

QUO VADIS, EDUCATION 4.0?

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Abstract

The text critically represents the concept of education 4.0, when the reform of the education system should be the education of graduates directly for the needs of industry 4.0 and labour markets. However, the goal should be personality development, not employee readiness for exploitation and full subordination to market needs, including technology dictates and the requirement for flexibility under conditions of permanent uncertainty. The main pillars of the Education 4.0 concept are considered in the context of 1) the broader framework of the so-called Fourth Industrial Revolution and Related Platforms (Industry 4.0 in our terms), including the vision of the Digital Society 4.0 or 5.0. Authors also mention the fundamental nature of the processes whether "new paradigms" determine their core. 2) In the context of progressive efforts to improve education and education system, including disproportionate liberalization, with an emphasis on domestic problems and realities. At the same time, the text warns against exaggerated optimism and unilateral reliance on new digital technologies in education and education. It also recalls the adverse effects of overuse of digital technologies on human thinking and brain, including the dangers of digital dementia, cyber disease.

Key words: Education 4.0, Fourth Industrial Revolution, Industry 4.0

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Introduction

In 2013, the German Industrie 4.0 platform (i4.0) was officially launched into the world, and the hype of "4th Industrial Revolution" (4IR) kicks off. The 4IR concept is propagandistically aimed primarily at the lay public, media and politicians. It will help to revive shaky confidence in the West and Europe. Social media as a substitute for real human interaction and computers as a substitute for human thinking should bring us into the fantastic future - in fairy tales 4.0. The automation should replace the human workforce with robots. We'll all be happy to share everything in our Internet communities, under the supervision of Artificial Intelligence (AI). The icing on the cake is to be robotic self-tuning cars (Mařík et al., 2016), (Sirůček 2017). We still hear slogans about extraordinary time, fatal existential challenge,

unique opportunities, fantastic possibilities, civilization transformation, qualitative break, discontinuity of development, etc. The unparalleled changes will come earlier than we can expect, because the 4.0 technologies are exponential, digital and combinatorial, and have a highly disruptive character. In core, there are the changes in industrial production. However, the whole economy and society also should profoundly change. Digitization, robotization, AI, CPS¹ should fundamentally transform capitalism into digital society 4.0². The official sources spoke about the 4IR launch. They prove nonstop that it is not just another phase of mass digitization and robotization (Mařík et al., 2016), (Kube & Rinn, 2014). The main focus is on the technological page. However, other pillars needed to implement i4.0 initiatives and platforms (e.g. management and social aspects) remain largely neglected.

The succession of technological, industrial and other revolutions, including criteria (e.g. epochal innovations) is for debate. Are today's changes really understood as an industrial revolution and a discontinuity of development? Is not the i4.0 rather the next stage of the industrial revolution the third or the information revolution? Could also be the third stage of the Second Industrial Revolution or the sixth technological age? Proponents 4.0 state that the essence of 4IR is primarily a "change of mindset" ... Although we do not believe in the bombastic slogans of fundamental civilization transformation, the end of capitalism or economic theory, the technological and related changes cannot be ignored. This is enhanced by the specific nature of the Czech economy (it extends second German production line; it is the inexpensive country for the production of low-cost components with a high share of manufacturing industry and automotive product). The mentioned leads to that the Czech Republic is the most vulnerable country in the EU. Deal with responses and preparedness of the Czech Republic at I4.0 is therefore entirely appropriate. In this context, all changes and reforms of the education system need to be seen in line with the needs of changing industries and labour markets. The paper critically discusses some aspects of Industry 4.0 with regard to the reform of the educational system. Authors also warn against the dangerous techno-optimism and potential negative impacts of the Revolution 4.0. The methods of description, comparison and qualitative analysis have been employed, making use of secondary data from specialist literature sources and the results of available research on the topic.

¹ Cyber Physical Systems is a mechanism that is controlled or monitored by computer-based algorithms, tightly integrated with the Internet and its users.

² Other variations on dozens of theories of the transformation of capitalism, using the phrases of the concepts of economy and society postindustrial, super-industrial, information, knowledge, digital or network, but also post-capitalist.

1 Education 4.0 - New Way of Thinking

Education 4.0 is another of the "cool" concepts which do not have a more precise and generally accepted definition. Many people often talk about it, but they do not know what that is all about. It is about the concept of education, respectively education in the digital era, responding to platforms i4.0 and broader 4IR (Abdelrazeq, Janssen, Tummel et al., 2016). It is sometimes perceived as education right for the needs of i4.0 and the labour markets in general. The purpose of the reform of the education system should be to educate graduates who can easily orientate yourself in constantly changing conditions and job opportunities, or even have the ability to create these actively. Critical voices, however, point out that the school is here for children and young people, not for the needs of industry 4.0 or else, or for the needs of automated job markets. The goal should be personality development, not employees' preparedness to maximize their exploitation. Not to live under the whip of requirement unprecedented flexibility, the fundamental uncertainties and the current needs of the markets. Education should always be a public good and not a commodity, as is often the case (Liessman, 2009)³

In connection with education 4.0, there is the talk of a "change of paradigm" or "sustainability" of the education model. There are not very clear differences in education 4.0 versus education 3.0. It is like in the case of the whole 4IR. The concept of education 3.0 has already included - in its media-intensive form - the integration of new technologies (especially ICT) into all levels of education in response to digital technologies and web interfaces (Demartini & Benussi, 2017)⁴. There is a ubiquitous word of application.... Sometimes, however, some specifics of education are also mentioned. The teacher no longer only needs to be a person, but also intuitive software. The role of the teacher and the pupil is wiped off (when they teach each other, for example, by improving Wikipedia or translations) and the school becomes only one of the possibilities for education. The emphasis is placed on to link schools and businesses. School hardware and software is (as in education 3.0) available to

³ Neoliberal education contributes to the decomposition of society. The market principles - the "capitalization of the spirit" lead to ignorance. The principle of double-entry bookkeeping jeopardizes the cognition as a free battle with knowledge and the education as a way to get it. Beneath the political label of the knowledge society conceals a society of ignorance.

⁴ Even here is not very clear what should be different from education 2.0. Standard differences are also related to the role of the teacher. The teacher should no longer be a guide to the world of education and a source of knowledge but is part of the process of collaborative knowledge creation. Also, educational resources should be more open, leaving the physical space of institutions, deepening the interdisciplinary approach and cooperation across institutions, regions, and nations. Students are emancipating and shifting from passive acceptance of knowledge to an active approach. Affordable Internet access facilitates access to knowledge, and the education system is democratized. A key factor is the motivation of the student to learn, and the environmental impact (e.g. real situation) should decrease.

everyone, but it is updated continuously, just like knowledge in networks. Personalization of the software and its adaptation to the individual needs of the student occurs. Virtual reality and digitization penetrate into education. Let us add that the robot can teach but cannot replace the cantor. While it's key role may be transformed from the information announcer into their tester and interpreter (Wahlmüller-Schiller, 2017), (Ciolacu, Svasta, Berg et al., 2017).

How does the domestic platform Industry 4.0 see these processes? A critical factor in coping with the impact of changes of 4.0 on employment is *"the quality and functioning of the education system, including the retraining process and lifelong learning"* (Mařík et al., 2016, p. 18)⁵. Traditional calls for high-quality teaching in ICT skills, general knowledge needed to understand the nature of 4IR processes and expertise and skills are already familiar. Again, including an emphasis on interdisciplinarity, and reminding that students of humanities - *"to the extent necessary for their work in the development of society"* - should be introduced to the ideas and trends of the 4IR (Mařík et al., 2016, p. 18).

2. Education 4.0 vs the Czech Republic

The advent of new technology will result during the 20 years up to 50% of the production, management and manufacturing processes under the leadership of people probably cease to exist, or take over the machine. It is evident that the key to mastering all aspects of the Industry 4.0 era is education. In the Czech Republic, education is a public service, and the state should take care of its quality. Now with an emphasis on the technical and natural science base of education enriched with critical thinking, information technology education related to mathematics, physics and creativity. The importance of humanities will also be of significance, which will complement and develop the technical and scientific basis of education. So-called transversal skills will be essential⁶. The primary ambition of the education system must not only be to educate competent "human resources" for companies, but it is evident that we will also increasingly need responsible citizens. They also will be able to work with information, analyze them and make autonomous decision-making. In short, we

⁵ The need for changes in the educational process, respective the improvement of the educational system is to be realized by the development of Industry 4.0 research, which will provide knowledge for the teaching. In other words, "knowledge of Industry 4.0 must penetrate the entire population" (Mařík et al., 2016, p. 184) which requires the introduction of new subjects and fields of study.

⁶ Transversal skills are for example the ability to learn, knowledge of information and communication technologies (ICT) or foreign languages etc.

need the education system that best prepares our society also for the challenges that await it in the future, but which we do not know yet.

What is the current state of Czech education? Czech education system addresses some difficulties and challenges simultaneously: the ever-increasing demands on the teacher's job; poor financial evaluation; the lack of interest in the profession among young people; the need to continually learn and develop; the increasing pressure of parents etc. It is no secret that Czech schools are underfunded. For example, in 2016 the CR spent on education, 3.7% of GDP in 2016, but the OECD average of the developed countries was 5.2%. The low attractiveness of the teaching profession, especially in regional education, is caused by relatively low average wages⁷, the low social prestige of this profession and the small career opportunities. The professional group of teachers in the Czech Republic is gender-unbalanced and ageing⁸. Although teachers' salaries have risen by 15% last year and are expected to grow further (15% since January 2019)⁹, teachers' real incomes remain still too low. As a result, about 60% of graduates in this field of study are looking for work outside the education area, after graduation. Among the major positives of the CR education system, we can mention: a good, broad general basis; the education is a value for Czech citizens; there is a wide range of interest-based education; Czech managers, technicians and other professionals are among the most wanted in the world. From the point of a view of the price/performance ratio, we operate an efficient school system (Fidrmuc, 2017).

Let us introduce some selected comparative indicators of the Czech education system in the context of the OECD countries. On average, every sixth (17%) younger adult (25-34 years) does not finish a higher secondary education in the OECD. The Czech Republic is among the best in the OECD countries, as 95% of the 25-34 year-olds complete upper secondary education. Based on current trends, it is to be expected that 85% of today's young people will receive higher secondary education during their lifetime. OECD results indicate 78% for the Czech Republic. On average, 35% of today's young people gain a tertiary education in the OECD countries before the age of 30. In the Czech Republic, this share reaches 34%. In 2013 in the Czech Republic 63% of graduates of tertiary education were women¹⁰. It would be

⁷ The average salary of teachers in the OECD countries in 2014 was 85% of the pay compared to other university graduates. In the Czech Republic, it was 56%.

⁸ There were 92.8% of women, 7.2% of men in basics schools in the CR according to Eurostat (2015). At the same time 33.6% of teachers, in general, were at the age of 50 and more in the CR in 2014. In secondary schools, there were 67.5% of women and 32.5% of men; 40.9% of teachers were older than 50 years of age.

⁹ In its program, the government is committed to raising the average cantor salary to 46,000 crowns by 2021.

¹⁰ The share of women graduates in science and technology is small. Each third graduate of tertiary education received a degree in social sciences, business or law in 2013.

possible to compare further indicators to analyze the Czech Republic education system (as pupil literacy in reading, mathematics, science) in the OECD context. But there is not enough space in this text for a more in-depth analysis. However, a significant problem which needs to be addressed is the insufficient motivation¹¹ of Czech students to study (MŠMT, 2014), (MŠMT, 2015), (CZSO, 2017) (Eurostat, 2015).

2.1. The Digital Education

What is the digital preparedness of our schools in the conception of the Education 4.0 was evaluated by the Czech School Inspectorate during the school year 2016/17? It compared a set of indicators that are crucial to the use of digital technologies in schools¹². The results are not flattering. Funding concepts are inefficient. Nearly all primary elementary schools, secondary schools and universities use specific information systems that spend at least 80 million a year. If the centralized system administered by the state were created and would be provided free of charge to schools, annual traffic would amount to about 10 million. It would also reduce the administrative burden on schools. It is necessary to take into account the high use of school information systems to create the open integration interfaces of the newly developed Information System (for automated data exchange). Also, staffing is not enough. Schools often deal with routine digital governance by self-help. Administrator's absence reduces the quality of the school's ICT environment. The ICT Coordinator, however, is crucial for the formulation of the ICT strategy of the school and to the implementation of technologies in education. There is also the insufficient qualification of teaching staff teaching ICT. Computers are obsolete and becoming obsolete, and interconnection is limited. Optimal is the state where each teacher has a computer, notebook, or tablet for his work¹³. The absolute speed of connecting schools to the Internet has increased significantly. Approximately 2/5 elementary and 3/4 secondary schools and post-graduate schools provide the opportunity for students to connect their facilities at the school. Using our technology could mitigate the impact of the inadequate equipment of schools. About 1/5 small elementary schools use tutoring and cloud services (online sharing systems), more than 1/3 of large elementary schools and more than 3/5 secondary schools and universities.

¹¹ According to (OECD - PISA 2015): The value of the PISA index, indicating whether the pupil considers school to be a friendly environment, was the lowest concerning all the OECD countries in the Czech Republic in 2012.

¹² The school has an ICT strategy, it has updated over the last year, it has its ICT administrator, more than 50% of teachers have their computers or other devices, computers for pupils are renewed at least every 7 years, at least 6% of classrooms are covered by the internal network while using the user's own devices).

¹³ 85% of nursery schools, 41% of elementary schools, 26% of primary schools and 28% of secondary schools and vocational schools have not a computer either a second teacher.

Overall, the proportion of schools meeting the so minimum standards of quality of the conditions for using digital technologies is critically low, only 5% of schools meet these conditions in the segment of small elementary schools. In the part of large elementary schools, it is not even 10%. In secondary and tertiary vocational schools this number exceeds slightly 20%. Why, however, does education lag behind technology development? The study of national digital strategies and their comparisons show that it is essential to ensure, in parallel, the digital infrastructure, which is computers and the Internet in schools; support for educational resources (formerly educational programs, and today there are more open educational resources and web portals); teacher training¹⁴ and pedagogical leadership and management of the whole research-based system. Probably the most common obstacle, however, are outdated imagines of people specifically on digital learning and education in general.

3. Challenges beyond the horizon

But what are the right ideas about education? These include extreme individualization and liberalization of education? The so-called "Free" education does not recognize curriculums, schedules or lessons, children discuss everything about everything and learn only what they want and accept as appropriate. As a result, pupils and students are often unprepared for reality. They lack the order, which is often lacking in families as well. It is the fixed order and clear rules that children and young people need. Among other things, because they bring a sense of security, support and peace into theirs live. If an adequate order is absent, the school changes into a mere "fun institution". And it no longer guarantees not only the necessary knowledge and experience but in many cases also the working habits essential for life, respectively learning habits necessary for further study. Is not, therefore, the campaign against so-called "rote learning" a fight against learning at all, often under the heading of alternative teaching methods and its so-called modernization? We do not have to learn hardly; we can quickly find everything? However, we can discuss and critically work just with information stored in memory that we have appropriately acquired, including contexts. Can the real education (i.e. critical and non-traditional thinking, own usual health judgment, general overview, knowledge of wealth, the ability to work with information, understanding the

¹⁴ From pedagogical researches, we know that the most significant impact on pupils' results has teacher education that takes place directly in the classroom. So modern teacher education focuses on forms such as the carefully planned teaching of two teachers, regular meetings with a mentor, teaching with a colleague's follow-up analysis or support for pedagogical leadership.

context of architecture) to be gained through simple search from open sources? Does not also important the quality of these resources, memorizing and memory exercise here? Finding answers not only to these questions is a challenge for professionals, educators, policy makers, and for society as a whole. At the same time, there is the question: "What impact do computers and digital technologies have on our brain?"¹⁵ Excessive use of the Internet and digital media, computers, smartphones, gaming consoles and television in the long run damages the body and, above all, the mind when brain function is lagging behind. Digital media deprives us of the need to perform mental work and creates dependence on them; there is a danger of so-called digital dementia. Digital technology, automation, robotization, AI delivers a wide range of other risks and threats. Technologies are a generator of inequality, a source of rising unemployment, and there are the risks of technological disasters and defects, the risks of communications collapse and production management, the financial sphere, infrastructure, the risk of cyber-attacks, etc.

Despite the above, it is clear that vision 4.0 may mean a chance for an overall improvement in education. They can identify with them and try to reflect their ideas to innovate Czech schools. Whoever should have a vision is the state and us too. So we ask what values are important to us, what world we want, education and work, and how the Industrial Revolution 4.0 can help us. It is increasingly difficult to estimate the labour market needs for the decade ahead, let alone the entire active life of the individual. How can we reach school 4.0? Technicians and computer scientists need to get a socio-scientific basis, including social skills. And it is necessary the students of the art and science disciplines will be equipped with the information and digital base. All of them will learn languages. The entire system will support thorough lifelong learning that will enable employees to keep up with age even in advanced age. We do not want to degrade the need for specialization, which is of course very important. Even the specialists must be prepared for the possibility that they will have to change their field of study during their career completely and they should be able to follow and understand their surroundings even beyond the borders of the Czech Republic.

Conclusion

¹⁵ Carr (2017) shows how new technologies change the way of thinking, decision-making priorities and the structure of human brains. The interactive internet has some benefits, but it also leads to the fragmentation of information, the inability to process it more in-depth, the failure to perceive the context, understand the content, or concentrate. And it causes addiction.

Due to the dynamic development of digital technology, there is a significant transformation of the world and the requirements for humans. Changes bring a number of opportunities for society as a whole, but they also carry the risks of incompatibility of the current form of the education system with emerging expected trends in everyday life, work and human learning. Emphasis is placed not only on the ability to work with digital technologies, but also on skills such as flexibility, adaptability, engagement, self-discipline, entrepreneurship, and, of course, the ability to learn all the time. The quality and effective functioning of the education system at all levels are becoming a critical factor for the successful implementation of the human society and the competitiveness of the Czech economy in a globalized world.

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