stage of **Management** is meant to manage educational technologies. It should be noted that the content (programs, projects, even sometimes customized settings) to be managed may differ from case to case, while the basic skills required to manage EdTech remain constant. In the EdTech context, these skills should be accentuated by prominent digital skills and will consist of planning and organizing program products, work sessions, supervising assistants, trainees, planning administration activities etc. Depending on the specifics of the institution, even the management of the budget and other facilities can be included here; coordinating policies and/or procedures, and also ensuring EdTech management.
- The **Evaluation** stage is the process of determining the merit and/or didactic value of a project, action, or educational activity with the aim of issuing relevant judgments and conclusions for estimating the quality of the educational product as an object (educational offer, study program, discipline, lesson, etc.). At this phase, the focus is on the subject to be assessed and not on the learners and/or the project or final product from the learner's perspective. The evaluation of the teaching staff and auxiliary teaching staff can be taken into account in the evaluation stage made in the EdTech context, but, certainly, it is not decisive and primary at the given phase.
- The **Update and maintenance** is the act that involves the periodic rotation, but in the continuous mode, of the contents of all previous stages for the purpose of analysis, revision, modification, amplification, etc. of all of the processes provided for in the previous stages.

It is essential to note that the concept of EdTech itself, with the contents of the basic fields specified above, involves the didactic design of educational activities in various curricular areas and, subsequently, their application in the classroom, by assisting numerous types of environments, some of which were listed under domains 2 and 3 – Development & Utilization (see Figure 1) (which provide text, audio, images, animation and/or video streaming and include technological applications and processes such as audio or video tape (in the not-so-distant past), CD-ROM or DVD-ROM, satellite TV, computer-assisted learning, harnessing the potential of local Intranet / Extranet and Web-based learning, but not only).

III. EdTech Connections: Pedagogical, Psychological and Technical Aspects

In our view, today, the EdTech concept is a cumulative one that includes several components such as:

- ***Pedagogical approaches*** regarding teaching-learning media and innovative didactic methods - we refer to learning based on the learner; experiential learning, strategies such as problem-based learning, research-based, project-based; collaborative learning, etc. with the integration of digital and technological environments, but also their fusion for the skills training and development (key, specific, inter- and trans-disciplinary, transversal competences) and critical and creative thinking;
- Developed ***didactic resources*** to be used in various learning environments assisted by various technologies, starting from computational ones, up to Hi-Tech products;
- ***The appropriate digital support*** (hardware and/or software compatible with the technological educational environment) that is used in the teaching-learning-evaluation process depending on the teaching circumstances, but also the educational needs of the learner, aligned with the contents curricular (as the minimum required), but also extracurricular.

Talking about the hardware dimension and its possibilities for didactic integration, for several years now, in different areas of the world, we can follow experiences of incorporating Hi-Tech technologies into the educational process. These are the innovative practices of education in Estonia [6], Australia [7], Finland [8], Japan [9], and South Korea [10], where the equipment and design of modern classrooms allow them: (1). learners (pupils or students) to accumulate new educational-formative experiences, and (2.) teachers to train in the development and implementation of new teaching-learning-evaluation strategies, most special from a technological and didactic consideration, then in the digital classrooms.

We consider that if the didactic process calls for the integration of Hi-Tech technological products, it can be attested not only as a simple practical implementation of the EdTech concept but also as the involvement of **Hi-**

Tech EdTech in the didactic act. That is, the presence of an EdTech, assisted by cutting-edge technologies, descendants of the most advanced hardware and software technologies appearing on the market for technological products, confirms the integration of Hi-Tech EdTech in the educational process.

Digital classrooms have become less surprising and are currently already considered insufficient for quality learning for some schools and academic communities in different countries of the world. Thus, they are partially replaced either with smart classrooms or with trips to extra-curricular spaces (dedicated museums and/or specialized exhibitions and / enlivened laboratories) where online learning and e-learning methods are accompanied by augmented reality [6-10].

As a result, under the umbrella of the EdTech concept, typologies of digital and technological tools are included, some of which, being of the highest level of innovation and performance, respectively, form the Hi-Tech core of EdTech. In the author's view, the structure of the Hi-Tech EdTech concept can have the following graphic representation (see Figure 2).

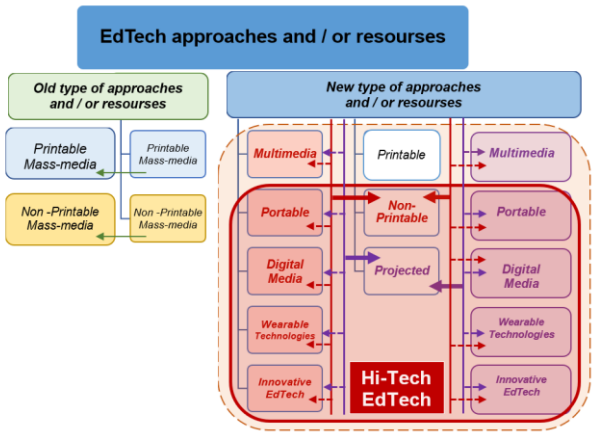

Figure 2. The Hi-Tech component (in red border) in the structure of the typology of EdTech environments (in orange border)

The efforts of researchers concerned with the theory of education and/or general didactics and/or specific didactics, engineers, trained in the development of software products intended for education, and also of those interested in the pedagogical, psychological, and technical effects of human-technology interaction are oriented toward measuring the efficiency of a wider range of Hi-Tech products intended to be applied in the teaching process and based on various learning environments (from multimedia and ICT (Information and Communications Technology) to augmented reality).

Regarding multimedia educational technologies, these can be defined as integrative technologies of several types, having a technical origin from different IT environments, such as text, graphics, animation, sound, and video - sometimes all are present, sometimes not; sometimes present in certain combinations.

Multimedia educational technologies, defined as integrative technologies of several types, are of technical origin from different computer media, such as text, graphics, animation, sound, and video - sometimes all present, sometimes not; sometimes present in certain combinations. Due to its complex structure, this kind of application brings a series of difficulties to the experimental research process; however, some observations can be made based on the attributes of the technologies with which they operate.

We consider it necessary to mention that when we are, apparently, dealing with the most complex combinations of technical media, we cannot necessarily classify them as innovative technological educational media, because of the trend of multimedia technologies, and also because the education supported by these media is already slightly outdated. At the moment, in the context of educational technologies, we cannot talk about educational innovation, limiting ourselves only to multimedia program products and/or multimedia systems and/or multimedia technologies, etc.

By Dron (2022) education is "the giving and receiving of systematic instruction, the process of facilitating learning, constituted from countless methods, tools, and structures, operated by teachers and many others – may usefully be seen as a technological phenomenon [...]" [p. 3, 11].

In this vein, there are several studies that investigate various dimensions of didactic human-technology interaction that we can classify as EdTech connections. In specific, regarding the interrelationship between education and technologies, we attest to a series of scholarly opinions with which, for the most part, we agree and which, emerging from their specificity, we can define in the categories described below.

- ***Connection with Educational Sciences.***

Although according to Dron, 2022, education itself boils down to "[…] the giving and receiving of systematic instruction, the process of facilitating learning, constituted from countless methods, tools, and structures, operated by teachers and many others – may usefully be seen as a technological phenomenon [...] some technologies are better designed, or more fit for purpose, than others" [pp. 24-25, 11].

An opinion that we also find at Dron and that we also share „Choice of technology does matter a lot, because of 1) how it affects other technologies in the assembly, 2) the adjacent possibles it provides, and 3) the avenues it closes. However, it is the orchestrated assembly that teaches, not any one component of it. Any effectiveness or otherwise of the assembly is a measure of emergent teaching skill among all the distributed teachers involved. This is

equally true of methods of teaching (pedagogies) or learning designs" [p. 24, 11].

Also, there is research that attests to the easier understanding of abstract concepts, and also of some complex scientific phenomena by some students when the theoretical material is presented not only in the form of analytical text / verbal discourse but also in visual form.

- There is the eventual ***EdTech connection with Psychology and Specific Didactics*** emerging here.

Salomon (1979), which are study on the fact that the global definition of the average stimulus insufficiently reflects the difference between cognitive-psychological and educational goals, "A medium does not interact as an invariant system with a leamer's aptitudes so that learning is facilitated for some but not for others. Rather, something within the Interaction of Media, Cognition, and Learning mediated stimulus, possibly shared to some extent with other media, makes the presented information more comprehensible or better memorized by learners of particular characteristics" [pp. 5-6, 12].

- ***The connection with the Psychology of Learning,*** this being a sub-field of Psychology.

In this manner, according to Cowen (1984), empirical research demonstrates that visual environments help to understand concepts, making them more accessible to students by increasing the more qualitative and detailed recall of information related to the explained theoretical concept [13].

The scientific investigation presented in the doctoral thesis by Judy Williams (2010) has demonstrated that when comparing sensory learning styles and reading comprehension through tests (1). Chi-Square for Independence, (2). ANOVA and (3). Post-hoc tests [p. 3, 14] "[…] the results indicated that there was a relationship between kinesthetic, auditory, and visual learning styles and reading comprehension levels. When comparing the learning styles of struggling readers and on-grade-level readers, the results indicated that there was a significantly different distribution of kinesthetic, auditory, and visual learning styles" [14].

- Since the exploitation of EdTech in the classroom capitalizes on the digital competence, which, in turn, is defined as a key competence, but also a transversal one [15 - 17], the following ***EdTech connection concerns more areas such as Didactics of ICT*** [18-20; 22]***, other Specific Didactics*** [18 - 23], ***Educational Management*** [24 - 26].

IV. CONCLUSIONS

The concept of EdTech, but especially the conjunction of Hi-Tech, is a new one, while the scientific research of a pedagogical and psychological and pedagogical order - theoretical and applied - are insufficient and/or worn out morally and/or technologically, both from the perspective of didactics and of the methodological opportunities and technical assistance offered to educational actors: teachers, but also students. The activities of documentation, elaboration, delivery, etc. matter, but also their consecutiveness for the purpose of elaboration and subsequent implementation in lessons of different types in terms of subject, scientific area, complexity, level of study, and/or form of education. At the same level, all the upper enumerated activities matter for the qualitative and effective integration of **EdTech**, but especially **Hi-Tech EdTech** in the didactic process.

Given the fact that for now some EdTech technologies, especially those in the Hi-Tech category, are impossible to make widely available to learners due to the motivated high costs, and others being a bit archaic or outdated, already they cannot be found either because at the time, again, these were expensive, and now these are already unprofitable for long-term purchase and use, in order to implement EdTech, but also Hi-Tech EdTech we consider necessary:

- The development of extra-institutional / extra-university / extra-school spaces (dedicated museums and / or specialized exhibitions and / Enlivened Laboratories);
- The subsequent provision of these spaces to educational institutions for scheduled and/or unscheduled visits, lessons according to the study plan, etc. and not only;
- Implementation of actions and activities organized directly by the administrations/employees of these locations (which should have a staff as small as possible, but very competent from a technological point of view).

In the described way, practice places will also appear for students from study programs with a technical, technological, ICT profile, such as TUM (Technical University Of Moldova), but also of other types of universities. Such are universities with a pedagogical profile. These practice spaces could also be used to study some topics/modules within different university disciplines.

We also consider it beneficial to expand the technological possibilities at the level of local educational institutions (in the peripheral regions and/or extra-urban territories of our country) to ensure the implementation of educational experiences for both teachers and learners.

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