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MULTI-COMPONENT INFORMATIZATION MODEL FOR THE SUCCESSFUL TRANSFORMATION OF THE EDUCATIONAL PROCESS*

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The widespread digitalization of the society poses serious challenges to traditional activities and economic sectors, forcing them to evolve in different forms and, at times, to be completely transformed in order to be adequate to the new trends in the social development. One of the most important sectors, accompanied by such a key change, is the education, where the impact of the information and communication technologies (ICT) is complex and long-term, changing many of its traditional characteristics. In this article, I consider such a multi-component complex impact model, whose individual elements are linked and combined, creating a qualitatively new standard for education and training..

1. Introduction. The dynamic development of the technology and innovation creates preconditions for a qualitative leap in the economic development of the modern societies. Countries that succeed in recognizing and integrating in a timely manner the basic tenets of the so-called "knowledge economy" are moving upwards and playing an increasingly important role in the global world, and the newly created products and services are becoming an increasingly important part of the modern man's life. Genomic, quantum and nano technologies, autonomous drones, artificial intelligence or smart cities are just part of the huge arsenal of innovative improvements that make life more manageable, safe and attractive and contribute to raising the well-being and the satisfaction of the citizens. The upward development of all these products and services, however, presupposes a dynamic, relevant and constantly improving education, which already requires qualitatively new features that are not inherent in the "analog" educational model so far. The digitization, or more precisely the informatization of the education, by no means simply equips the traditional way of education with digital means of technology but represents a key change in the way the education has evolved so far. The traditional public education model, designed and outlined in the industrial age suddenly turns out to be extremely imperfect and inadequate to an age, in which the knowledge is already a key resource and at the same time an end product reflecting publicly recognized added values. So is changed the way we acquire and multiply knowledge and skills and such change is inevitable in order to maintain the growth rates.

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In Section 2 of this paper, I discuss the main features/modules of the change that is necessary for the successful transformation of the educational model, and what arguments the need to implement each of them. Section 3 describes the relationships between the individual modules and validates the need to integrate them in a complex and synchronous manner, while Section 4 explains how the informatization aspects of each of these lead to those qualitative changes that are necessary to achieve the desired net effect and ultimately – to get an improved and transformed educational model that is adequate to the modern realities. Section 5 outlines the pedagogical framework of this model, and the last section (6) summarizes the conclusions and main findings of the development and outlines a consistent plan for launching and implementing the change.

2. Key features of the change. It is not an exaggeration to say that modern education is in fact a kind of revolution, provoked by the technology penetration. Its main features can be synthesized as follows:

• *Raising attention and commitment to the process.* In the contemporary ocean of information (audio, video, 3D, etc.), it is becoming more challenging and time-consuming to attract young people's attention to the educational content and the essence of knowledge, so this content must be increasingly attractive, dynamic and mind engaging, since at the end it is not the teacher, but the brain of the student that makes the learning successful.

• *Extending the classroom beyond school boundaries / ubiquitous learning.* The modern technologies, which I will refer to in the next sections, allow the learning process to go outside the classroom and be introduced into the student's personal time, allowing him/her to study at home, on the tram, while on vacation or even while having fun with friends. In this way, the learning process becomes continuous, in line with the continuously accelerated concept of lifelong learning, and the activity itself becomes more informal and natural, such as breathing or drinking water, unobtrusively raising the student's competences and knowledge.

• *Learning as fun and empathy.* In line with the positional breakthrough of the educational process, it is changing in qualitative aspect as well – modern learning can in many respects also be considered as a type of entertainment requiring a different level of empathy, judgment, and often critical thinking on behalf of the student. Much of the serious educational content could be turned into game situations, engaging students to solve a scientific problem, find a practical solution, or just look at the problem from a different angle. At the same time, they cultivate communication skills, dialogue, criticality, teamwork and rational judgment, which are especially important in the context of the educational change in order to meet the needs of the knowledge-based economy. Serious games can play important roles in modern day education by combining appropriate content with interactivity and reflecting both the current state of technology and learners' social profiles [2].

• *Learning at various speeds.* Also known as *individualized learning*, learning at various speeds is a rational interpretation of the fact that all people are different and the circumstance that several children are the same age does not make them identical in terms of skills, assets or interests. After all, each individual represents a whole separate universe, and if we want to take the best out of him as a potential and results, we obviously need to approach him/her individually, taking into account his/her strengths and weaknesses. Our long-term goal, beyond a relatively modest educational minimum,

which should be covered by everyone, is to leave students alone to draw the boundaries of their potential, developing in an educational or professional field as they wish, not just following the desires of the teacher, the parents or the society.

• *Engaging parents.* Given the ubiquitous nature of the modern education and the fact that the learning process continues in the student's home, the need to involve parents in this process naturally arises, and they need to support their children in an important niche where the teacher has no real opportunity to intervene directly – the self-study. The parent can, on one hand, exercise some control over the child's homework while at the same time assist him or her with a particular subject or simply encourage him/her appropriately – for example, a promise of a reward when reaching certain learning outcomes, excellent grades, successful tests, etc.

3. Complex implementation of the transformation modules. It is important to analyze the already described characteristics of the modern educational model in order to argument why it is so important to consider them in parallel. Above all, they successfully complement each other. For example, it is not possible to imagine education as an out-of-class process without engaging parents who should assist us in securing a significant portion of the student's time (staying home) or engaging the sustained attention of the adolescents without considering their individual characteristics. Hypothetically, modern education can be equated with an **endless educational space** in which the student develops not linearly but organically – the skills he receives are complex, reflecting various life aspects, not just a narrow educational framework, often incomparable with personal biases, needs or interests. In many ways, the modern educational model is much more adaptable to life in the knowledge-based economy and prepares competitive individuals, because the knowledge they receive is not any more an abstraction or an ideal mathematical model. The contemporary students, trained in the transformed educational environment, could feel the empathy and engage in critical comprehending of the reality in search of specific practically oriented solutions. At the same time, the need for more active communication – with teachers, parents and classmates, is a natural development of the model, as the multidimensional nature and the increasing complexity of the surrounding educational ecosystem provoke many questions and, respectively, require many more answers and involvement at all levels. It is no exaggeration to conclude that the collaboration of participants in the process is a key necessity, as long as the new model goes far beyond the traditional frameworks and understandings of school education (special building/classroom, designated teacher and fixed teaching hours with clear targets). In this way the identification and engagement off all the potential stakeholders of the educational process is the only way to positively tackle the challenges. Particularly, important ally in this endeavor are the informatization and capabilities of the new ICTs, since in many cases they are the only working mechanism for achieving the preset goals and the ambitious tasks, and they tend to be not just a catalyst, but also a consequence of the change, as the increased needs constantly require newer and better technologies.

4. Digital and informatization aspects of the new educational model. Let's look at how the individual "modules of change" can be realized with the means of ICT, and how the individual aspects of computerization would affect one or another part of the new educational revolution. Without neglecting the fact that a digital technology can have multiple layers and affect all aspects of transformation, I will briefly describe which key innovations directly affect specific changes. For example, multimedia edu-

cational resources, 3D animations and interactive learning content directly affect the attention-grabbing and engaging aspects of learning as they are a natural environment for contemporary young people and a qualitative change compared to traditional paper textbooks. Rich digital content is a powerful way of providing today's students with high quality, relevant and up-to-date instructional materials [5]. Our education can become extremely attractive, modern and efficient if we take advantage of information technology and make a qualitative transformation of the educational process, using these advantages [3]. Extending the classroom beyond the school boundary and the concept of ubiquitous learning are successfully implemented through cloud technologies with adjacent distributed data centers with information and services, augmented reality resources and high penetration of mobile technologies and devices within the society (high-speed optical and mobile Internet, WiFi, smart phones and tablets). Modern distance learning methodologies now include technologies such as virtual classroom, which not only delivers course materials to the learners, but also provides a live, contextual and interactive environment for them [4]. Considering the learning as a fun and empathy can be successfully identified with the so-called "gamification" (the opportunity for learning content to be presented in the form of a game and the participant to reach the educational output through the process of discovery). There are hundreds of educational games, especially in the field of cultural and historical heritage and the research of the past, but it is no exception to include any other subjects (like math games, virtual physics and chemistry labs, etc.). Traditional teachers, equipped with appropriate technologies such as AI, automated knowledge assessment systems, and questionnaires with interactive questions, now have the ability to evaluate students' knowledge and skills much more thoroughly and comprehensively and mentor them according to their interests and needs. In line with the above, we should considerably appreciate the availability of a suitable ICT infrastructure (PC or smart mobile device) for literally anyone, thus allowing the training to be conveyed online without the limitations of the traditional classroom where everyone is forced to learn the same material with the same speed no matter how smart he is. Involvement of parents, on the other hand, is already quite possible through various educational portals, e-journals, video conferencing systems (Skype, Google Hangouts, etc.), social networks such as Facebook and Twitter, e-mail and more ICT based communication systems. In Fig. 1 I have illustrated the multicomponent information model, which gives a clear idea of the main modules that inspire the educational revolution.

5. A pedagogical framework for the change. There are various definitions of a *pedagogical framework*, but according to one of the most common it actually represents the integrated set of philosophical considerations, teaching preferences, and learning values that informs and motivates the instructor in designing and facilitating a learning experience. Obviously, the framework itself also has several components that secure the elements of the change. However, my enumeration does not follow any prioritization or emphasis, but provides guidance for the symbiosis that must be built in order to have the optimum educational effect and includes:

• *Technology culture* – extremely important in terms of the context and entry of innovation into the knowledge economy, because it provides the basic skills needed to operate technology in a modern society. This component has a direct impact on the management of the technology ecosystem and the driving attention module, but it also has a significant impact on the other elements of the multi-component model – participation/gaming, etc.

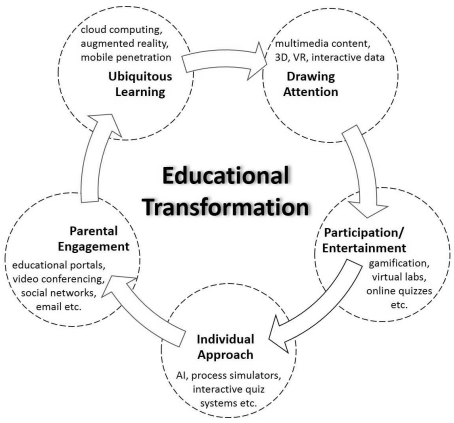

Fig. 1. Multicomponent Informatization Model of the Educational Transformation

• *Distance teaching and communication skills* – represent a qualitative leap over the traditional communication skills, as long as some basic social assets are no longer available or objectively suppressed (e.g. body language or the hierarchy in the classroom), while others have a significant impact (such as time flexibility or effective involvement in offline activities). These skills have a significant impact on the individualized learning as well as on the parental involvement.

Dialogue and interactivity – breaking the frame of the typical broadcast manner of teaching, as long as listening to the students' opinions is a key component in the modern education and a basis for promoting a critical thinking, which helps students to empathize with and actively participate in the learning process.

• *Creativity and imagination development* – going beyond the curriculum and tolerating the transformation of the theoretical knowledge into life skills in line with the needs of the society and with the concept of lifelong learning. Creativity is also an important component in creating and evaluating attractive educational materials thus engaging students' attention to learning.

• *Team and community building skills* – although learning itself remains a strictly individual process, we still need a friendly ecosystem that includes a wide range of players – classmates, other teachers, parents. The ability to create and maintain such ecosystem is reflected in the team-building skills of each teacher and brings the success of his/her students.

6. Conclusions and recommendations. The contemporary education faces tremendous challenges as the dynamics of the social development predetermines the need for its radical transformation in order to be successful in the new digital economy. We can safely conclude that "the emergence of the knowledge economy poses a new challenge for education" [1]. The main characteristics of this new type of education are related to encouraging the development of individuals in a much more multidimensional and dynamic environment, where empirical knowledge is inferior to the need for practical life skills, creativity, critical thinking and enhancing the learner's personal potential. Linear education is transformed into an organic process covering all the aspects of life, involving

a much wider range of stakeholders (parents, classmates, society), which is impossible without harnessing the potential of the new information and communication technologies and a consistent and purposeful informatization of the learning process. It would include building an adequate digital infrastructure – cloud services, high-speed information networks, multimedia educational content for all subjects, and launching national campaigns for individual access to a computer or mobile device for each learner, use of social networks and video conferencing services to promote communication between parent and teachers. The national governments should support appropriate teacher training programs for the development of suitable educational scenarios and teaching them in an attractive and game-resembling manner to the students, thus catching their attention. Such strategy should help making learners not just feel empathy to the learning process but also be active participants in it, which will guarantee lasting educational results and successful realization of the future labor market. The timely implementation of such a multicomponent model with a suitable pedagogical framework, facilitating the transformation of learning and education as a whole, is of paramount importance for the a successful realization of the societies in the new digital reality.

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МНОГОКОМПОНЕНТЕН ИНФОРМАТИЗАЦИОНЕН МОДЕЛ ЗА УСПЕШНА ТРАНСФОРМАЦИЯ НА ОБРАЗОВАТЕЛНИЯ ПРОЦЕС

Орлин Кузов

Повсеместната дигитализация на обществото поставя сериозни предизвикателства пред традиционни дейности и икономически отрасли, като под различна форма ги принуждава да еволюират, а понякога и тотално да се трансформират, за да са адекватни на новите тенденции в общественото развитие. Сред особено важните сектори, съпътствани от подобна ключова промяна, е и образованието, като въздействието на информационните и комуникационни технологии (ИКТ) върху него е комплексно и дългосрочно, променяйки много от традиционните му характеристики. В настоящата статия разглеждам именно един такъв многокомпонентен комплексен модел на въздействие, доколкото отделните му елементи се съчетават и комбинират, създавайки качествено нов модел на образование и обучение.