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LONG RANGE PROSPECTS OF EDUCATION – FROM NOW UNTIL SINGULARITY

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ABSTRACT

This work describes key characteristics and genesis of educational system today. As it is considered that we live in information society, presented are major goals of information society education and the school system in general in relation to the labour market. Briefly is described the concept of singularity and how it will make a quantum leap in the history of human development.

Education is briefly put in the singularity framework and the concept of future society that is more technologically advanced. This paper also discusses the chronology of future technological development until the singularity age. It is argued that once we reach the singularity age the consequence will be the shift away from economic centered education and employment and toward humanities research.

Ultimately, the goal of this paper is to open up a discussion about the different possible future scenarios of education, its long term perspective and the role in society rather than making a precise forecast about the education in mid-21st century.

KEY WORDS

education, future, singularity, labour market, STEM

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INTRODUCTION

The issue of education is related to three key terms: education, learning and school. Traditionally education was a synonym for the school building and perception was that non formal education was not adequate for the job market and the needs of society. Historically, education shifted from individualised, play like learning to the industrial concept of mass education. Because of technological advancements and the accelerating generation of new information mass education concept is slowly falling apart and moving again toward individualised, more non-formal like learning.

Revolutionary advancements in STEM (science, technology, engineering, mathematics) fields will ultimately lead to the development of sophisticated artificial, superintelligent non-biological "life" forms that will take over many activities previously exclusively reserved for humans. This trend will lead to merger of humans with non-biological intelligence, enabling humans to actively participate in the technologically based society and expand both the learning and communication capacities.

EDUCATION – PAST AND PRESENT

To clearly understand historical development of education, it is necessary to view knowledge as a major contributor to economic development. As such, early humans in hunter-gathered cultures allowed children to learn and develop spontaneously – through play as a natural way of learning. There was no need for systematic education as the communities were structured on day to day basis without the long range vision that would lead to development of their goals. In other words, learning process was based on individual creativity. With the development of agricultural and later, industrial society, children were viewed as a working force obligated to contribute to their family, master or land lord. As a consequence, in the middle ages, church in Europe introduced first mandatory schools that taught and promoted obedience as a prerequisite for development of good labourers. The third historical phase that started in 19th century was marked with the development of schools that promote inculcation as a primary goal of educational system. In that manner, school was viewed as a children's "work" [1]. 19th century was also marked by development of contemporary (for that time) pedagogical approaches that was initiated by Johann Heinrich Pestalozzi who "advocated education of the poor and emphasized teaching methods designed to strengthen the student's own abilities" [2]. Although the society and technology have changed, Guthrie et al. [3; p.26] argue that public school pedagogy did not substantially change in last 200 years. Therefore, it can be concluded, that schools and educational systems today do not match the needs of the modern society.

What is common for all phases of historical development of education is that education is viewed as an investment for the national economy. And the main result of that investment is the development of educated workforce that was an important resource for production of goods and services. In that manner, education expenditure is fully consistent with capital concept of investments. Nobel laureate G.S. Becker stresses that education is an integral part of human capital concept, because "you cannot separate a person from his or her knowledge, skills, health, or values the way it is possible to move financial physical assets while owner stays put" [4; p.16]. Therefore, traditional pedagogy is consistent with human capital approach to population as a (nothing more than) potential working force. This is evident in everyday teaching practice, that Freire describes as a "banking concept of education, where knowledge is a gift bestowed by those who consider themselves knowledgeable (*teachers*) upon those whom they consider to know nothing (*students and pupils*)" [5; p.72]. The main

role of education is to modify behaviour of groups and individuals and to direct them to contribute to nationbuilding, interpersonal tolerance, and to maximally develop and utilize the skills and knowledge to support economic growth and economy in general [6]. All abovementioned characteristics are still evident in formal education system that is constituted by number of agencies (all participants in educational process, from ministries of education to various types of schools) that are under strict control of governments because they are "consciously and deliberately planned to bring about specific and special influence in educand" [7; p.12]. This notion of education, as one of the key economic factors of the society, or to name it, economic centred education (where interests of market based economics have priority in relation to general issues of the society), is common to most educational systems. Economic centred education is also criticised; i.e. Noddings considers that education system should be an enterprise with multiple goals where in today's world "it is important to consider not only how to pursue" moral, aesthetic, civic, and spiritual growth of the students but "how to prepare students in all three domains: personal/family, occupational, and civic" [8]. The rigidity of economic centred education is reflected in formal educational agencies, such as schools, where school system is clearly characterized by stability not adaptability. The issue that raises here is not the issue of rigidity of the school system itself, but the rigidity of their "final product"; pupils and students that represent future citizens that will participate in social, political and economic life of particular country, and world in general. As the world is rapidly changing, rigidly educated population is unprepared for active participation it.

EDUCATION AND THE LABOUR MARKET

As Toffler states, we are now surfing an information wave [9]. Information wave is supported by accelerating, exponential development of information and communication technologies that Kurzweil refers to as the law of accelerating returns [10]. Information wave supports many societal changes that are demonstrated through the rise of team work, networking, integration of jobs, and individualised, custom production of goods and services, among other things. The consequence for education is evident; current early signs show us that educational experts try to transform mass education concept (standard schooling) into custom made education that is oriented more toward individual than societal norms (new contemporary trend is promotion of learning through play – good example is newly opened public elementary school in New York, Quest to Learn [11]). Custom made education is oriented more toward creation of life-long learner, rather than creation of formed working force. It should foster social change [12] so that humanity can adapt to changing environment and make society sustainable. As Dewey emphasizes, education, "in its broadest sense, is the mean of this social continuity of life…" [13; p.8], where "… the very process of living together educates" [13; p.11]. The traditional concept of education, or as stressed before, economic centred education, is driven by the needs of labour market where the society tries to provide scarce workers through formal education agencies. Formal education agencies must actually conduct national policies specific to each society. Conducting policy changes is usually slow in relation to technology changes, making formal educational systems sluggish in their response to labour market needs. Lack of flexibility of formal educational system makes non-formal education more attractive, cheaper and viable option for many individuals on the labour market. Such large penetration of non-formal education options is largely due to the advances of information and communication technologies that make e-learning, open courses and other technologically intensive options of education possible. In that manner, non-formal education is more flexible and adaptable to the needs of individuals and the society (Table 1).

Table 1. Differences between formal and non-formal education [7; p.13].

Formal Education	**Non-Formal Education**
Finite and limited by the formal educational cycle	Lifelong learning aimed toward specific individual needs
Fixed beginning and end	Flexible beginning and end adapted to the interests and life span of an individual
Focused onto impersonal knowledge acquisition	The goal is making understanding of environment and specific needs of each individual
Directly related to specific work	Related do the development of unique individual and maximizing his potential
Concepts and curriculum are fixed	Fixed curriculum is diversified and adapted to the needs of individual
It is based on clear relation between teacher as a giver and student as a receiver	Learning is based on interactive participation of learner
It fosters uncritical obedience	It fosters critical thinking and self-awareness
It is defined within fixed social framework and slowly adapts to social and environmental changes	It is future oriented anticipating change

The problem occurs because "technology destroys jobs" [14]. The fear of job destruction is the consequence of the concept of lump of labour fallacy, historically disputed by economists, where the labour input is "seen as fixed, and it is believed that if each worker works fewer hours, this work can be spread over more workers, and employment will rise" [15]. In the past, the lump of labour fallacy was seen as the solution to unemployment problem because new technologies create new jobs. Good example is information and communications sector that introduced many new jobs, previously non-existent [16; p.26].

But, it appears that things are about to change radically. Technological advancements, mainly due to the effect of law of accelerating returns, will take over many jobs previously taken for granted that they are exclusive for humans. In their recent study, Frey and Osborne analysed the influence of computers to 702 jobs over the next 20 years in US labour market [17]. The result of their research is that about 47 % of total US employment is threatened by new technologies. Some of the jobs were thought of being unreplaceable by computers (or robots) but the results of their study are surprising (Table 2.). It is evident, that according to that study, in the next 20 years we will witness disappearance of certain jobs that require semiskilled workers. The biggest demand will be for both the lowest paid jobs that require only some basic education, and the highest paid jobs (from today's perspective) that require intensive and demanding formal and non-formal education. The medium term consequence of computerization is that it fosters "a polarization of employment, with job growth concentrated in both the highest and lowest paid occupations, while jobs in the middle will decline" [18]. It is because machines will become cleverer and they already have access to large amount of data. And this "combination of big data and smart machines will take over some occupations wholesale; in others it will allow firms to do more with fewer workers" [19]. In other words, labour polarization is widening the gap between lowest and highest paid occupations, where post-baccalaureate degree is becoming a necessity to have a high earning job [20]. The immediate effect, that Robinson nicely named "academic inflation" [21], is that, i.e. for jobs that you were required to have a Bachelor of Science degree now you need to have Master of Science degree, and for the jobs that you were required to have Masters of Science degree now you need PhD degree.

Table 2. Selected occupations from Frey and Osborne study whose computerization will lead to job loses [17].

Probability of computerization	**Occupation**
0,0035	Occupational Therapist
0,0039	Dieticians and Nutritionists
0,0042	Physicians and Surgeons
0,0044	Elementary School Teachers, Except Special Education
0,0055	Human Resources Managers
0,0071	Athletic Trainers
0,0074	Preschool Teachers, Except Special Education
0,0078	Secondary Teachers, Except Special and Career/Technical Education
0,009	Registered Nurses
0,011	Mechanical Engineers
0,014	Engineers, All Other
0,016	Special Education Teachers, Middle School
0,03	Database Administrators
0,032	Postsecondary Teachers
0,037	Biomedical Engineers
0,047	Mathematicians
0,084	Childcare Workers
0,1	Physicists
0,15	Electricians
0,23	Financial Analysts
0,37	Actors
0,4	Judges, Magistrate Judges and Magistrates
0,44	Historians
0,51	Dental Assistants
0,63	Geoscientists, Except Hydrologists and Geographers
0,65	Librarians
0,7	Tire repairers and Changers
0,72	Carpenters
0,77	Bartenders
0,8	Barbers
0,83	Cooks, Institution and Cafeteria
0,84	Security Guards
0,89	Taxi Drivers and Chauffeurs
0,91	Tour Guides and Escorts
0,91	Automotive Body and Related Repairers
0,93	Butchers and Meat Cutters
0,96	Secretaries and Administrative Assistants, except Legal, Medical and Executive
0,96	Locomotive Engineers
0,97	Dental Laboratory Technicians
0,98	Insurance Appraisers, Auto Damage
0,99	Watch Repairers

This medium term period we can consider as transitional period before technology completely takes over. After a while (in the time of singularity), the artificial intelligence will take over most of the human commercial activities making humans obsolete in many instances. The reason for this is that when computers become skilled, in the short time they become very skilled, "mainly because of focus, patience, processing speed, and memory. Computers far outstrip us in these capacities" [22; p.16].

According to D. Graeber, many jobs already represent a social category making people busy just for the sake of social peace [23]. Therefore, it can be concluded that we already educate many people for futile careers that have no economic but only social justification. With the development of technology, many jobs will become obsolete because computers will perform them faster, better and cheaper. Exponential growth of knowledge, even today, makes many jobs more complex and more difficult for people to perform as they would need to process much more data making their learning process more time consuming and more narrowly focused. In other words, human based activities are becoming less efficient in comparison to computer based activities. Cowen nicely illustrates this issue: "Mathematicians used to prove theorems at age of twenty, but now it happens at age thirty because there is so much more to learn along the way" [24; p.41]. All this gives a room for technology to take over making many people jobless jeopardising economics driven employment, so the main issue that arises is "how can we organize society around something other than employment" [25]. This issue is not challenging just for the economy, but for the educational sector as well.

THE CONCEPT OF SINGULARITY

Singularity as a concept was in details explained in 1993, by science fiction author and mathematics professor V. Vinge where he, under this term, implies the rise of super intelligence that humans will use to enhance their intellectual abilities through the direct technological bonds [26]. He expects singularity to occur after the year 2030.

R. Kurzweil, well-known futurist, further developed the concept of singularity (more precisely technological singularity) in his book "The Singularity is Near – When Humans Transcend Biology" where he defined singularity as "an expansion of human intelligence by a factor of trillions through merger with its non-biological form" [27; p.123]. He expects the occurrence of singularity sometimes after the year 2045. Apart from Vinge and Kurzweil, Danaylov identified 15 more definitions of the concept of (technological) singularity [28]. What is generally in common for all definitions of the concept, are the notions of acceleration and discontinuity that clearly distinguish technological singularity form other meanings of the word [29; p.4].

The idea for the term came from physics, related to the concept of gravitational or space-time singularity, that occurs in black holes where gravitational field becomes infinite and impossible to measure. Black holes are characterized by event horizon where "things can go in, but nothing can get out" [30] meaning that the singularity is irreversible. This occurrence of event horizon in humanity will mean that things cannot be foreseen and that the "quantitative measure of intelligence, at least as it is measured by traditional IQ tests, may become a meaningless notion for capturing the intellectual capabilities of superintelligent minds" [29; p.5].

The singularity concept is appealing to many because it appears that once the artificial intelligence surpasses that of the human, the life of an average person would be much easier. The roots for these hopes come from robotics. Robotic scientists dream of building intelligent machine that will completely do all our work while we would live a life of leisure. The second dream is that robotics would potentially make us immortal by allowing us to upload/download our consciousness [31]. Basically, the notion is that our body is our hardware while our mind is our software. The opponents to singularity approach find this

vision of the future very speculative and hold an attitude that "the singularity is a religious rather than scientific vision" [32].

The possibility of the occurrence of super intelligence opens the discussion about the positive and the negative sides of singularity. Potential benefits are seen as possibility to cure all known diseases, transformation of the society through the end of poverty, etc. Potential threats are seen as possibility to end the human race and even destroy the whole Earth [33]. The bottom line is that if singularity comes true, the human race as we know it will cease to exist. The event horizon of singularity will be manifested in the invention of first ultraintelligent machine as that will be, as Good noticed in early 1960-ties, "the last invention that man need ever make" [34]. Why? Simply because ultraintellignet machine, that is far beyond human intelligence, will make new things (inventions) better, faster and cheaper. This standpoint is best stressed by Dyson who points out that "In the game of life and evolution there are three players at the table: human beings, nature, and machines. I am firmly on the side of nature. But nature, I suspect, is on the side of the machines" [35]. This issue raises the main question – what is the future of education.

FUTURES RESEARCH

Futures studies is not yet established worldwide as an equal discipline to other scientific fields and disciplines but it's significance is recognized globally among leading companies and universities [36]. The main goal of futures research is to identify what is in people's minds when they think about the future [37], and based on these attitudes, historical experiences and technical trends, development of alternative scenarios of the future. Futures studies are about identifying trends and scenario development [38; p.185]:

- better understanding of qualifications, within sectors and countries,
- possible futures – show us what might happen and they give us broad understanding of the situation,
- plausible futures – out of futures that might happen which are the futures that are acceptable and actually likely to happen,
- probable futures – ranking of plausible futures based on their probability of occurrence,
- preferred futures – these alternatives represent our preference for the future scenarios.

Until today, there are many techniques developed for analysing futures, i.e. trend analysis, scenario development and analysis, modelling, computer simulations, brainstorming and visioning [39], to mention some. The bottom line is that futures research requires multidisciplinary approach and is not exclusively reserved for the experts in the sector of specific interest. On the contrary, experts from the specific fields usually suffer from "path dependency" often being reluctant to accept prospects of changes in the future that would radically impact their work or even existence, making difficult for them to imagine the possibility of the impossible.

EDUCATION – FROM PRESENCE TO SINGULARITY

This article attempts not to forecast future of educational system and education in general, but to initiate the thinking out of the box about the education in the mid-21st century. Real future scenarios need more extensive research and dialogue between all interested parties in the educational system.

As technological changes rapidly advance, in the future we will find ourselves at the critical point, beyond return where technology will overwhelm us. In that manner, technology cannot be viewed just as a tool for better, in this instance, education, but rather as "an expression of a social world" [40; p.47]. As much as we will change and influence the technology, it will also

influence and change us. As such, singularity perspective is just one alternative future that might happen and that should make us radically rethink the purpose of education.

In his book on singularity, Kurzweil does not pay too much attention on education. The reason for this is obvious: do we really need education in the age of singularity? This question might sound radical, but if we take a look at the 6 Epochs of Evolution things become clearer (Figure 1).

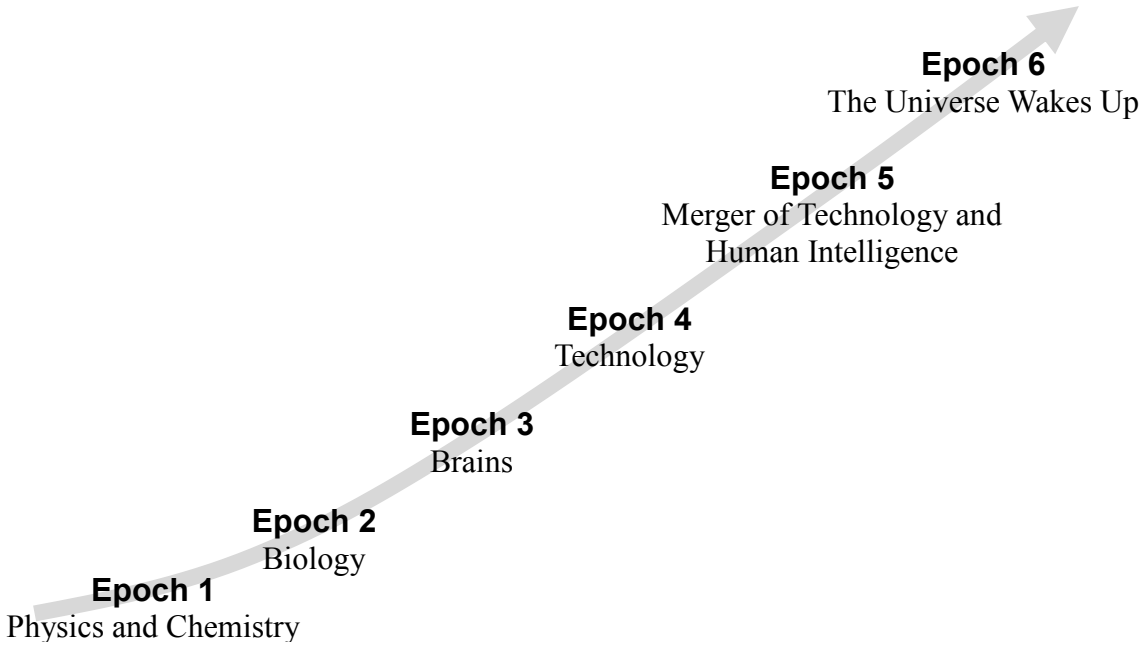

Figure 1. The Six Epochs of Evolution, adapted from Kurzweil [27; p.15].

Six epoch of evolution represent evolution of information carriers. In Epoch 3, information carriers are neural patterns and this epoch overlaps with the evolution of higher life forms with fully developed brains leading ultimately to Homo sapiens. Epoch 4 is based on information in our technology (hardware and software) and corresponds to, what we usually call, an information age. Today, we are witnessing the pre-birth age of Epoch 5, where humans will merge with the technology. Early attempts to make successful bonds with technology are already present in medicine [41, 42]. The next step is making bonds with technology (i.e. Internet) enabling us to access information and communicate with others directly, without peripherals such as computers, smartphones and other devices. The ultimate goal is to expand our natural intellectual and computing capacity with non-biological means. The fulfilment of this goal will be realized through the development of uploading technology, sometimes after year 2040 [43; p.127].

The development of uploading technology will force us to rethink the concept of education. The singularity age will enable us to instantaneously get the information that we need. All professions related to knowledge transfer (teacher and professors) would need to be redefined because even today no human can match the abilities to hold and process information of large network, today known as Internet. In the future Internet will be transformed in some kind of cloud accessible from everywhere to everyone. This tremendous interconnectivity will make another evolution of the human society leading to intellectual renaissance. To paraphrase J.M. Keynes, the vitality of information age is not based on the quantity of information available, but rather on the exchange rate of information available. And we are talking about real time, instantaneous information exchange.

PERIOD OF THE TRANSITION

Before coming to that future we will go through the transitional period that already started. Advocates of current economic and social model stress the importance of education in STEM fields (science, technology, engineering, mathematics) [24, 44, 45] as the jobs in these fields are seen as the jobs of the future. Basically, they are right. To reach singularity age and make transhumanism possible humanity needs to conduct extensive research in all these fields as they are foundation for the development of so called "transhumanist technologies" [46]. As we are close to real-time information exchange, the rigidity of the educational system becomes an obstacle to successful education of experts in the STEM fields through formal educational agencies. There are two major reasons for that: curriculum based education and increasing need for specializations.

Curiculum based education

Our school system is curriculum based. The curriculum determines "the subjects that will be taught, the identified "mission" of the school, and the knowledge and skills that the school expects successful students to acquire" [47]. The advanatege of this approach is obvious – standardized knowledge and skills transfer. But, the whole process of curriculum modification and change as to reflect the changing needs of the society and economy is to slow, making schools and other formal educational institutions rigid and non adaptible. The curriculum change cannot anymore adequately follow the pace of technological change in the digital age [48]. The occurrence of "just-in-time knowledge" will not tolerate any delays in delivery of information through educational system. As Carroll stresses, this will lead to rapid knowledge emergence, rapid knowledge obsolesce, and the migration of knowledge creation further away from academia [49].

Specializations

Advances in technology and science, and consequently, needs of labour market, have made a pressure on students to narrowly focus their education toward specific fields of research as this became the prerequisite for incremental advances and discoveries in most scientific fields [24, p.206]. The problem occurs because an average educator does not have enough knowledge to cover all aspects of certain field of science necessary to develop highly skilled and trained specialist as there is already too much content in each field of science for any single educator to cope with. The reason for that is not only increasing growth of knowledge produced worldwide but also the nature of educator's work that is aimed to transfer of standardised knowledge to larger population of students. Therefore, in the future we will witness larger shift toward self-education leading to development of custom made education suited specially for each individual. This concept is referred to as "just-in-time learning" [50, 51].

These two factors will lead to redefinition of factory based school concept that will gradually transform school premises to premises for social contacts and individual development. Gorbis stressed that "the future of education eliminates the classroom, because the world is your class" [52]. This situation will also lead to redefinition of workers in education. Educators will be transformed to educational managers, helping individuals to coordinate their educational efforts toward individualised educational goals.

The Chronology of the Future Until Singularity

Above mentioned transition will gradually abandon factory based classroom through the usage of transitional technologies of three decades to come. Teaching will move from unidirectional, physically based teaching, still predominant today, to the virtual teaching that

will be conducted regardless of place and time (Figure 2). We are already witnessing the beginning of this transition through digitized classrooms where information and communication technologies are becoming less, and less standalone tool, but are starting to be integrated in all aspects of students work. Around year 2020, it is expected that we will see a period of AI assisted disintermediation where traditional teacher-student model will be abandoned, and teacher will not anymore have a function of mediator between the knowledge base and the student, but it will become a coordinator in personalization of educational process. Next expected step, sometimes before year 2030 is the emergence of tangible computing as a predominant method of experiencing and manipulating with digital data through physical objects [53]. And last phase, before the emergence of singularity that will flourish in mid-2030, are so called virtual/physical studios where the whole concept of education is based on information access with the goal to have instant information access which will, with the development of neuroinformatics, lead to the instant learning.

Already with the development of neuroinformatics and active data exchange interfaces between biological and non-biological forms, education or even learning cannot anymore be viewed as a process. With the instant data access, students will acquire knowledge when necessary. As such, memory will be stored in the cloud as human brain will not have sufficient memory capacities without artificial enhancements. Eventually, sometimes after year 2045, the border between knowledge stored in the human brain and the one in the cloud will be blurred. The tendency is that because of vast knowledge base human brains wouldn't perform as knowledge bases but rather as database indexing system.

RISE OF SUPERINTELLIGENCE

Taking that Kurzweil is right, somewhere around 2050 we will make our last invention – the superintelligent machine. From that point on, the technological and scientific development will be in the hands of artificial intelligence making exclusively human STEM scientific research obsolete.

This moment will represent a breaking point in human history, or event horizon, as mentioned before. From the perspective of human and social development, we can refer to this

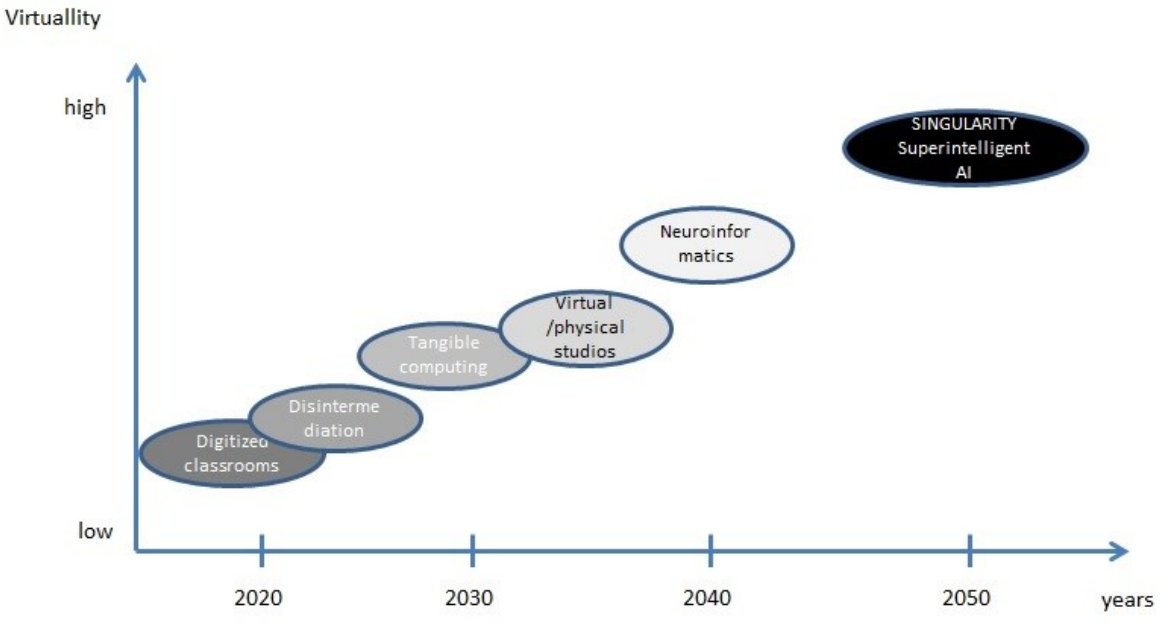

Figure 2. Evolution of educational technology until singularity, adapted from Zappa [53].

point as a loop closure in intellectual development of human race. That loop started in ancient times, with the development of philosophy as a mother of all sciences because the aim of philosophical inquiry is "to gain insight into questions about knowledge, truth, reason, reality, meaning, mind, and value" [54; p.1]. Philosophical thought was the reason why human civilization developed different scientific fields. This development represented our aim to analytically understand our world. The consequence was development of technologies that will ultimately lead to the development of superintelligence. R. Kurzweil considers this development as "our ultimate act of creativity: to create the capability of being creative" [43; p.116]. This will lead humanity to return to the beginnings, to live our lives introspecting our existence and purpose. Therefore, we can talk about loop closure effect where we will centre our lives on humanities (arts, crafts, literature, etc.) where each individual will be able to express itself. In other words, science started with holistic approach to the understanding of world around us. Throughout human history, we developed analytical skills to explain parts of the world for better understanding of the whole. Now, we are slowly reaching the point where even the best sciences cannot truly understand some scientific areas [24, p.210]. Therefore it is almost inevitable that superintelligence will take over further research and development in STEM fields allowing people to come back to truly holistic approach of understanding (and therefore learning) through humanities.

CONCLUSION

Accelerating dynamics of knowledge creation that is necessary for further economic development makes traditional educational systems based on knowledge transfer and learning outdated. Development of highly specialised working force forces schools to adapt their programs to the specific needs of individuals. As the amount of available knowledge surpassed the ability of educators to effectively transfer it to students, in the future we can expect that many teaching functions of educators will be transferred to artificial intelligence solutions. The consequence will be that educators should transform their function of teachers to managers for customized learning.

Furthermore, complexity of STEM scientific fields will lead to advances beyond the comprehension of top scientists. Development of STEM fields will lead to the rise of superintelligence that will take over its further scientific research and development. Ultimately STEM fields development in the singularity age will diminish its need for human research and development impelling society to turn back to humanities where traditional schooling concept will be replaced with debates and individualised research supported by superior technology and artificial general intelligence.

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DUGOROČNA PERSPEKTIVA OBRAZOVANJA – OD DANAS DO SINGULARNOSTI

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SAŽETAK

U radu su opisane ključne karakteristike i geneza razvoja sustava obrazovanja kakvog imamo danas. Prikazani su temeljni ciljevi obrazovanja današnjeg, informacijskog društva iz perspektive tržišta rada. Ukratko je pojašnjen koncept singularnosti te kako će njegova pojava dovesti do prijelomne točke unutar povijesnog razvoja ljudske civilizacije.

Razvoj obrazovanja je stavljen u kontekstu singularnosti te budućeg, tehnološki vrlo naprednog i razvijenog društva. Prikazana je i kronologija budućeg tehnološkog razvoja do pojave singularnosti. Temeljem prikazanog, kao vrlo izgledan scenarij navodi se mijenjanje koncepcije obrazovanja temeljenog na interesima gospodarstva i tržišta rada u smjeru izgradnje sustava obrazovanja koje se temelji na humanističkim znanostima.

Cilj rada nije izrada preciznog predviđanja budućnosti obrazovanja već pokretanje rasprave o mogućim scenarijima budućnosti obrazovanja te redefiniranju njegove društvene uloge sredinom 21. stoljeća.

KLJUČNE RIJEČI

obrazovanje, budućnost, singularnost, tržište rada, STEM