Progressive digital and information technologies in natural and technical education

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Abstract. In the context of a pandemic in 2020, a serious transformation of natural and technical education took place, in this connection; the authors consider modern approaches to the introduction of educational activities in conditions of restrictions. The paper proposes a concept that allows for a high-quality transition in natural and technical education, which allows students to assimilate material in a virtual learning environment. The work formulates a step-by-step system that allows transforming natural and technical education.

1. Introduction

Education is a key element in achieving many of the other Sustainable Development Goals (SDGs). If people have the opportunity to receive quality education, they can escape the vicious circle of poverty. Therefore, education helps to reduce inequality and achieve gender equality [1].

As a result, the rules and laws of life of each new century dictate their own conditions. Emergencies in the 21st century, these are crises, environmental disasters, global epidemics, etc., are pushing the heads of organizations to restructure the systems of their enterprises. So it happened with education. Educational organizations have switched to online learning. After analyzing the situation, the authors of the article concluded that it is necessary to create a new system of education in academies, universities, colleges. The following areas of education are being explored in the world:

- Assessment of competence [2];
- Environmental education programs [3];
- Civic education [4];
- The practice of education in the field of languages [5];
- Special education [6];
- Medical education [7];
- Teacher education [8];
- Urban education [9];
- World ratings [10];
• Ethical education [11], etc.

The system developed by the authors of the article will increase the level of education of students and will help in emergency situations to move to online learning in a mobile manner, without stopping the work process. Therefore, this system is so necessary now.

2. Materials and methods

"A timely education system and its punctual connection with social life and industrial development ensure the country's prosperity" [12], in this regard, in-depth studies of the learning process arise and take place (public education [13], comparative education [14], additional education [15], civic education [16], higher education [17], interdisciplinary education [18], maternal education [19], teacher education [20], sustainable development [21].

Because of the study, the following methods were used:

• An analytical method that allows you to analyze the scientific research of scientists in the field of education;
• Theory of choice and decision making - allows you to choose and make a decision in the field of education in a given situation;
• The qualitative method made it possible to collect and analyze information on the educational process and develop a high-quality education system.

3. Results

To develop a new system of innovative education, it is necessary, when drawing up a curriculum for each discipline, to allocate a certain number of hours, for example, for subject N, 10 hours of lectures in offline format, 20 hours of practical lessons in offline format and 12 hours of practical lessons in online format. Despite the fact that the number of hours is increased for practical training, this will increase the level of learning. Mixed forms will allow them to work out the practical and theoretical skills of the subject they are studying. In addition, those classes that are held online will allow you to invite and attend (connect) practitioners in order to share practical skills with the trainees. In the course of such classes, it is precisely the knowledge of students who is consolidated by combining theory and practice.

The result of such an innovative research in education is a knowledge test because of two stages:

• Testing throughout the course N (in online format);
• Ticket exam (offline).

The final grade is summed up from the two results of the knowledge test.

Testing will give an opportunity to understand the general level of a student's training in his subject, and the exam is a deeper answer to two or three questions from the ticket, which confirms his professionalism in his future profession.

Figure 1. Scheme of distribution of hours by subject.
As a rule, the parties in the offline practical and lecture classes will be the teacher - listeners, and in the online practical classes - the teacher, listeners or teacher, listeners, practitioner in the industry profession chosen by the students. Nowadays, when people are in different cities, countries, or they are very busy at work, it is online debates, discussions, training that provide an opportunity for practitioners to communicate with students of educational organizations.

**Figure 2.** Diagram of the principles of an innovative education system in natural (or technical) education.

**4. Discussion**
Undoubtedly, it is necessary to adapt to this system and introduce it into the educational process of the educational organization. Perhaps this is only under the guidance of the rector of the educational organization and the interaction of the vice-rector for strategic development and digital transformation, the vice-rector for academic affairs (their responsibilities include the development and transformation of the educational process), who will assist in the work of the head of the educational and methodological department for the successful result of innovative research and further application, and use in the learning process of students in obtaining higher and secondary education.

**5. Conclusion**
Progressive innovative research in the field of education conducted by the authors of the article will definitely increase the level of knowledge of students (obtained by theoretical and practical materials). The blended format of training will improve the quality of training, inviting employees with experience in industry enterprises, organizations to immerse students in the true specialty they have chosen for practical training. In addition, using this system in the event of an emergency, an educational organization will be easier to adapt to the learning process by switching to online work, which will in no way affect the quality of education. All this must be consolidated in the local acts of the educational organization, tested in practice, and then take into account the shortcomings and eliminate them. Then, at the state level, it is necessary to develop a law on innovative education systems, which will increase the level of information of the younger generation. The acquisition of new knowledge will allow young specialists to develop science in the future, work in factories, factories, law firms, which will affect the growth of the economy in countries, and therefore the well-being of people around the globe.

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**References**
[1] *Quality Education: Why It Matters Sustainable Development Goals* Retrieved from: https://www.un.org/ru/development/devagenda/pdf/Russian_Why_it_matters_Goal_4_Education.pdf

[2] Armstrong L, Harding F, Critchley J, McNarry Alistair F, Myatra Sheila N, Cooper R and Baker Paul A 2020 An international survey of airway management education in 61 countries.
[3] Palmos D, Papavasileiou C, Papakitsos Evangelos C, Vamvakeros X and Mavrakis A 2021 Enhancing the environmental programmes of secondary education by using web-tools concerning precaution measures in civil protection: The case of Western Attica (Greece). *Safety Science* **135** 105117

[4] Reichert F, Lange D and Chow L 2021 Educational beliefs matter for classroom instruction: A comparative analysis of teachers’ beliefs about the aims of civic education. *Teaching and Teacher Education* **98** 103248

[5] Frances Kvietok Dueñas 2021 Llegando a secundaria les ha dado amnesia...ya no quieren hablar’: Indigenous speakerhood socialization and the creation of language deniers in Quechua education. *Linguistics and Education* **61** 100888

[6] Virinkoski R, Eklund K, Lerkkanen Marja-Kristiina, Holopainen L and Aro M 2021 Development of reading and arithmetic skills across Grades 1 to 4 in two groups of children receiving part-time special education. *Learning and Individual Differences* **85** 101956

[7] Laura Hopkins M D, Helen Morgan M D, Samantha D, Buery-Joyer M D, LaTasha B Craig M D, Elise N Everett M D, David AForsell D O, Scott C Graziano M D, Brittany S Hampton M D, Margaret L McKenzie M D, Sarah MPate-Rowe M D, ArchanaPradhan M D, Susan Bliss M D 2019 Undergraduate Medical Education Committee, Association of Professors of Gynecology and Obstetrics. To the Point: a prescription for well-being in medical education. *American Journal of Obstetrics and Gynecology* **221**(6) 542-548

[8] Yeji Kim and Minsik Choi 2020 Towards critical multicultural teacher education in the midst of ethno-nationalism: Korean pre-service teachers’ international learning experiences. *Teaching and Teacher Education* **96** 103155

[9] Sutherland D, Ponnock Annette R, Jordan Will J, Kuriloff P and Hoffman B 2021 Sustainable Teaching: Three urban teachers make a case for teacher education 30. *Teaching and Teacher Education* **99** 103271

[10] Anafinova S 2020 The role of rankings in higher education policy: Coercive and normative isomorphism in Kazakhstani higher education. *International Journal of Educational Development* **78** 102246

[11] Kidd D, Miner J, Schein M, Blauw M and Allen D 2020 Ethics across the curriculum: Detecting and describing emergent trends in ethics education. *Studies in Educational Evaluation* **67** 100914

[12] Gazi Mahabubul Alam, Abdur Rahman Forhad and Ismi Arif Ismail 2020 Can education as an ‘International Commodity’ be the backbone or cane of a nation in the era of fourth industrial revolution? - A Comparative study. *Technological Forecasting and Social Change* **159** 120184

[13] Liu J and Bray M July 2020 Private Subtractory Tutoring: The Negative Impact of Shadow Education on Public Schooling in Myanmar. *International Journal of Educational Development* **76** 102213

[14] Smolentseva A 2020 Marketisation of higher education and dual-track tuition fee system in post-Soviet countries. *International Journal of Educational Development* **78** 102265

[15] Hanley P and Thompson R 2021 Generic pedagogy is not enough: Teacher educators and subject-specialist pedagogy in the Further Education and Skills sector in England. *Teaching and Teacher Education* **98** 103233

[16] Byker Erik Jon and Vainer V 2020 Social studies education in Argentina: Hacia Una Ciudadania global? *The Journal of Social Studies Research* **44**(4) 355-365

[17] Kountouris Y 2020 Higher education and fertility: Evidence from reforms in Greece. *Economics of Education Review* **79** 102059

[18] İpek Köse Tosunöz, Seda Karaçay Yikar, Zehra Çerçer, Pınar Kara, Sevban Arslan and Evşen Nazik 2021 Perceptions of interdisciplinary education and readiness for inter-professional education of nursing students: A sample of three different cities in Turkey. *Nurse Education*
Today 97 104673

[19] Le K and Nguyen M 2020 Shedding light on maternal education and child health in developing countries. *World Development* 133 105005

[20] Straub R and Vilsmaier U 2020 Pathways to educational change revisited—controversies and advances in the German teacher education system. *Teaching and Teacher Education* 96 103140

[21] Davis Julie M 2020 Creating Change for People and Planet: Education for Sustainability Approaches and Strategies. *Encyclopedia of the World’s Biomes* 438-446