THE IMPORTANCE OF DEVELOPING 21st CENTURY SKILLS FOR ADVANCED STUDENTS

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Abstract. The purpose of the paper is to study the most essential skills that young people need to develop in order to be perspective, prosperous in the 21st century. The present situation in education that has resulted from the processes of globalization and Industrial Revolutions needs a thorough study and modernization. Today's people can use artificial intelligence and robotics, additive manufacturing/3D printing and neurotechnology, virtual and augmented reality, nanotechnology and quantum computing, advanced innovative materials, and energetic technologies. Therefore to choose a competitive job, young people should take into account the development of STEM technologies and skills that will be on-demand in the future. The education system aimed to accumulate knowledge is becoming of no importance; the amount of information increased 8-10 times as much during the last half of the century. The so-called "information explosion" caused a new phase of our world development and teachers face a new challenge as a personalized learning and an integrated approach take the place of the standard education system. The role of universities is changing for research ones, and teaching is becoming more automated (online courses, video-conferencing, etc.). Teachers are transforming from "transmitters of information" into educator-organizers (Web-quest, project work, case study, etc.). They have to know how to use information technologies (Podcast, Vodcast, and Pre-Vodcasting). Nowadays the ability to learn, communicate, collaborate, to think creatively and solve problems in a digital information environment has become crucial. That's why, to prepare young people

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for the challenges of our modern life, teachers have to develop the most essential skills (hard and soft skills) and competencies: critical thinking, creativity, communication, and cooperation. Predicting the education and job market, the attention is paid not only to what people can do but to how they do it, their ability to divergent thinking, to what extent they can change themselves, learn, and master new spheres of applying their knowledge, skills, and techniques in today's environment. It is clear that humans are not born with these skills and it's necessary to work on them. To develop and improve skills of the 21st century, outstanding educationalists developed a variety of effective methods: flipped learning, mind maps, discussion clubs, didactic and business games, "brainstorming", scientific and practical conferences, scientific and research work, INSERT, "Cluster" etc.

1. Introduction

"We're here to put a dent in the universe.
Otherwise why else even be here?"
© Steve Jobs

Humans are born with a variety of natural talents. But many of them lose a connection with their capacity, getting entangled in the education system's meshes. A huge number of highly-talented, brilliant, creative people think they're not, because the thing they were good at school wasn't valued, or was actually stigmatized and sometimes they were laughed at for their inventions and assumptions. And it causes catastrophic consequences for them and the development of society on the whole [50].

The processes of globalization, the rapid development of information technology and computerization of work-life determine new requirements for educating modern people. In "The New Division of Labor" (published firstly in 2004 and republished in 2012), Frank Levy and Richard J. Murnana show how computers are changing the employment landscape, and how the right methods of education can relieve the transition to the new labour market. The computers are enhancing productivity in many jobs even as they eliminate others – both directly and by sending work offshore. At greatest risk are jobs that can be expressed in programmable rules – blue collar, clerical, and similar work that requires moderate skills and used to pay middle-class wages. The loss of these jobs leaves a growing division between those who can and cannot earn a good living in the computerized economy.

The nation's challenge is to prepare the population for the high-wage/high-skilled jobs that are rapidly growing in number. The future belongs to people who excel at expert thinking (solving problems for which there are no rules-based solutions) and interpersonal communication (interacting with people to acquire information, understanding what that information means and persuade others of its implications for action) [34].

The purpose of the article is to emphasize the importance of studying the XXI-st century competencies (critical thinking, creativity, communication, and cooperation) that will help young people to adapt themselves to the huge data streams and to benefit from in their adult life.

The tasks are to investigate the present situation in education; to describe the role of the world communities, organisations in solving the current problems; to determine the perspectives of the future education system; to define crucial soft skills for IT specialists; to study critical thinking, creativity, communication, collaboration and methods of their development and improvement in class.

2. Global overview on problems and perspectives in education

If we deal with an issue that our students are neither motivated nor interested in the educational process, we should study the situation in the education system which we have at present as a consequence of the 19th century Industrial revolution.

Humans witnessed three Industrial revolutions for 250 years. The first Industrial Revolution began in Great Britain in the mid-18th century and many of the technological innovations were of British origin: the iron and textile industries, machine tools, along with the development of the steam engine and railroads.

The Second Industrial Revolution took place between 1870 and 1914. It was a period of growth for pre-existing industries and the expansion of new ones, such as steel, oil and electricity, and used electric power to create mass production. Chemical synthesis also developed to bring us synthetic fabric, dyes, and fertilizer. Methods of communication were also revolutionized with the invention of the telegraph and the telephone and so were transportation methods with the emergence of the automobile and the plane at the beginning of the 20th century.

Nearly a century later, in the second half of the 20th century, the Third Industrial Revolution occurred with the emergence of a new type of energy whose potential surpassed its predecessors: nuclear energy. This revolution witnessed the rise of electronics – with the transistor and microprocessor – but also the rise of telecommunications and computers. This new technology led to the production of miniaturized material which would open doors, most notably to space research and biotechnology. For industry, this revolution gave rise to the era of high-level automation in production thanks to two major inventions: automatons – programmable logic controllers (PLCs) – and robots.

The Fourth Industrial Revolution is based on the Digital Revolution, representing new ways in which technology becomes embedded within societies and even the human body. It is marked by emerging technology breakthroughs in many fields, including robotics, artificial intelligence, neurotechnology, nanotechnology, quantum computing, biotechnology, The Internet of things (IoT), virtual reality (VR), decentralized consensus, fifth-generation wireless technologies (5G), additive manufacturing/3D printing and fully autonomous vehicles.

Satya Nadella, the Chief Executive Officer (CEO) of Microsoft Corporation, affirms that corporate giants will be forced to spend a considerable amount of money to "reteach" the previous staff till 2020. However, a real battle for talent will continue in science, architecture, engineering, mathematics, and technology. So the competition in these spheres will reach its peak. Education is one area that allows the tech industry at large to foster the kind of talent it needs in its workforce, and reach young consumers [72]. According to experts, if you want to choose your future career, you should focus on subjects that are commonly referred to as STEM (Science, Technology, Engineering, Mathematics).

The Mahindra Group chief, Anand Mahindra, referred to the popular movie series Star Wars making his point about how to move forward in this difficult economic period at the World Economic Forum at Davos in 2016. The business leaders from across the world were debating the challenges and benefits of the Fourth Industrial Revolution. Anand Mahindra said: "Technology is like the Force and everything depends on how we use it. Question is do we want Jedis or Sith. Sith are the arch enemies of the quasi-religious Jedis" [74].

Erik Brynjolfsson (the director of the MIT Center for Digital Business and one of the most cited scholars in information systems and economics) and Andrew McAfee (the co-director of the IDE and a principal research scientist at MIT) reveal the ways how digital technologies are transforming business, economy, and society in their book "The Second Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies" (2016) after they published the book "Race Against the Machine" (2014). They confirm that in the second machine age, which saw the automation of cognitive tasks, people are replaced by robots and during the first machine age people and robots complemented one another. Some examples that are given in the book include "software which assesses students' essays more objectively, consistently and faster than humans do" and articles "on Forbes.com about the corporate earnings preview were all generated by algorithms without human involvement" [8, p. 23].

To illustrate sustained exponential growth, two thinkers retell an old story of the emperor who was so impressed by the invention of chess that he invited the inventor to name his reward. The last one chose rice to feed his family and suggested to use the chessboard to determine the amount of rice he would be given. He asked the emperor to put one single grain of rice on the first square of the board, two on the second, four on the third, and so on. The emperor agreed but he didn't understand that sixty-three instances of doubling yields a fantastically big number, even when starting with a single unit. As a result, the inventor would wind up more than eighteen quintillion grains of rice (more rice than has been produced in the history of the world) if he finished the second half of the chessboard. Authors compare this second half of the chessboard with the steady and rapid exponential growth of Moore's Law.

With the development of the steam machine in 1765, human social growth started to rise very quickly. In the second machine age, the doublings happen much faster and exponential growth is much more salient. Currently, we live in a world where we experience tremendous progress in digital technologies. Erik Brynjolfsson says that "we're now in the second half of the chessboard and we see cars that drive themselves in traffic; Jeopardy!-champion supercomputers; auto-generated news stories; cheap, flexible factory robots; and inexpensive consumer devices that are simultaneously communicators, tricorders, and computers – have all appeared since 2006, as have countless

other marvels that seem quite different from what came before" [8, p. 30]. Let's take into consideration the spread of the Internet to people and things! Soon everybody on the planet will have a smartphone and every cash register, plane engine, student iPad or thermostat will transmit digital data via the Internet. It means that we are able to immediately detect and analyse patterns, to reproduce everything on a global scale and simultaneously improve things which don't work – either eye surgery methods or study of fraction. Combinatory achievements show that you can take Google Maps and connect them with your smartphone. That will help drivers transmit information automatically about traffic on their way, simply putting their smartphone into the car. GPS informs you not only what destination is the best in general, but it tells you what route is the best right now, including all problems (traffic, accidents) that have happened on the road.

If you put all these advances together, you'll see that our generation will have more opportunities to improve (or destroy) the world that ever before because of fewer humans and more technologies. It also means that we should reinterpret social contracts because the labour force is essential for a personality, human dignity and the stability of our society.

Brynjolfsson and McAfee's reveal the forces driving the reinvention of our lives and our economy, identify the best strategies for survival and offer a new path to prosperity. They include revamping education so that it prepares people for the next level of economy instead of the last one, designing new collaborations that pair brute processing power with human ingenuity, and embracing policies that make sense in a radically transformed landscape. Humans should always be able to adapt to new technologies that bring opportunities as soon as possible and the most important thing to focus on is to keep people working. They have to find ways to race with machines rather than racing against them.

Scientists will do much more to promote entrepreneurship, that is the best way to create jobs and opportunities, and even they'll create new fields and workplaces. Hence, increased efforts to boost entrepreneurship will lead to more innovation and productivity. As authors say, we have to reinterpret a lot, because we are on the cusp of a dramatically different world brought on by technology, which changes our workplace and it keeps doubling.

Brynjolfsson and McAfee's give an example when the Dutch chess grandmaster Jan Hein Donner was asked how he'd prepare for a chess

match against a computer, like I.B.M.'s Deep Blue. Donner replied: "I would bring a hammer" [8].

The education system in the majority of world countries was aimed to accumulate knowledge, and humans performed relatively simple operations many times one after the other. Now, these repetitive operations are performed automatically due to robotics and digital technologies. For instance, there are some changes, even in juridical systems. Ordinary people conduct about 80% of private judicial affairs on their own without any help from an experienced lawyer. It turns out that humans seek simply similar judicial affairs on the Internet, and they collect data themselves, so they don't need a lawyer anymore.

According to the exponential growth (whose rate becomes ever more rapid in proportion to the growing total number or size), scientists estimated that in the world:

– the first knowledge doubling was going on approximately from 750 to 1750 (i.e. within 1000 years);

– the second – within 150 years (i.e. in 1900);

– the third – within 50 years (in 1950).

As a result, the amount of information increased 8-10 times as much during the last half of the century. From 2015 human knowledge doubled every two years, and experts assume that it will be within a week in 2050. This phenomenon got known as "the information explosion" and marks the beginning of the information era when human knowledge and the amount of data will increase at record speed.

Technological development happens faster and faster in our life. For instance, the first list of S&P (Standard and Poor) [60] contained 500 large-cap corporations in 1957. There were only 74 companies in 1997. According to experts, in 2020 this list will comprise 75% of companies involving in such kinds of business that haven't been invented yet.

A group of scientists, Shai Ben-David (a famous scientist-programmer from University of Waterloo, Canada), Pavel Hrubeš, Shay Moran, Amir Shpilka and Amir Yehudayoff (associate professor, Technion-Israel Institute of Technology) have recently published their research results in the article "Learnability can be undecidable" [57] where they affirm that AI won't be able to solve a problem because of peculiarities of machine logics functioning. It turned out that even the smartest machine algorithms are

unable to overcome the limitations of mathematics. Their research is connected with the scientific works of Kurt Friedrich Gödel (an Austrian mathematician, logician; an honorary doctorate of Yale and Harvard universities) [19], who published his incompleteness theorems in the 1930s which state that not all mathematical questions can be resolved (independence results), that's why machine learning is limited by the same problem. Machine learning is related to the development and analysis of algorithms that can learn and improve their work because they're influenced by analysed data. To underline the validity of this idea, we can use the example of Viola-Jones machine system [28]. It can detect human faces in real-time after having learnt marked photo samples. Consequently, to learn in this case, AI uses databases that are prepared by a human in advance. However, when infinite sets of data are used in making a decision, everything becomes complicated because a problem can be either solved or refuted depending on circumstances. As a result, AI won't be able to solve a problem that is unable to prove and it couldn't be solved with one of the answers "true or false" in the Mathematics field.

In their study scientists deal with the problem of machine learning that they call "evaluation of maximum" (the question is about a website that tries to show an advertisement to visitors who look through the site more frequently but it isn't known in advance who visits the internet-resource at this moment). In other words, AI can possess information only about some website visitors or about all of them depending on circumstances. So we can't predict whether we will succeed in training artificial intelligence based on these limited data to provide perfectly advertising for all customers. There appears an unforeseen distribution of probabilities – it isn't known in advance which users of Portal are chosen. In this case, the standard axioms of mathematics can't be applied to solve tasks and AI will come across a problem that can neither be true nor false (Continuum hypothesis (CH)) [12]. These studies show that creating universal Artificial Intelligence able to solve any problem will be much harder than people have thought before [13].

During the last 250 years, qualitative transformation has occurred repeatedly in many spheres of human life. Professor Klaus Schwab, Founder and Executive Chairman of the World Economic Forum (WEF), is convinced that we are at the beginning of The Fourth Industrial Revolution that is fundamentally changing the way we live, work and relate to one another,

impacting all disciplines, economies and industries, and even challenging ideas about what it means to be human. In his book "Shaping the Fourth Industrial Revolution" [55], Schwab emphasizes three key technology trends necessary for further development:

I. Mixed Reality (a new user interface transforms your sight into a computer display where digital and physical objects coexist and interact in real-time. Data, applications, friends, colleagues will be accessible wherever we are in the office, at the symposium, etc.).

II. Artificial Intelligence (AI) will strengthen any professional experience, complementing, enriching human capabilities with their expert conclusions, knowledge, and such a prediction power that is beyond public perception.

III. Quantum computing will change the physical principles of computation and will give an opportunity necessary to solve extremely complicated problems.

Our world is moving into a new phase of explosive development, and we have to teach our students to influence their families, organizations due to 4Cs (4 Competencies: Critical thinking, Creativity, Communication, and Cooperation) of the 21st century skills.

As for European Commission, "higher education and its links with research and innovation play a crucial role in individual and societal development and in providing the highly skilled human capital and the engaged citizens that Europe needs to create jobs, economic growth, and prosperity. Educational organizations have to evolve and adapt to achieve their core mission: to educate students to be successful in a complex and interconnected world that faces rapid technological, cultural, economic and demographic change" [16].

UNESCO (United Nations Educational, Scientific and Cultural Organization) used the term "Reverse Mentoring" that refers to an initiative in which older executives are paired with and mentored by younger employees on topics such as technology, social media, and current trends. The younger people learn business terminology and industry practices from older employees. As a result, both of them have to think, work and learn in a new way, leaving their comfort zone.

UNESCO Institute for Information Technologies in Education (IITE) affirm that "Teaching and learning for a sustainable future" [63] is devoted

to Learning For the Future (LFF) where such essential competencies as *critical thinking* and *problem-solving skills, cooperation and leadership, effective communication, curiosity* and *imagination, initiativeness* and *adaptability* are outlined [30; 70].

How to understand the term "Learning For Future"? To increase access and improve the quality of 21st century education and achieve the overarch goal of Education 2030, new models of the school system environment are required. LFF will enable schools to enhance an innovative paradigm of the school educational environment so that they can play a more pro-active role in preparing students, teachers, parents, and local communities to the rapidly changing reality both for the present and for the future. The goal of the project is to investigate potential perspectives for educational ecosystems and support new competencies of students and teachers of the 21st-century schools by identifying, piloting and supporting emerging approaches and practices used in technology-mediated school education.

The most popular report at **TEDx** (Technology, Entertainment, Design) **Talks** (an American private non-commercial foundation, known for its annual conferences where unique "ideas worth spreading" are discussed) was made without help of any requisites, technology or slides and with the fewest number of movements. That was a report of Sir Ken Robinson "Do schools kill creativity?" made in 2006, downloaded more than 4000000 times. Ken Robinson is not just an amazing orator in the world – he is the most-viewed speaker on TED.com. In general, his presentations on the role of creativity in education (during 2006 and 2010) were viewed by nearly 200 million people in 150 countries. Being the world-famous expert in the development of creativity, innovations, and human resources, he collaborates with governments of Europe, Asia, and the USA, as well as with large-cap corporations. In 1998 Sir Ken Robinson prepared a very influential report "All Our Futures: Creativity, Culture and Education" that was published for general public. His book "The Element: How Finding Your Passion Changes Everything" (2009) became an international bestseller translated into 21 languages. In 2003, he was made Knight Bachelor by Queen Elizabeth II for his services to the Arts. The author showed that our present education is not economically profitable, and it doesn't meet today's needs. He affirms that "the whole purpose of public education throughout the world is to produce university professors" [50].

3. Challenges for future education around the world

The origins of personalized learning ideas go back far away to the history of education. In the XVII century, John Locke stood up for the harmonious development of a human. Those scientists who supported and practiced an integrated approach in teaching viewed that issue at different points. Their approaches are not possible to consolidate into one scientific practice. But all of them aimed to create an education system based on **how** students learn and what skills they have to acquire in order to become successful and all-round people. Among these outstanding educationalists are Jean-Jacques Rousseau, Johann Heinrich Pestalozzi, John Dewey, Kurt Matthias Robert Martin Hahn, Maria Montessori [39], Lev Semionovich Vygotsky, Avram Noam Chomsky, Rudolf Joseph Lonz Steiner, Alexander Sutherland Neill, and many others. From the beginning, the school created as a progressive tool due to which a personality learns universal concepts about our world.

Ken Robinson (an educationalist and a professional engaged in learning pedagogy issues for 40 years knows western and eastern systems of education very well) was one of the four international consultants developing a super modern model of school education for Singapore. Due to these pursuits, this country has become a creative centre of South-Eastern Asia. Taking into consideration Ken Robinsons' ideas, we can conclude that modern science is characterized by synergy, interaction with the different spheres of knowledge. The scientist suggests innovative methods of global shifts in general education used in the professional-oriented learning of students [49].

Currently, the major efforts of education aim to raise educational standards through competition and liability. Sir Robinson recommends moving from theory to practice, from testing to educating a creative personality able to cope with the challenges of our modern world and to meet our millenary's demands.

In a majority of developed countries, systems of state, education for the masses appeared only in the XIXth century and were created to satisfy the needs of the Industrial revolution for the workforce and based on principles of the mass goods' production. But the population of the Earth has doubled for the last 40 years! The development of digital technologies changed the way people live, think, communicate and it changed the kinds of tools they use for work. The new skills and ways of thinking, living, and working demanded new forms of education systems to provide them. As the products and the

technology to develop them become more digitized, another set of management and production skills will focus on increased literacy, numeracy, and new ways of thinking. Increasingly these are recognized as essential and the pressure on education systems to provide these skills will intensify [21].

Ken Robinson outlines such **4 major objectives of education** as economic, cultural, social, and personalized. Based on them, **8 key competencies** can be defined: 1) curiosity; 2) creativity; 3) criticality; 4) communicativeness; 5) collectivism; 6) charity; 7) self-control; 8) civic responsibility [49, p. 95-98].

The idea of personalized education and integrated approach to learning has to change the system of education standardization at this stage. Such leading countries as Singapore, China, Britain are ready to reject PISA (The Programme for International Student Assessment) tests.

In order to make present students successful in their further (adult) life, it's necessary to develop the XXIst-century competencies within the framework of educational training. They help find students their place in a rapidly evolving, technology-mediated world and provide them with lifelong learning skills. In a report "New vision for education" presented at WEF at Davos (2015) three broad categories of skills essential for a contemporary human were outlined: foundational literacies, competencies and character qualities [73].

Vice-presidents of three companies – Microsoft, Cisco, and Intel – launched a new project on developing a new education system because they consider that schools and universities do not graduate specialists that could occupy virtual workplaces and stay on top of a new system of production. On their order, an American scientist Robert Kozma (a professor from The University of Memphis) conducted a research "Assessing and teaching 21st century skills: A call to action" that allowed these companies to appeal to national governments of 6 countries – Australia, Singapore, Portugal, Finland, Great Britain, and the USA – to start the international scientific project on Assessment and Teaching of 21st Century Skills (ATC21S). It was headed by Patrick Griffin, a professor from the University of Melbourne. The first step was to follow a list of these skills. At the moment they are already at the stage of developing concrete patterns and methods that allow achieving critical thinking, problem-solving, cooperation skills that can be combined into a complex skill – collaborative problem-solving. It is therefore defined as a joint activity where two or more people work together to contribute knowledge, skills, materials, and procedures and move through a

series of cognitive states that involve collection and analysis of information and the formulation of hypotheses that they jointly set out to test [21].

In 2010 six countries participated in the project. Portugal and Great Britain went out of the research but the Netherlands and Costa Rica joined it instead of them. Such countries as China, Japan, Latin America, and others show an obvious interest too.

Last year the Organisation for Economic Cooperation and Development (OECD) tested this invention – collaborative complex problem-solving skills – in the framework of PISA. The test took place in 53 countries. From this number, we can see how fast this project is developing.

As global economies move to the trade in information and communications, the demands for learning new skills will require an educational transformation of a similar dimension. Education faces a new challenge: to provide the population with the information skills needed in our present society. Educational systems must adjust, emphasize information and technology skills, rather than or in addition to production-based ones. The ability to learn, collaborate and solve problems in a digital information environment has become crucial.

In Griffin's words, we have to change the structure of the educational curriculum in a way it will become more up-to-date and based on actual scientific data and critical thinking. It has to develop communication and interaction skills, inventive and creative capacities because they build interpersonal relations that are more on demand in this era.

Concerning exams, practical courses, laboratory works – they will remain but the way to assess students' results will change. Examiners won't check how many facts students can remember or keep in mind, but they'll assess **how** students can think and learn on their own. The future test won't contain such assignments as finding an unknown number in an equation, learning names of countries, formulae, historical dates by heart, etc. Instead of this, communicating with each other thanks to computer gadgets, students will solve different problems and the computer will record their actions – everything they say and write. Then an examiner will look at all these records and will assess students' skills of communication, critical thinking, creative abilities and so on.

As for Patrick Griffin, universities will play a more important role in research, and teaching will be more digitized due to online courses, for

instance. Nowadays, thanks to the Internet and Information technology, students can access a lot much data than a teacher knows. That's why the role of teachers will change too. Teachers will transform from "transmitters of information" into educator-organizers. They'll become specialists in helping students how to learn. Educational establishments will be forced to move to such an education system that will prepare specialists for an innovative economy and information society.

The present education system that is to reform, was created when manual work consisted of 80% and a mental one of 20%. Nowadays the percentage of manual, non-automated work is less than 12%, and this number is constantly reducing. Non-routine analytical and interpersonal skills are increasing in demand while routine manual and cognitive skills are in decline. In the world economy, we can see the actively developing businesses related to intellectual occupation: software engineering, development of science and technology, different forms of art where new ideas are appreciated much more [50].

For 10 years the European Union has considered 8 key competencies for lifelong learning as a basis of educational reforms published in the document "The Key Competences for Lifelong Learning – A European Framework" in 2007:

1) Communication in the mother tongue;

2) Communication in foreign languages;

3) Mathematical competence and basic competences in science and technology;

4) Digital competence;

5) Learning to learn;

6) Social and civic competences;

7) Sense of initiative and entrepreneurship;

8) Cultural awareness and expression [17].

At present, the issue of «XXIst century skills» development is actively discussed. Hanover Research [22] has recently published their conclusions of major educational platforms aimed at improving the development of these skills:

– Partnership for 21st Century Learning, or **P21** [42], this education consortium comprises 19 states and 33 corporate partners, located in the United States);

– Tony Wagner's Seven Survival Skills [67];

– the Metiri Group's enGauge framework [15];

– the Iowa Core 21st Century Skills, developed by the Iowa Department of Education [23];

– the Connecticut State Department of Education [11];

– the Assessment and Teaching of 21st Century Skills (ATC21S) [65].

According to the conclusions of this research, 4 major 21st-century skills were defined: 1) collaboration and teamwork; 2) creativity and imagination; 3) critical thinking; 4) problem-solving. They were always topical but it is obvious they are getting more and more essential because of the rapid development of digital technologies. In order to meet the demands of changing occupations, ways of working, techniques and tools for working and lifestyles in the era of high technologies, the labour market increasingly needs higher-order skills.

Education alliance program "Partnership for 21st century skills" also highlights ***critical thinking, creativity, communication,*** and ***cooperation*** as essential parts of the current educational system.

In 1950s specialists in different fields of science began to seek a certain set of "key competencies" – **soft skills** – that would determine a successful career. In 2016 "The Future of Jobs" report by The World Economic Forum (WEF) announced ten essential skills to develop in order to be in demand in 2020 (so-called Davos competencies or competencies – 2020) [75]. To compare the shift of skills actuality, analysts of WEF offered a table of top ten skills comparing 2020 and 2015 (the first research was conducted that year):

2015	2020
1) Complex Problem Solving	1) Complex Problem Solving
2) Coordinating with Others	2) Critical Thinking
3) People Management	3) Creativity
4) Critical Thinking	4) People Management
5) Negotiation	5) Coordinating with Others
6) Quality Control	6) Emotional Intelligence
7) Service Orientation	7) Judgement and Decision making
8) Judgement and Decision Making	8) Service Orientation
9) Active Listening	9) Negotiation
10) Creativity	10) Cognitive Flexibility

As we can see Complex Problem Solving is on the top of the list through the majority of processes that are becoming automated. Creativity is not inherent in AI for the present and this is a creative approach to problem-solving that can be chosen as the best variant. Nevertheless, AI machines are expected to be part of some companies' board of directors by 2020. Critical thinking will be the second in 2020 (it had the 4th position in 2015). 5 from 10 skills concern communication with people, the ability to manage, understand and agree. The other 4 skills are related to brain peculiarities to make decisions, to generate creative ideas.

Active listening, considered a core skill in 2015, will disappear completely from the top 10. Emotional intelligence, which doesn't feature in the top 10 in 2015, will become one of the top skills needed by all. Our future is a period when the brain, emotions, and development will be the most important ones.

Cognitive flexibility (an ability to ponder several things at the same time) that wasn't so significant in 2015 will be in the top 10 in 2020. International experts assume that 35% of key competencies in demand will change.

Nowadays this set of skills has transformed into shorter concepts, so a model of "4Cs" – four characteristics of a human (the most essential skills of the 21st century) – has appeared:

1. Critical thinking.
2. Communication.
3. Creativity.
4. Collaboration.

We all understand that nobody comes into the world with all these skills. We even have to work on critical, analytical, systematic thinking inclinations. We have to develop them. For many contemporary educators, especially linguists, these skills are clear, necessary for high quality education because every teacher wants the students to be able to do tasks on their own, to work in pairs/groups in a high-tech atmosphere, to be ready to collaborate with the teacher and other students, to be open to a flexible and creative thinking.

Psychologists George Land and Beth Jarman published the results of their divergent thinking research in the book "Breakpoint and Beyond: Mastering the Future Today" (1992). **Divergent thinking** (from Latin *divergere* – to diverge, to differ) is an ability to generate a huge number of

different, possible solutions to a problem, an ability to think in a spontaneous, free-flowing, "non-linear" manner, such that many ideas are generated in an emergent cognitive fashion. In other words, it is a component of a creative approach to problem-solving. The essence of this research was to test the creativity of 1600 children ranging in ages from three-to-five years old and it revealed that 98% of them were "geniuses" of divergent thinking. 5 years later the same children were re-tested and only 30% remained "geniuses". The same test was organized again 5 years later and only 10% of the children were considered creative "geniuses". Then the scientists conducted the same test on 280000 adults (average age is 31) and only 2% of them scored at the "Genius Level" of divergent thinking. This longitudinal study proves that children gradually become less creative over time, studying in the current education system [29].

Professor Allan Snyder (the director of the Centre for the Mind at University of Sydney, Australia) suggested a hypothesis that savant skills are latent in all of us, but not everybody can "awake" them. According to the scientist, the capacity to see the world differently, not to be afraid of making mistakes, to exceed the limits is called "champion's thinking". Studying famous sportsmen and leaders throughout the world, he concluded that they had a common feature – they didn't accept stereotypes, they were capable to examine a situation from the different sides and different points of view. Allan Snyder and John Mitchell consider that "the capacity to think logically" stops ordinary people from showing such features. Real geniuses such as Leonardo da Vinci, Albert Einstein, Plato, Nikola Tesla could alleviate the analytical work of brains as their thinking was based on "naked facts", phenomena as the earliest representatives of the civilized world had very long ago.

A well-known cognitive psychologist Mark Runco (the E. Paul Torrance Professor of Creativity Studies at the University of Georgia, USA) said that "Everyone is creative but not everyone (is genius) doesn't realize the full potential" in his textbook "Creativity: theories and themes: research, development, and practice" (2014) [53; 54].

As we see, the prediction of the education and job market, a thesis on the "disappearance" of a majority of well-known occupations arises. It means that it is important not only what you can do but **how** you do it and to what extent you can change yourself, learn and master new spheres of applying your knowledge, skills, and techniques.

Studies conducted by Harvard University, Carnegie Foundation and Stanford Research Center noted that 85% of achievements in career are determined by **soft** and people **skills** and only 15% by **hard skills** (2017) [45; 71]. "The Harvard Gazette" newspaper presented research results by Devid Deming (a professor of education and economics at Harvard Graduate School of Education and a professor of public policy at Harvard Kennedy School). They show that workers who combine social and technical skills fare best in the modern economy, as measured by a 7.2 percentage point increase in available jobs and a 26 percent wage increase between 1980 and 2012 [44].

Terms **"hard skills"** and **"soft skills"** originated in the military sphere. Since 1959, the U.S. Army has been investing a considerable amount of resources into technology-based development of training procedures. During their investigation, they revealed that for the military personnel, professional skills ("hard skills") are important as well as universal competencies ("soft skills") that are not taught. The difference between them was published in a training doctrine known as "Systems Engineering of Training" in 1968: "hard skills" are job-related skills that involve interaction with machines and "soft skills" are job-related skills involving actions affecting primarily people and paper. After issued terms were approved in military science and psychology, they were started applying in the business sphere.

Developing strong "hard skills" typically requires the left brain or logic centre (IQ) and they can be proved by a Diploma or a Certificate. In contrast, strong "soft skills" are typically formed in the right brain or emotional centre (EQ). They are less tangible and harder to quantify. A human has to prove them only in the process.

The Collins English Dictionary defines the term **"soft skills"** as "desirable qualities for certain forms of employment that do not depend on acquired knowledge: they include common sense, the ability to deal with people, and a positive flexible attitude" [59]. They are more personality-oriented interpersonal skills, such as teamwork, flexibility, patience, persuasion and time management. Soft skills are becoming more and more important than **hard skills** that are specific, technical ones acquired during education, workshops, certificating and closely related to professional qualification. Hard skills were the only skills necessary for career employment and were

generally quantifiable and measurable from an educational background, work experience, or through interview. For IT specialists, for instance, they are programming languages, data transmission protocols, principles of networking, cybersecurity standards, virtualization systems management, risks management, knowledge of system analysis, etc.

At present, there remain jobs where "hard skills" are more important than "soft skills" (for instance, nuclear engineers and accountants), but the number of these jobs is becoming fewer and fewer because "soft skills" are future competencies as was mentioned earlier.

Let's study the soft skills of a programmer in detail. For these specialists, they are not ones connected with creating programs, developing software, but they concern the ability to communicate and collaborate, to persuade and motivate, to be good team players and great at time and task management. They enable them to work and interact effectively and harmoniously with other people.

Developing software is teamwork and a programmer is an integral part of this process. Collaborating in a team setting is essential so that they can avoid conflicts that slow down the development and influence a general result. IT specialists are regularly expected to interact with senior managers, co-workers, and clients. They have to explain problems clearly, discuss them, break them down into hypotheses, and propose solutions coherently. They have to motivate co-workers, to organize feedback. Sometimes IT professionals are asked to participate in client meetings and explain how a system works. We have mentioned only some everyday processes but we see that their effectiveness is connected with the communication skills of each worker.

Such **soft skills** can be defined as crucial for IT specialists:

I. The ability to speak and write in English (B2 level at a minimum). English is the de facto language of most documentation (instructions, foreign projects) and developer interactions. If they don't speak it well enough, they'll require interpreters and translators, making their knowledge second hand and quickly outdated.

II. The ability to work in a team and supreme communication skills are of paramount importance. IT specialists should be ready to communicate with colleagues and clients. The ability to help other teammates get better is a superb quality of premium IT specialists. They teach new skills

to others and write documentation that would help teammates. They have to avoid crises, taking the time to understand what's going wrong, even when there is a catastrophe: but more than that, they have to treat regular problems as issues to be solved.

III. Active listening also plays an important role in this list. For instance, IT specialist has to give full attention to what clients say, take time to understand the points being made, asking questions as appropriate and not interrupting at inappropriate times. He may find out information that will have a substantial impact on the result of work.

IV. Writing skills are very necessary too. While working remotely, a lot of issues are indicated in letters. IT specialists have to explain some technical specifications and processes to ordinary people who are not into the IT-sphere.

V. The ability to plan. For example, a programmer should first learn as much as possible about the desired end product. Once he's completed that analysis, he will first design the program structure before typing the first line of code. Consistency is a skill that everybody needs including IT specialists. Starting a project, it's important to bring it to a logical end.

VI. Great at time and task management: the ability to estimate the amount of time needed to complete a task, communicating this and delivering on it. IT specialists have to show respect for terms and do everything possible to meet assigned deadlines.

VII. A business perspective. It's easy to lose sight of the big picture while focusing on creating one piece of software. The ideal programmer has a business focus that allows him to move beyond the current application. A business-focused programmer will suggest ideas for new applications that can improve operations.

So the way IT specialists communicate, the way they conduct themselves and the way they approach programming speak volumes as to their amazing level of soft skills.

Mostly the whole companies and firms with the strong corporate culture from startups to giant corporations such as Airbnb, Dropbox, Snapchat, Spotify, Google, Apple, Netflix and others clearly understand which interpersonal/people skills they wish to see in their co-workers because they know that it is a crucial parameter in a successful activity of their company [1].

Professor Eric Mazur from Harvard University developed an interesting system of "flipped learning" or "flipped classroom" where students read, find out facts on their own, and then they come in class, systematize acquired knowledge, and consolidate it thanks to their educator.

Two teachers Jon Bergmann and Aaron Sams (the authors of the best-sellers "Flip your classroom", "Flip your classroom: reach every student in every class every day" and "Flipped learning: gateway to student engagement" [6] published in 10 foreign languages) are widely recognized as pioneers of the "Flipped classroom" model of teaching. In 2007, they were concerned that students frequently missed a great deal of school because of sports and activities. They began to use live video recordings and screen casting software to record lectures, demonstrations, and slide presentations with annotations. Then this idea transformed into a new educational approach.

The role of students changes in "flipped learning". They are not more passive participants of the educational process, the product of teaching, but they become self-directed learners. As a result, the classroom becomes a truly student-centered learning environment: students are encouraged to learn and demonstrate their understanding in ways that are meaningful to them; they engage in hands-on learning, collaborate, interact more with their peers and evaluate their progress share. They explore topics in greater depth and progress faster as richer learning opportunities are created through various student-centred pedagogies. Flipped learning allows them to be more responsible, and they've got a stimulus to experiment. Activities headed by students and their communication motivate them to learn due to practical skills.

Jon Bergmann and Aaron Sams outline that the contribution of a teacher can't be depreciated as for learning subjects. The role of the teacher has changed from the presenter of content to the learning coach. It means that skilled, professional educators are more important than ever, and often more demanding than in a traditional system. Educators use in-class time to actively engage each student in the learning process, and provide them with individualized support, guidance and inspiration. Students' learning pace is taken into account too. They help young people gain conceptual understanding; they evaluate what they need to teach and what materials they should explore on their own. They try to maximize classroom time in order

to adopt various beneficial methods of instruction, such as active learning strategies, peer instructions, problem-based learning, depending on grade level and subject matter.

Teachers can apply grouping forms and activities such as ***cooperative learning, group projects*** to explore more issues learnt at home. It is a good idea to introduce ***debates, discussions*** that will promote collective work and develop creative thinking skills. Michael Gorman (2012) observed that any learner-centered educator would provide activities in the classroom that are action-based, authentic, connected and collaborative, innovative, high level, engaging, experience-based, project-based, inquiry-based, and self-actualizing.

As a rule, in "flipped learning" the teacher faces some questions:

– What can students do with acquired information?

– Which activities will help consolidate new material?

– Can students enrich acquired knowledge thanks to practical experiments, discussions, and can they apply it to generate their project?

– How can you organize and control the teamwork of students at lessons?

– How can students consolidate acquired knowledge?

Talking about the advantages of flipped learning system, we can highlight:

– a personalized approach tailored to students' needs and feedback;

– students can review video lectures and appeal to other sources to make material more precise as many times as they need to, thus they are more productive learners in the classroom;

– all complicated questions appeared during individual work will be discussed and explained by the teacher in class;

– "flipped learning" model can be applied at any stage of learning.

There are also some disadvantages:

– students can't ask questions immediately "during lectures";

– not all students are diligent in doing their homework;

– students don't always have access to the high-speed Internet or computers;

– students who lack adequate background for the material, are uninterested in the subject.

Answered these questions, teachers should be aware of using modern information technologies. For instance, they have to know and understand

the difference between ***Podcast*** (digital media-file, audio file, audio lecture made available on the Internet for downloading to a computer or mobile device), ***Vodcast*** (a podcast with video content) and ***Pre-Vodcasting*** (a new educational technology in which the teacher creates a vodcast with lectures and students are able to watch these videos before their lesson, so they are prepared to learn new material).

Let's analyse thoroughly all competencies and methods which can help to develop and improve them.

4. Competencies and methods of their development

Davos competencies interpret **critical thinking skills** as "complex problem solving and cognitive flexibility" [73]. People adapt to the environment thanks to their well-developed thinking as a minimum. They can transform the reality as a maximum. In order not to lose yourself in these information streams that we get every day and to keep your mind sharp, the ability to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems, to analyse and evaluate situations, ideas and information, to make decisions using logic and reasoning is becoming more and more essential.

The term "critical thinking" has its roots in the mid-late of the XX century. The issue of critical thinking development was studied from philosophical, psychological, and pedagogical points (Michael Scriven & Richard Paul (1987), Edward M. Glaser, Paul Everett Thomas etc). As these scientists state, critical thinking – in being responsive to variable subject matter, issues, and purposes — is incorporated in a family of interwoven modes of thinking, among them: scientific, mathematical, historical, anthropological, economic, moral, and philosophical [56].

In general critical thinking refers to complex skill that helps solve problems when there is a lack of information. In scientific sources it has four components:

1. System analysis: the ability to determine a relationship among variables in a certain system.
2. Argumentation analysis: the ability to come up with logical conclusions, relying on facts or statements.
3. Creative process: the ability to build some strategy, theory, methodology or an argumentation line (logical reasoning) based on a complex of

accompanying facts (that should be more in-depth than obvious information on the surface).

4. Evaluation: the ability to evaluate the quality of processes and decisions. Evaluation encompasses criticism of final thinking product taking into consideration the peculiarity of a given situation.

Forming students' critical thinking is realized due to such activities: ***didactic game, business game, "brainstorming", discussion, scientific and practical conference, scientific research work*** [25]. Students can also solve crosswords, puzzles. For instance, in ***discussion clubs***, IT students exchange ideas, express and justify their point of view on different topical themes in the sphere of information technology. Creating ***mind maps*** that visually represent hierarchical information including a central idea surrounded by connected branches of associated topics is a good activity for IT students (for example, mind map of hardware and software) [27, p. 24].

To develop critical thinking, methods of ***using texts*** are applied (psychological researches by Lev Semionovich Vygotsky, Jean William Fritz Piaget):

1. INSERT (I – interactive, N – noting, S – system, E – effective, R – reading and T – thinking) – text reading involves special signs: «+» – new info, «v» – I know, «-» – I don't know, «!» – It's interesting, «?» – I want to know more details.

This method requires an attentive (close) reading. In passive reading students omit unclear parts of the text and they don't really question or analyse the details. When they read actively, they engage in a dialogue with the information and use it to synthesize a new, refined understanding of the subject. It focuses their attention to each line.

This method aims:

a) to remind things that are known (challenge stage);

b) to sort out of parts (comprehension stage);

c) individual analysis of information, interactive discussion can be applied at the stage of reflexion;

d) argumentative writing (students are proposed to express their ideas on a given topic during a short period (10-15 minutes)).

To develop students' critical reading skills while reading different texts, they should pay attention to:

– details (find and remember the important details);

– main idea (put the details together and find the main idea);

– sequence (underline and remember the order in which things happen): for instance, to put parts of the text in a logical order;

– context (use the words and sentences nearby to find out the meaning of the word);

– inference (find the meanings and ideas that are not stated, and draw conclusions);

– cause and effect (understand what makes things happen and why);

– predicting outcomes (based on what you have read and your personal experience, tell what will happen next);

– understanding character (find out about people through their words and actions).

To develop critical reading skills such methods can be used:

– ***scanning*** means to look for specific information quickly; when you scan you don't read every word; to glance at a page to find a certain item; it is important when you look for a particular detail in the research;

– ***skimming*** is reading through a passage quickly in order to learn what it is about; it is useful when we need basic information about a subject;

– ***making inferences*** means to conclude by reasoning from evidence, guess or find the meanings and ideas that are not stated, and draw conclusions;

– ***making associations*** is connecting in thought, memory, or feeling;

– ***predicting*** is to foretell, to make a conclusion based on the previous experience;

– ***classifying*** is to arrange or organize in classes. For instance, the teacher chooses some category headings, gets students to sort words into groups and justify why. As a rule, this generates more discussion if the categories are a bit nebulous (whole class or small group activity);

– ***making analogies*** means to make a comparison showing that two things are similar in some ways;

– ***making generalisations*** means to say that something is true in most cases, ignoring minor details;

– ***summarising*** something means to give a short account of its main points [51, p. 51-62].

2. One of the effective critical thinking development methodologies is the use of so-called ***"thick and thin questions"*** that are supposed not to be answered Yes (or No) but they will be discussed using a creative approach and an individual comprehension. For instance, "Give three reasons

why…?", "Explain why...?", "What is the difference...?", "What would happen if...?" etc. Such questions are called problematic and they were used from Socrates' times. As a rule, they pose a problem and trigger a debate as well as intensify pupils' and students' research activities. This method is used in pair and group work while discussing different topics.

Due to open questions, some predictions are possible to make. For example: "What will happen to main characters", "Why do you think so?" [40].

"Thin" questions like *What…?, Where…? When…?* require short answers but replying ***"thick"*** questions (*If you were… would you…?, Why do you think…?*), students have to reason, give arguments or examples.

Directed text perception is based on a wide range of questions that promote a deep understanding of the text.

3.*"Cluster"* (a graphical method of material systematization) aims to gather all ideas and associations related to a notion or phenomenon. This innovative method can be used in all stages of teaching a foreign language to both young and aged learners. It is applied to systematize and review some material, to work with a text, to revise some vocabulary at the beginning of the lesson, to introduce the theme, to collect necessary vocabulary or to control students. As for pros of this method, all students take part in this process, and they are not afraid to make a mistake.

4.*RAFT* strategy includes writing from different viewpoints and it helps students learn important writing skills such as audience, main idea, and organization. It teaches them to think creatively about writing by responding to the following prompts: **R**ole of the writer (who or what are you as the writer?), **A**udience (to whom are you writing?), **F**ormat (in what format are you writing?), **T**opic (what are you writing about?).

5.*Keywords* (the teacher says keywords and students guess the topic of their lesson).

6.*Problem-solving activities* are the most effective methods of developing critical thinking skills. They involve the ability to critically analyse a problem, map out all its elements, predict and make conclusions, express clear ideas and build the consistency of facts, events, solutions. Such endeavors encourage cognitive as well as social development and can equip students with the tools they'll need to address and solve problems throughout the rest of their lives. Assignments can be given to pairs, groups or individually. Students think about solving a problem, discussing possi-

ble variants (additionally working on key vocabulary, grammar structures, communicative situations such as "Agreement and Disagreement", "In my opinion"). While talking about the problem, they use the target language and improve their communicative skills. Students learn to interact with others as they discuss solutions and outcomes of the solution. They learn to negotiate when they try to agree on different points of the solution, thus they develop critical thinking skills [4; 10; 61].

"Critical thinking development technologies" improve communicative skills, the ability to hold a conversation and to work in a team. Students are suggested to play the role of the teacher because the method of mutual education is in its origin. Information transmission from one to another develops different types of perception: analytical, visual, audial, reflexive. The main goal of Critical thinking development technologies is to teach students to work on their own with educational material and then with other information sources. Authors of Technologies through reading and writing are American educators C. Temple, J. L. Steel, K. S. Meredith. In its origin, there are a dialogic conception of culture (M. Bakhtin, V. Bibler) and psychological researches of L. Vygotsky, J. Piaget and many other scientists. They outline that critical thinking is free, independent, reflexive, analytical, and evaluative. Reflexive analysis of problems that students solve, is a necessary precondition to practice ways of setting individual tasks, hypotheses, plans, making decisions and assessment criteria of final results [64].

Evaluation can be organized in a form of writing tasks or reading the book before project presentation as well as participation in debates. The teacher evaluates how students give sound reasons for their points of view, i.e. their communication skills.

At the present stage of our social development, there have disappeared almost all time and space limitations for contacts and collaboration, offering us immense possibilities. Nevertheless, it requires us to be ready to communicate our ideas with different people in order to succeed. Listening carefully, speaking clearly and putting others at ease are very valuable attributes to possess. The ability to work in coordination with others to convey information or tackle problems as well as to justify our point of view and to establish a contact to continue collaborating is a minimum set of **communicative competences**. And if we talk about company management, leadership success, we won't succeed without communication skills.

To develop communication skills one can use different methods such as *game-based activities ("Circles on the water", "Hot seat", etc.), interactive games (Kahoot), blogging, video filming*.

1. *Hot seat.* One of the pair/small group defines, the other guesses the word (team or pair work competition).

2. *"Circles on the water"* game is a universal method of stimulating students' communication skills. A keyword can be a phenomenon that is learnt. The task is to give new words (nouns, verbs, adverbs, collocations, and others) to the letters of this word. For instance:

C – Commonly
O – Operated
M – Machine
P – Particularly
U – Used for
T – Technical
E – Education
R – Research.

3. *Interactive games* are on trend now. You can play on your own or with your friends. *Kahoot* app (https://kahoot.com/) is a free game-based learning platform that makes it fun to learn – any subject, in any language, on any device, for all ages. It is a tool for using technology to administer quizzes, discussions or surveys. Students can play by the whole class in real-time. Multiple-choice questions are projected on the screen and students answer them with their smartphone, tablet or computer. *Kahoot* can be used as a break from traditional classroom activities or as a mobile application for homework. Then game results can be discussed.

4. Due to ***video filming***, you can develop speaking skills. It can be a part of group project work (interview, contest, presentation of ideas), as well as individual work.

5. *Blogging* is the process of writing a blog, an online journal in which you share your thoughts about a particular subject with readers. Usually, blogs are being updated quite often (once a day, once a week, once a month). They can be private, but most of them are available on the internet for others to see. People usually post useful hyperlinks, interesting articles, short stories, videos, images; bullet-points, different headings or interesting collocations; project works.

Blogs (and blog posts) can be shared on social networks (Twitter, Facebook, Google+), and people can leave comments under them to start meaningful conversations.

We can conclude that online communication tools also allow students to help each other. They can now create and share digital notebooks through tools such as *OneNote*; discuss readings and assignments, share related information and keep up with classroom announcements through social networking sites; and comment on and discuss assigned readings through such sites as *Ponder*.

Creativity (from Latin *creatio* – to create, make) is a creative and innovative activity [9]. It is the newest term that denotes "the creative capacities of an individual who can generate fundamentally original ideas that are a part of creative talent as an independent factor" [43]. In the past, the term "creative capacities" was used in the literature but later English borrowings like *creativity, creative* took its place. Professor I. Miloslavskyi thinks the term "creativity" defines creative work that "generates not only ideas but brings them to a concrete practical result. And the word "creative" keeps its basic meaning that doesn't distinguish whether the activity is effective, or on the contrary unsuccessful" [38].

The concept of "creativity" was used for the first time by D. Simpson (1922) to identify a human's ability to reject stereotyped types of thinking. Although this term began to use after Joy Paul Guilford's 1950 address to the position of the American Psychological Association president. He developed a "three-dimensional model of Intellect" (Structure of Intellect (SI) theory) that comprises content, operations, and products. Guilford distinguished two types of thinking: convergent (the ability to give a single, correct solution based on analysis of multiple preliminary conditions) and divergent (a creative generation of multiple ideas by exploring many possible solutions, characterized by flexibility, originality, and precision). He interprets creativity as divergent thinking.

But intelligence researcher, Professor Louis Leon Thurstone found a weak relationship between creative potential, capacities to study and the intelligence, as creative thinking also includes sensibility to the problem, the ability to defining and so on. An American researcher, Professor Nancy Adler sums up that parameters of creative thinking are possible to assess due to tests and observations [2].

At present the term "creativity" has more than one hundred definitions: intellectual activity (D.B. Bohoiavlenska); ability (general – O.V. Morozov, creative and intellectual – M.O. Holodna, spiritual – V.D. Shchadrykov, integrative – A.V. Hutorskoi, S.V. Trishyna); process (E. Paul Torrance, G. Wallas); characteristics of an integral personality (O.M. Matiushkin, O.L. Yakovleva, G. Butterworth, M. Harris, G. Schottenloer); personal attributes (V.G. Kamenska, I.Ye. Melnykova, J. Catena, D. MacKinnon); representing a level or characteristics of thinking (D.B. Bohoiavlenska, E.D. Telegina, O.O. Tunik); lifestyle or personal development (A. Maslow, K. Rogers); independent factor of talent (V.M. Druzhynin); cognitive process (J. Guilford, E. Paul Torrance, Donald J. Treffinger); product (H. Gardner, J. Catena, D. Perkins); need in a research activity (V.M. Kozlenko).

A creative person is able to imagine and devise innovative new ways of addressing problems, answering questions or expressing meaning through application, synthesis or repurposing of knowledge. They assess a situation from different sides and don't follow stereotypes. A set of "creative competencies" ensures the ability to stop at nothing, to be determined when the environment is rapidly changing. When patterns, usual schemes don't work, creative people don't get into a panic, but they create confidently their own world.

Dr. E. Paul Torrance described creativity as a "process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements, disharmonies, and so on; identifying the difficulty; searching for solutions, making guesses, or formulating hypotheses about deficiencies: testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results" [68]. To assess creativity, diverse tests on divergent thinking, personal questionnaires, effective activity analysis are used [43; 47, p. 6].

There are cognitive and interactive exercises, such as ***brainstorming*** (a quick generating of ideas on a topic and getting to the essence of the problem); ***case-study method***; ***modelling***, ***observational learning***; ***game-based*** (Guess the word, Grabaminute, Lucky bingo) and ***metacognitive learning*** (students manage their learning instead of passively absorbing material; they perceive their process of thinking; there can be some restrictions in their perception); ***collage creating***, ***improvisation***, ***role-play*** and ***drama education***; ***destruction of stereotypes*** (the ability to logically dissipate them, formulate explanations, assumptions concerning some data, or

to apply a well-known theory to a new field of knowledge where it is not applicable at first sight).

Teachers should create a friendly and relaxed teaching-learning atmosphere in which students will not be embarrassed and creatively express their opinions. "Think different" is not only a slogan of a well-known company Apple, but it can be a universal formula for developing creativity.

Creativity development (exercises):

1. ***Storytelling*** can be in a written form or orally, in pairs or groups. Students are given cards with words or grammar structures they are learning. They have to make a little story including all words. The teacher starts a story, making up a sentence with a word on a card. Students continue doing the same. In the end, they repeat the complete story. Writing prompts can be used for a written variant too.

2. ***Eavesdroppers*** (pair work): students are given cards with different relations (teacher-student, software developer-customer, etc.); each pair prepares a conversation over the telephone, and other students have to guess a relationship between speakers.

3. ***People-watching:*** students are offered to look at the window and make some assumptions about passers-by; such questions as "Where is this person going?", "What mood are they in", "What are they thinking about right now?", "Where have they been?", "What are they going to do?" can help practice not only vocabulary but different tense forms. Pictures or videos can be used as an alternative.

4. ***Songs:*** games with songs are a very interesting and productive method of learning. For instance, exercises "Make up the title", "What is a given song about?", "Continue the song", "Make a story", "Illustrate the song", "Act it out".

5. **Charades/ Pictionary** (in pairs or teams): a student explains, shows, or draws a word without saying it.

As was mentioned earlier, it is very hard to evaluate soft skills, non-standard thinking and a result of the creative work. Creative products are essays, scientific researches, presentations, projects. They can be assessed by their originality, imagination, the difference from traditional solutions, novelty, relevance, and usefulness as for solving a certain task.

To assess or measure creativity, tests were made. They all have some pros and cons. Results and key processing schemes were created for them. For instance:

– The Torrance Tests of Creative Thinking (TTCT) was first offered by Ellis Paul Torrance, an American psychologist, professor at the University of Georgia (USA), known as the "Father of Modern Creativity". Torrance has used many of Guilford's concepts in the test construction, but in contrast to Guilford, he sought both verbal and figural activities and grouped the different subtests into three categories. He developed a benchmark method for quantifying creativity. The newest version of TTCT measured 4 norm-referenced abilities: fluency, originality, elaboration, flexibility [69].

– Creativity Assessment Packet (CAP) by Frank E. Williams;

– The Creativity checklist (Cch) by D.L. Johnson (an express-method of creativity psychodiagnostics);

– Methodology "Verbal imagination" of Hermann Ebbinghaus;

– Stroop test;

– Rating scale by J.S. Renzulli, R.K. Hartman [48, p. 38].

Collaboration is the ability to work effectively with others as a team player to reach a common general result, taking actions that respect the needs and contributions of others, facilitating and accepting the consensus, negotiating to achieve the objectives of the team that leads to the success. The majority of interesting and hard problems is practically impossible to solve for one person because there is too much information and it's necessary to find a quick solution. Collaboration allows for a more productive way of getting tasks and goals completed, as team players can utilize the strengths and skills of everyone involved. As a result, it can also increase your motivation and level of engagement at work. You can learn things from other team members every time you come together to collaborate. Therefore, cooperation fosters healthy relationships in a team. At the same time, successful collaboration requires a cooperative spirit and mutual respect. It's essential to listen closely to each team member's ideas, feedback and advice in order to reach a compromise.

To develop and improve collaborative skills, ***team learning*** (to achieve a common goal within the group) should be implemented more frequently in class. In today's conditions of information-based education, a communicative ***Web-quest*** is an appropriate and effective form of organizing the educational process, as it helps to use student time efficiently and to focus on working with information. Based on the method of projects, it has some stages of the preparation: introduction, planning, provision of Bank information resource, the process of implementation, conducting oral presenta-

tions and the presentation itself, reflection. Students are creatively involved in the process (creation, design, compilation, reproduction) of preparing an interesting presentation using the online resources. They usually work in groups. Due to the use of this methodology, students demonstrate skills that will be profitable for future specialists to accept, process, interpret, transmit, evaluate and express personal ideas and emotions in professional communicative situations [31].

As a result, students can collaborate in real time on assignments using digital tools such as Google Apps for Education to collectively develop ***documents***, ***spreadsheets***, some ***projects***, prepare ***multimedia presentations*** (for example, Particularities of 3D printer or Smart devices). To improve collaboration skills, they can play some ***didactic games***, ***discuss*** some scientific issues in teams, and perform some ***drama***.

5. Conclusions

Due to the rapid addition of new information and the advancement of science and technology that occur almost daily, the information-based role of education in developing 21st-century skills has become indisputable. The nation's challenge is to prepare students for the high-skilled jobs that demand higher-order competencies, some character features. It's of paramount importance to invest in skills development and respond in real-time to the changing skills landscape. Governments, educators, business leaders all need to be proactive in up-skilling and retraining people so everyone can benefit from the Fourth Industrial Revolution.

Educational organisations should develop, implement, and disseminate innovative approaches to the teaching-learning environment that efficiently and comprehensively deploy technology throughout the stages of instruction and learning. For example, the key feature of flipped learning is the opportunity to increase active learning possibilities in the classroom by shifting direct instruction outside of the larger group learning space. It enables more differentiated and democratic learning for all students. The flipped learning combines different effective teaching methods (reading, explanation, demonstration, etc.) that can be employed in different ways to carry out interactive and interesting learning activities which students will enjoy and benefit from. When students are more satisfied, they achieve better learning results.

In order to meet the demands of changing jobs, techniques, and tools for work and lifestyles, the labour market increasingly requires significant interpersonal interaction. Consequently, soft skills are becoming more important than hard skills as they are critical for being industrious and successful in today's workplace. As for IT specialists, their technical skills need to be supplemented with strong social and collaboration skills. Language proficiency, communication and listening skills, teamwork, agility, patience, persuasion, time and task management enable them to work more effectively, productively and harmoniously with other people.

Teachers have to educate students to succeed in our modern society using the most essential competencies such as critical thinking, communication, creativity, collaboration because they would enable students to demonstrate new ways of thinking, working, and living in the world that emerged as a result of technology. Students can integrate all these skills in such activities: reading or listening to a situation, a problem, or a question and then responding or commenting either through speaking or writing. The research shows some methods are effective to develop two or more skills at once (problem-solving activities, discussions, brainstorming, and many others).

Critical thinking can help you in any profession where you must analyse information, systematically solve problems, generate innovative solutions, plan strategically, or present your work or ideas to others in a way that can be readily understood. To form these skills, didactic and business games, brainstorming, mind maps, discussion clubs, scientific and practical conferences, scientific research work, problem-solving activities, methods of using texts (INSERT, mixed parts of the text, Cluster, RAFT strategy, etc) are applied.

In today's competitive jobs market, communication skills are highly sought after, with employers looking for candidates who can communicate information, negotiate and confidently deal with customers. It involves the distribution of messages clearly and concisely, in a way that connects with the audience. Good communication is about understanding instructions, acquiring new skills, making requests, asking questions, and relaying information with ease. To develop communication skills such as methods as discussion, problem-solving activities (categorizing, circles on the water, keywords), blogging, interactive games, video filming can be practiced at the lessons.

To educate a creative personality capable to cope with challenges of our modern world and meet our millenary's demands, cognitive and interactive exercises such as brainstorming, team learning, case-study method, modelling, observational learning, game-based, and metacognitive learning improvisation, role play and drama can be employed. Storytelling, eavesdroppers, people-watching, songs, charades can be done at the lessons.

Collaboration means working together with one or more people to complete a task or develop ideas and function well in the process. It can lead to greater efficiency and success as you have the support of your team. Positive results create a more inspiring work environment. The study indicates that team-based, project-based approaches should be a point of emphasis, as they help students boost their collaborative skills and improve their effectiveness. They can create interesting projects, presentations in the form of Web-Quests, accomplish such activities as brainstorming as a group, collaborative communication, and open discussion, play some didactic games or participate in drama performances. Using these methods, teachers train their students for the future job market.

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