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Taxonomy of purposes, principles, forms, technologies in on-line education: comparative analysis of virtual universities: pedagogical aspects

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Importance. The paper presents the findings of comparative pedagogical research done against the backdrop of new tendencies and developments on the global learning landscape. With the pandemic pushing universities online and ensuing digitalization of educational environment with a flurry of multi aspect virtual learning activities, there has emerged a growing need for reliable criteria to assess effectiveness and efficiency in higher education. The research is aimed to build the taxonomy of virtual universities purposes with the focus on the paramount principles, educational forms and technologies they employ.
Research Methods. The research methods involved comparative, descriptive, inductive-deductive ones, typical of comparative pedagogy. We studied the purposes, principles, forms and technologies used by the following virtual universities: The UK's Open University), Canadian Virtual University (CVU), The University of Phoenix (UoP), The Virtual University for Small States of The Commonwealth (VUSSC), The Virtual University of Pakistan.
Results and Discussion. The research enabled us to aggregate, analyze and compartmentalize the data on purposes, principles, forms and technologies of different virtual universities, which offers a new viewpoint on i-learning in a new setting. The purposes of virtual universities are presented in the hierarchical order in compliance with the goal-setting levels: expediency, focus (purposes on this level are differentiated according to the type of activity: educational, pedagogical, maintaining and organizational) and goal commitment. We identified a set of basic principles regulating academic activity of virtual universities in the digitalization context of education, described the most popular forms and technologies employed and specified priority activities of virtual universities.
Conclusion. The taxonomy of purposes and paramount principles of virtual universities educational activities make these activities unique. The number of factors and variables defining the educational activities of virtual universities is growing, still the ability to choose the learning route which fits a certain individual has always been and will remain important. Tailored learning style (built on individual preferences in the ways of information searching and processing) suggests an opportunity to adjust the situation and learning material to your needs and thus become more efficient in obtaining new information and skills.

Keywords: universities, virtualization, purpose, principle, taxonomy

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Таксономия целей, принципы, формы и технологии деятельности виртуальных университетов: сравнительно-педагогический анализ

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Актуальность. Представлены результаты сравнительно-педагогического исследования, предпосылками которого стали: актуальность определения действенных ориентиров эффективной организации систем высшего образования, многоаспектное усиление проявлений тенденции виртуализации образования, необходимость интенсификации образовательной деятельности виртуальных университетов (особенно актуальная в условиях пандемии). Целью исследования являлось создание таксономии целей и выделение основополагающих принципов, форм и технологий образовательной деятельности виртуальных университетов.
Методы исследования. В исследовании были задействованы классические для сравнительной педагогики методы: сравнительный, описательный, индуктивно-дедуктивный. Изучались цели, принципы, формы и технологии деятельности следующих виртуальных университетов: Открытого университета Великобритании (The UK's Open University), Канадского виртуального университета (Canadian Virtual University (CVU)), Университета Phoenix (The University of Phoenix (UoP, США)), Виртуального университета малых государств Британского Содружества (The Virtual University for Small States of The Commonwealth (VUSSC)), Виртуального университета Пакистана (The Virtual University of Pakistan).
Результаты исследования. В результате проведенного сравнительно-педагогического анализа цели, принципы, формы и технологии образовательной деятельности виртуальных университетов обобщены и систематизированы, что определило новизну исследования. Цели работы виртуальных университетов представлены в иерархическом порядке, соответствующем уровням целеобразования: целесообразности, целенаправленности (на уровне целенаправленности цели дифференцированы по видам деятельности: образовательной, педагогической, обеспечивающей и организационной) и целеустремленности. Выявлена совокупность базовых принципов, регламентирующих образовательную деятельность виртуальных университетов в контексте информатизации образования, дана характеристика наиболее востребованным формам и технологиям. Обозначены приоритетные содержательные направления работы виртуальных университетов, детерминируемые системой ее целей.

Выводы. Представленные таксономия целей и основополагающие принципы образовательной деятельности виртуальных университетов определяют специфику этой деятельности. Количество факторов и переменных, от которых зависит образовательная деятельность виртуальных университетов, постоянно увеличивается, но это не отменяет важности и ценности умения выбрать способ обучения, который подходит конкретному человеку. Индивидуальный стиль обучения подразумевает возможность адаптировать ситуацию и материалы в соответствии со своими потребностями и, как следствие, быстрее и эффективнее осваивать новую информацию и навыки.

Ключевые слова: университеты, виртуализация, цель, принцип, таксономия

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IMPORTANCE

The prospects of building a digital society fueled public interest in online learning opportunities, internet communication, offered a wider menu of educational services. New generation information technologies (ITs) set new requirements for information support of all higher education information processes. “Linking of IT facilitates knowledge management processes of distribution and use. This type of knowledge management technology enables the development of software architectures, that enable the creation of learning environments in research departments of higher education institutions, allowing experts to access tacit and explicit knowledge that improves individual learning” [1; 2]. It means, first of all, a large-scale employment of all global (research and education) information resources. All the subsystems of the open information system of a higher educational institution (information resource system, remote access system, education subsystem, administrative subsystem, transportation subsystem) are aimed at well-coordinated coherent functioning in line with global digitalization trends (requirements).

The key elements of essential ITs in higher education today involve:

– research and education portals used as web IT complexes, providing reference, analytical, communication and other information services; with the main task to ensure access to global information resources and eventually unified information and learning space;

– distant learning systems (DLS) that offer not only certain software platforms (Moodle, Edmodo, WebTutor, Getcource.ru, iSpring Online and others), but also relevant tools, methods, means, forms, technologies of cooperative learning;

– automated document and content management system, meant to manage the administrative information, e.g.: «Electronic dean’s office» with the interface accessible to all the players in the learning environment, which reflects the specifics of distant learning as well as academic performance accountability in higher education;

– network communication technologies – Software-Defined Networking technology (SDN) and Network Functions Virtualization (NFV) have the best upgrading potential; the first one is designed to operate the network apart from other netapps responsible for circulating information on the web; the second one aims to cut down operational, time and electricity expenses due to virtual versions.

Innovation technologies are currently emerging and becoming available at a far faster pace than higher education institutions, which train specialists to professionally use these technologies, are developing. By and large, there is no paradox in this mismatching. Scientific research has skyrocketed driven by the requirements of our time and social life. Tertiary education predictably does not keep the pace. Still, if

it did, it might lose links with other spheres, jeopardize the driving force of our future growth.

Amid the pandemic practical issues of employing digital technologies in higher education have become paramount, as the outside circumstances revealed an urgent need for education system to be flexible, mobile and respond promptly to unforeseen circumstances – changes in (seemingly static) outside parameters.

The processes seen in the information and educational environment involve increasing numbers of students and are winning more supporters of digitalization in different spheres of training, showing sensible and well-grounded attitude (from neutral to positive) towards the trend. The benefits are obvious: it saves time, brings convenience and comfort, availability of learning materials.

In this context it is critical to have digital technologies, which quickly become outdated, well-coordinated with the educational technology aimed at fostering digital competences as part of professional training. To reach this target it is necessary to upgrade the framework of higher education towards further virtualization.

Similar to real life educational systems, in virtual learning environment (VLE) "school" stands for secondary education, "university" – for tertiary education. The number of virtual universities is rising worldwide, still the pandemic made it necessary to step up their academic activity. This agenda calls for streamlining its conceptual framework, particularly purposes, principles, forms and technologies, which are currently being studied extensively to find the most effective ways of managing higher education in the virtual context.

By "virtual university" we mean a network educational institution, delivering degree programs online in the distant learning format, applying information and communicative educational technologies (EdTechs) [3]. The most common virtual university functioning models described in the academic literature are: traditional university offering online teaching of certain subjects [4], consortium, distant learning model and virtual university model per sei [3; 5]. Institutional aspects of setting up virtual universities have been studied in detail so far [6]. Evolutionary trends of communication and information technologies (CIT) have been analyzed as a significant factor to define the learning design (LD) in tertiary school [7]. To ensure the quality of virtual education effective ways of methodological, organizational, and resource support are still being sought after. "The concept of the virtual university is relatively new and it is necessary to distinguish a number of contradictory points in its verification. Firstly, it is the quality of the education received.

The problem of educational process content at the virtual university, organization of control and level of accomplished tasks, issues of intellectual abilities and critical thinking development, reflexivity of consciousness are the subject of heated discussions of both the supporters and opponents of the virtual university idea. Secondly, there is the question of the way of thinking. The virtual space involves a network mode of organization characterized by openness of the structure, poly variability of determination and expediency of modal logic. The phenomenon of virtual university is the result of responding to the needs of social transformation. In such model, the content of the social roles of the teacher and the student changes significantly. The competence of the modern teacher is not limited to knowledge. After all, the most experienced academician is not able to absorb all the information in a certain science, and obviously loses in the volume of assimilated information to any search engine" [8].

Our research is based on the hypothesis that it is the hierarchy of purposes and principles which makes the backbone of virtual universities academic activity, defining their avenues and focuses, forms and technologies.

RESEARCH METHODS

The main method used in our research was comparing aimed at revealing similarities in the educational activities of modern virtual universities. We centered our comparative pedagogical analysis on the virtual universities which are known to provide high quality educational ser-

vices: the UK's Open University, Canadian Virtual University (CVU), the University of Phoenix (UoP, США), the Virtual University for Small States of The Commonwealth (VUSSC), The Virtual University of Pakistan. The comparison was performed on the basis of these universities' sites, as well as critical literature review: comparatives studies, articles, published in international journals. While developing taxonomy of purposes we employed the descriptive method to compartmentalize the data collected, which called for careful interpretation of the discerned regularities. To verify the impact of the hierarchy of purposes and principles on the virtual universities avenues of activity, we turned to the hypothetical and deductive method.

RESULTS AND DISCUSSION

Systemic structuring of educational activity purposes in virtual universities into goal-setting levels resulted in the following taxonomy.

Expediency level. The paramount purpose of virtual universities on this level is the general pedagogical priority, personality development, which retains its relevance in the online context as well. A special emphasis is made on fostering a proactive attitude to life, which manifests itself in gaining new knowledge, obtaining skills and a new perspective on already obtained knowledge. Apparently, one of the most characteristic features of virtual universities' mission is ensuring life-long education, built in the virtual education paradigm. Seeking life-long educational opportunities individual is provided with all kinds of virtual and other resources available to ensure self-realization in the current climate.

Focus level. Virtual university purposes are grouped according to activity types: educational, pedagogical, sustaining and administrative/organizational.

The educational focus pursues the following purposes:

– satisfying the national labour market demands amid growing virtualization trends as a characteristic feature of information public landscape;

– designing and building a multifunctional virtual learning environment to perform, in the first place, teaching, communicative, controlling and administrative functions;

– ensuring conditions for quality education through tailored approach to an individual learner (with personality development potential as one of the landmarks of individual learning route);

– full-scale (at the same time limited and justified) computerization mechanisms used as basic tools for obtaining a degree, etc.

The pedagogical purposes involve, in particular:

– customized approach to learning, which implies individual-centered learning process – students develop their individual learning route, control its realization and decide what and how they will study;

– encouraging students' self-education, motivation for experimental research activity and personal growth;

– developing and implementing information and communications educational technologies;

– developing new approaches to students' career guidance given IT penetration, computerization and digitalization of our life;

– setting up multifunctional educational portals to streamline the use of the whole system of electronic educational resources, etc.

The purposes of virtual universities sustaining activity are:

– developing the system of multi aspect interaction of learners to enhance learning opportunities due to interactive nature of communication and cyber socialization;

– providing unlimited access to high quality services in education;

– more accurate monitoring of learning progress;

– ensuring pedagogical support for learners to help perceive the contents and visual presentation of certain texts, interpretation of visual information carriers;

– reducing expenses on the staff and infrastructure; etc.

The organizational activity purposes include:

– ensuring equal education opportunities for learners both from rural areas and cities;

– designing and holding on-line educational events of project and research nature;

– selling multimedia educational products, etc.

Goal commitment level. Finally, the third level of virtual university purposes involves objectives aimed to prevent and handle potential problems which might emerge in the teaching and learning process. These potential troubles can be reduced to:

– lack of in-person communication with real teachers and other people;

– low teacher readiness for online instruction;

– significant expenses: financial, time, equipment, copyright;

– computer addiction, etc.

Educational purposes of virtual universities, listed in the taxonomy are based on certain principles – general principles of educational activity and specific ones, working in the context of virtual learning. The fundamental educational principles of virtual universities are:

– individualization;

– continuity;

– interaction;

– focus on practice;

– pedagogical expediency in realizing virtual learning environment potential.

Our study helped reveal the priority avenues of virtual universities determined by their system of purposes and principles:

– teaching (different e-learning modes);

– educative action, done through traditional in-house organizational efforts, social experience and individual help based on information and communications technologies;

– organizational and methodological work, aimed at teachers' retraining, advice on the methods used, counselling, expert evaluation;

– cultural education, providing multiple chances to bridge cultural gaps virtually;

– recreational and health-improving work, involving various kinds of virtual rehabilitation, mental health healing, fitness, workouts, relaxation, games.

Taxonomy of educational activity forms and technologies hinges a lot on the virtual university contents-related activities.

The focus on life-long learning was announced part of the economic development strategy "Europe 2020: A strategy for smart, sustainable and inclusive growth". Increasingly popular free educational apps available at AppStore и Google Play are quite instrumental in translating this principle into practice.

Virtual interaction is meant to ensure effective feedback for learners, create opportunities for cooperation, teamwork, all based on information and communications technologies. The key feature of teaching and learning in this context becomes its dialogical (or even polylogical) character, which allows for certain modification of data management in compliance with the implemented degree program [9].

The practical focus principle is illustrated by John Dewey in the slogan "Learning by doing!". Virtual universities can establish a bank of effective practices on how to use digital resources to enhance learners' practical skills. "Virtual university is a learning system by providing an online environment based on information and communication technology. This system can overcome the problems that arise due to covid-19 not to gather together to do the learning process, but must learn from their respective places. Realizing the importance of education and knowledge which is the capital to bring people to a more advanced direction with a very strong positive influence in creating a change, then a university must always improve the quality and education system in its scope of work. One aspect that requires development by taking into account the use of information technology and internet technology is a learning method that only relies on conventional media in the classroom. With a learning model that utilizes information technology and internet technology, it is possible for teaching activities to continue effectively and efficiently even though it is limited by

space and time so that it benefits both students and universities. Appropriate technology is technology that can be used maximally for public use" [10].

Yet, virtual universities are trying to get away from omnipresent, uncontrolled technologization and digitalization. Virtual learning environment should stimulate creative, emotional, spiritual and moral development of a learner [11]. This task can be handled only through carefully selected subjects to study at virtual universities, which pursues the goals of security [12] (amid the pandemic [13]), mobility and polyfunctionality [7].

Given the marked variety of virtual interaction forms, it makes sense to indicate the most common formats of arranging virtual university activities world-wide.

Online video-conference. One of the most popular forms of teaching in virtual universities is an online video conference, which became an alternative to conventional lecture-seminar mode. To be more specific, this mode was transferred to the virtual learning setting, as an appropriate format for holding both lectures and seminars. "Virtual classroom" also relies on the online conference format. This form of activity provides plenty of learning opportunities: video recording of classes, whiteboard use, file downloading in the video session, screen sharing, etc. One of the pioneers of pro-active use of video conferences is Fern Universitat in Hagen, Germany, founded in 1974.

Internet communication in the virtual network community. This form of virtual university activities is seen as stimulating educating efforts. Virtual networking communities include social networking sites, as well as various means of communication in the real time or messengers, like Whatsapp. Virtual networking can help build effective communication and establish new forms of information exchange between teachers and learners. This implies, in particular, work in closed groups, maintaining and encouraging communication, placing and discussing materials, organizational issues, holding panel discussions, making up online tests, surveys, additional apps, providing pedagogical support for learners, etc. Thus, Vietnam, within the frame of the Pedagogical Degree Enhancement Project makes a special emphasis on social network, individual and group blogs, message exchange, channels and forums use.

Massive open online courses (MOOC – net resources, developed by professional teachers on specially built provider platforms Coursera, Udacity, edX, FutureLearn, OpenupEd and others). This format is especially effective for administrative and methodical work. The most popular MOOK platform – Coursera – offers more than 600 courses and unites nearly 100 universities of North America, Europe, Australia and South-East Asia. In 2014 some Russian universities joined the project (HSE – High School of Economics, MIPT – Moscow Institute of Physics and Technology, St. Petersburg Polytech University). Most courses are certified. Different MOOC models offer customized online learning programs, mixture of on-line and offline classes, online tests, tutor support, step-by-steep administration and finally – course completion certificate.

Virtual excursion. This form of virtual university activity is a world-wide popular format of cultural and educational activity. Its obvious advantages are: presence effect, availability, multiple viewing opportunity. Online services Google Maps, Mapwing, AcrGIS Online, Meograph are used as effective tools to develop an excursion. Virtual tours offer a walk through Piazza San Marco, Venice (Italy, White House tours (the USA), the Imperial Palace, Forbidden City (China, "BeyondSpaceandTime" project), The RF President' residence "Opening the Kremlin" and many others.

Online performance. One of the effective forms of arranging virtual university activities – recreational work aimed at promoting healthy lifestyle is an online performance. It can be staged on Edmodo platform. Students choose a historic personality who they are going to role-play with the teacher being a moderator and overseer. The list of objectives to achieve during at least two weeks (the project length) involves creating an account, digital portfolio, a character picture (using Voki app), as participants are to

discuss new material on behalf of their characters, perform tasks, interact and exchange ideas.

Given the great stockpile of virtual technologies employed in global educational practices, it makes sense to emphasize just a few of them, remarkable for their interactive and universal nature – they are applicable to all the above-mentioned avenues of activity, which indicates their large scale, fundamental use principle.

Learners claim to be interested in general purpose technologies (GPTs), which they consider most effective in building academic and professional competences. These preferences relate largely to artificial intelligence-based chat-bots, Learning Management Systems, LMS [15], social networking sites (VK, Odnoklassniki, Google+, LinkedIn) [16], multimedia data exchange services (Youtube/Rutube, Picasa, Realtimeboard), document exchange services (Dropbox, Google Disk, Yandex Disk**)** [17], real-time communication services (Skype, Viber, WhatsApp, Google Hangouts), blogging and microblogging services**,** social bookmarking sites (Digg, Stumble Upon), various tools, applications, games, podcasts ("Science Friday", "6 minute English", "TED Talks", "Personal Growth Podcasts"**)** and others. These technologies won their global recognition due to easy access and use, universal character, mobility, interactivity, communicativeness. The functions of social services provide wide opportunities for further personality developing, meeting students' cognitive and educational needs, enhancing pedagogical interaction among all the stakeholders on the learning landscape [18].

Growing demand for digital technologies within the frame of new educational model changes the teaching and learning major characteristics, both teachers' and students' approaches to this process, which makes it essential to overhaul the learning material. Digital technologies make a difference in the traditional school as well, making teaching and learning more attractive, comfortable and relevant, easily accessible and stimulating individual growth [19; 20].

Technologies for open educational resource use. In fact, this technology means using online recourses for learning. It helps each learner build up their own learning route and experience. Any member of the internet community can go for any resources absolutely free. Open resource-based learning stems from the digital generation potential. This technology allows to design an individual learning program meeting the learning needs of an individual at its most. It can be implemented via classes with tutors, mentors, performing team-tasks, swapping experience, doing research online, keeping a blog, using social networking sites and other interactive tools. Public-domain software-based learning is part of global database with free access for everyone, ensured via Creative Commons licenses, for instance. Still, open educational resources learning should not replace other educational opportunities, ignoring other skills development. This technology is based on methods which clearly signal a watershed – the shift of major focus from the teacher towards the learner. The most sought-after open educational resources are MIT OpenCourseWare (the USA), Learning Space Project (the UK), edX – free online courses of the global leading universities, OpenStax College – free textbooks, educational platform Udaccity, polylingual educational platform BilimLand, etc.

Augmented reality technology. The technology is used to add computer-generated information on a screen with the real object or scene that you are looking at. The device has to be equipped with a "transparent screen" or a camera – it might be a laptop, tablet or a smartphone. Additional information – graphics, sounds, animation, GPS coordinates or a reply to a question can be laid on the realworld images. Thus, the real world goes interactive and is subject to digital processing. There are numerous variants of augmented reality app use: augmented reality browsers, computer games, interactive crime maps in forensics. The opportunity to rely on virtual information, developed by a software, real images and video make this technology a perfect teaching technique. Augmented reality technology has been successfully implemented in: SixthSense project, Bufalo Hunt computer game, virtual GoS-kyWatch Planetarium, ARIS Global Game Jam, ARIS games, etc.

Significantly, there is a real risk these factors might jeopardize the whole tertiary education system, in particular, affect security of the learning environment stakeholders. Cyber safety and information security have become sore issues today. Information security threats are grouped into: confidentiality breach threats, cyber breach threats, information resources unavailability threats, system parameter exposure threats (including protection system). Still, limited digital skills (of both teachers and students) remain the biggest potentially hazardous factor jeopardizing accessibility of information resources. This problem can be settled only if removing these threats and successful risk managing becomes a strategic priority of the universities' administration.

CONCLUSION

The taxonomy of purposes and paramount principles of virtual universities educational activities make these activities unique.

The number of factors and variables defining the educational activities of virtual universities is growing, still the ability to choose the learning route which fits a certain individual has always been and will remain important. Tailored learning style (built on individual preferences in the ways of information searching and processing) suggests an opportunity to adjust the situation and learning material to your needs and thus become more efficient in obtaining new information and skills. The individualization principle allows learners to choose information, making their own decision on what is more important, interesting and worth in-depth studying, and what can be skipped.

Detailed account of virtual university technologies reveals their broad applicability, e,g.: artificial intelligence, gamification, blockchain systems, cloud knowledge database, smart systems of communication and cooperation – all these technologies rely on web design, case method, on-line games (business, imitation, didactic, etc.), quests and many others.

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