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A complex perspective on digital education development: From economic impact to community advancement

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Słowa kluczowe: rozwój edukacji cyfrowej, rewolucja technologiczna, zmiana społeczna

Drivers of educational transformation

The educational process and the social environment are interlinked in a thousand ways. Education is an arena of constant challenge and struggles through the advocacy influence of three distinct groups. The three interest groups: family, economy, and the state (politics), all seem to have concerns and policies in the interest of young people, but all three have different agendas and different intentions. The Hungarian education system is thus constantly under attack, plagued by both a centralised prescriptive system and an internal pressure to innovate, doomed to fail due to a lack of resources. The fact that the school models of the late 20th century cannot be applied in the 21st century is widely recognised. There have been several initiatives to change the direction and reposition the role of schools, driven by the state, which in Hungary mainly prioritises the interests of the industrial segment of the economy.

The cyclical nature of the economy, the recurrence of economic booms and busts, was first formulated by Nikolai Kondratyev in 1920. Based on historical and statistical methods, he concluded that crises are as temporary as business cycles, and in his theory, 50-year cycles – so-called long waves – are global phenomena. Their impact is felt not only at the origin of the crisis or boom and in its immediate vicinity but also throughout the world through economic and financial interconnections and interactions (Csath, 2010). Kondratyev identified three major cycles, two more were confirmed after his death, and the main points of his theory were again confirmed in the context of the 2008 global crisis (Bródy,

2007). The main idea is that cycles can be divided into two waves (rising and falling) and arise from each other. However, the new waves are not repetitions; the driving force behind the cycles is the introduction and diffusion of the new invention, while its exit leads to the descent phase. Austrian economist Joseph Schumpeter describes four types of cycles – Kondratyev, Kuznets, Juglar and Kitchin – and, integrated into a single theoretical framework, argues that the driving force behind cyclical booms is innovation, which opens up new directions in the economy through creative ventures (Kiss, 2005, pp. 10–13). The break in continuity is a natural economic phenomenon. Innovative entrepreneurs are constantly innovating and, at the same time, disrupting as they replace the old with new processes, new products, new resources, new organisations and new markets (Schumpeter, 1980; Inzelt, 1998, pp. 33–57). Seen in this way, the period of economic decline is also a period of adaptation to future change. The 2008 global economic crisis brought the era of information technology and laser technology to a close. The new era is taking humanity into a world of infinitely large and infinitely small through the biological and industrial use of space technologies and nanotechnology.

The lives of the generations living with us (Törőcsik, 2015, pp. 13–15) are well defined by one or another economic wave, a typical innovation that encodes both attitudes and social behaviour. Those born in the period defined as the oil and automobile era (1900–1970) are divided into three generations: the veterans, the baby boomers and part of Generation X. They have dropped out of the education system altogether or may be in adult education, but they are mostly grandparents following their family members' educational progress. Their expectations and aspirations for school are determined by their lived experiences: order, discipline, respect for teachers, implicit rebellion, human values, personal friendship, and predictable career paths (Törőcsik, 2015, p. 17). Those born in the period defined as the era of IT and laser technology (1970–2008) are divided into two generations: Generation X and Generation Y. They are partly regime-changers or partly socialised in the post-regime-change situation and have little or no personal experience of the recent past. Their expectations and aspirations for school are also shaped by their lived experiences, but these are different from those described by the previous generation: more freedom, opportunity, self-centredness, wealth as a measure of value, and aspirations for a prosperous career (Tari, 2010). They are typically parents who have the best interests of their children in the current education system at heart. Among others, children who belong to Generation Y, Z and alpha, i.e. digital natives, 'screenagers', who exist in networked online peer relationships, who look to the internet for information and solutions to the big questions of their lives, who are fundamentally distrustful and contemptuous of what does not exist online (Mile, 2012, pp. 26–27). They are active participants in kindergartens, schools, and secondary and higher education today. They are also active in the way they communicate their interests and expectations, whether as participants in street demonstrations against government positions and actions or as speakers in letters to principals and meetings. In recent years, we have seen examples of this, both

following the established norms of communication and of strong norm-breaking. While the everyday lives of generations are becoming less and less compatible as a result of technological changes, schools seem to be resisting these changes, not forgetting, of course, that the definition of the public and social role of schools and education, their budgetary support and the moral standing of those working in the sector are also being undermined. As a consequence, we are educating the 21st-century generation in largely 20th-century conditions. The internal transformation of classrooms in Hungary is a process of modernisation that started more than ten years ago, but along with spatial disparities, it can be said that significant differences remain. The dividing line is not necessarily based on Budapest-rural, public-private differences; much more depends on the initiative and partnership-seeking capacity of the school community and its cooperation routine. A good example of this is the Lisznyai Utca Primary School in Budapest, which, in partnership with the Turkish Embassy in its neighbourhood and the parents of its pupils, has developed a digital classroom and a smart room with laptops and tablets and, in the meantime, a state device grant has also been implemented (Koncz, 2017).

We are now in the fourth industrial revolution. The first brought the rise of the steam engine and the manufacturing industry. The second was the triumph of mass production, assembly lines, electricity and steel. The third brought the information age with automation, digitalisation and the revolution in telecommunications and data transmission. In the era known as Industry 4.0, smart networks will become dominant. People are no longer the smartest, the internet connects not just people but everything to everything, and we are experiencing all the positive and negative consequences of this. Intercommunicating, self-learning devices, data collection and analysis lead to optimised processes where needs can be met instantly, further increasing the satisfaction and security of individual and business users. Molnár points out that while digitalisation is developing at an exponential rate, this is not yet being matched by an increase in productivity and new jobs and that the fourth industrial revolution is not following the "cut and create" pattern of the past. If only market mechanisms are allowed to prevail, the workers of the future will be in a vulnerable position. Poverty may increase, society may be divided into winners and losers, and the middle class may be weakened in the long run (Molnár, 2018).

Microsoft researchers see it differently. They are also aware of the social changes that will accompany this process, but they emphasise the positive side (Microsoft, 2018, p. 11). In the countries that are leading the global economy, some of the changes listed below are already in place or will be in place in the near future (by 2025):

- 30% of corporate financial investigations are performed by artificial intelligence;
- US: 10% of cars will be self-driving, and 3D-printed cars will appear. Car-sharing systems will be used instead of ownership;

- USA, Australia: Tax collection and stock market transactions will be done through intelligent systems;
- 1 trillion sensors connected to the internet;
- robots appear in the service sector: pharmacy and elderly care;
- telephone implants become commercially available;
- 10% of reading glasses are connected to the Internet;
- 10% of people wear clothes that are connected to the Internet;
- 50% of all Internet traffic is from home;
- governments replace referendums with Big Data.

If this becomes a reality, some basic things will have a different meaning: such as privacy (will there ever be any?), free will (brand manipulation, shopping incentives, individual choice?), ownership (what's mine?, data about me?), awareness (will I know what I need to know? continuous learning), participation in decision-making, advocacy. If we leave a trace of our every action, tracking our movements in both online and offline spaces, how much more will the possession and use of the data generated in this way be under our control?

Changes such as these have first affected large organisations in industry, commerce and finance. According to a US survey, only a third of business and public sector leaders are confident in their ability to navigate their organisation through the new era, and even fewer feel confident in their ability to fully exploit the changes of Industry 4.0 (Forbes Insights and Deloitte, 2018). 87% see the impact of the fourth industrial revolution on society as promising rather than bad, with a positive reading of it as creating stability and equality. 61% are confident that the current workforce can be retrained for the future. They do not believe that this future will be a success for everyone: for many, it will be painful, and businesses may go out of success, but they strongly believe that the positive scenario will be realised: Industry 4.0 can give new meaning to work, which can then be more about self-fulfilment than about a forced and exploited breadwinner.

Steps in the technological transformation of the educational environment

A complete overhaul of education to prepare today's students for the challenges of tomorrow is not a new challenge. Evidence shows that education prepares future generations for the future, but technological innovations are reshaping not only the near future but also our present to such an extent that it is increasingly unpredictable and less clear what exactly future generations should be prepared for. The content of literacy has also changed significantly, and now there is a need for literacy based on combinatorial skills that are adaptable to the situation. Tamás T. Kiss sees the essence of combinativity in the fact that the individual is not blocked by the new situation but is able to integrate his/her previous experiences and knowledge in an innovative way

in order to adapt to the situation, make creative decisions and act (Kiss, 2008, pp. 120–124). The 21st century expects all participants in the school environment to apply these existing skills in the digital space and to strengthen new skills. The change must affect not only children, who suffer the impact of new school reforms, but also school administrators, teachers, parents and staff supporting education, as well as businesses and social actors in the neighbourhood, who act as facilitators and, optimally, as collaborative partners. It seems that in the future, the main knowledge content will be described by the acronym STEM (Science, Technology, Engineering and Mathematics) and that science, engineering and mathematics will be the leading direction. In addition, soft skills such as collaboration, the ability to work in teams, creativity, problem-solving, intercultural communication skills, entrepreneurship and experimentation will be necessary for the future workforce. For this reason, it is necessary to provide stimulating environments and inspiring situations in the school environment and beyond, from the canteen to the library, from the laboratory to the sports field, and from Mondays to summer camps. This goes far beyond the purchase of digital tools and digital teaching of learning materials.

Microsoft is one of the world's largest software companies, but its research agenda and social responsibility programme go beyond the narrowly defined needs of the industry. Artificial intelligence, machine learning and human-to-machine communication are just some of the innovative areas that the company's research department, which employs more than 1,000 people, is working on, alongside security, privacy and networking. The technological innovations that keep the world on its toes are largely based on the knowledge and experiments accumulated here. In August 2018, Microsoft published a compendium on the timely transformation of education, Transforming Education – Empowering the students of today to create the world of tomorrow (Microsoft, 2018). The volume presents a 21-step scenario based on Microsoft's research to make it easier for schools to adapt their educational programmes and physical environments to the needs of the 21st century (Microsoft, 2018, p. 46). What they describe is remarkable, even if we know that their proposals are partly aimed at providing a stable market for their own products. However, the report, which is based on almost 30 years of research experience accumulated in the company, not only provides inspiration but also sheds light on the most common mistakes and how to avoid them. It provides lessons to be learnt in thinking about what we have tried to skip over and get away with and why this is not a viable path. In the following part of the paper, the background of the research is reviewed, and the 21 proposed points are evaluated.

Over decades, Microsoft, with 130 policy and academic partners, has examined case studies and essays on schools, school districts, and countries, where initiatives to transform education have led to dramatic changes. There have been successes and failures, and analysis of the data and evidence has highlighted what works and what is doomed to fail. The result is called the Education Transformation Framework, and it sets out the steps and considerations it recommends in bullet points across four areas (see Figure 1).

To support the programme, detailed guides for education managers and teachers are available in English on the Microsoft website at https://education.microsoft.com/, and other content and webinars are available in English at https://www.microsoft.com/en-us/education.

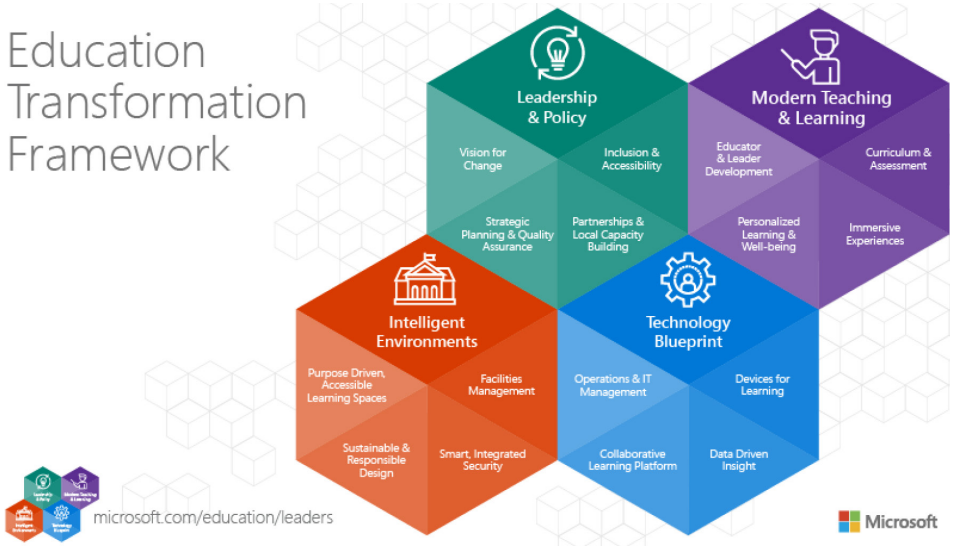

Fig 1. Education Transformation Framework, Microsoft, 2018
Source: https://education.microsoft.com/school-leaders-toolkit/learning.

The 21 steps compiled by the Anywhere Anytime Learning Foundation (www.aalf.org), Education Queensland (https://education.qld.gov.au/) and Sean Tierney, Microsoft. The comments are based on the Hungarian situation and provide explanations that may also be worth considering in other countries in the region.

Phase 1: Create the need for change!

1. Assess and understand the full context of the institution! In this part, the institution carries out a thorough analysis of its environment, looking at the situation in space and time, and examining its embeddedness in the municipal and professional institutional system. A SWOT analysis can be used as a tool to assess its strengths and opportunities, identify its weaknesses and forecast critical points and threats. Perlman describes organisations as designing organisations that rely on both those inside and outside the circle to design social institutions and solve problems (Perlman and Gurin, 1993, pp. 67–98). Thus, professionals, lay people, employees and volunteers work together to achieve a common goal.

2. Develop a strong and shared vision! "The most successful initiatives have in common that they focus first and foremost on learning and not on laptops and other devices," argues Bruce Dixon, co-founder of the Anywhere Anytime Learning Foundation (Microsoft, 2018, p. 35). It is a mistake to think that digital transformation will depend on the selection and deployment of the right technology. This is, in fact, important, but not at this early stage of design. It will, in fact, be one of the last things to be done! It is a description of the vision, a detailed explanation of the end state that they want to achieve. It can also include details of what is needed, but it will do more if it articulates the positive changes that the transformation will bring about in students, schools, the education system, and the community.

3. Clarify objectives and expectations and indicate guidelines! Based on the situation analysis and a well-defined vision, several lines of development can be outlined and priorities set.

4. Start consultation and cooperation with parents and the community! So far, this process has been based on the joint reflection of the heads of the institutions and colleagues involved in the development process who are willing to participate. Here the circle needs to be widened to include the two most important stakeholders in the school environment: parents and members of the local community. Get behind the idea, and get behind the project! Involving parents and the wider community in the planning phase also means emotional involvement, which can help to support the process in the long term and help to solve problems as they arise, as individuals get the idea "I'm involved, I won't let it fail!".

Phase 2: Study the 21st-century practices of others!

5. Examine modern and contemporary learning practices and examples! Through international organisations, public institutions or international NGOs, school communities can nowadays choose from a wide range of international programmes that offer the opportunity to learn from good practice and exchange experiences. Companies that produce educational tools are another area where it is worth looking at how a tool or programme can be integrated into the teaching process and how it can be used to advantage; they also help to match innovation with users by managing the product on a large scale.

6. Consider new solutions and opportunities for educators! Individual study tours and exchanges and participation in collaborative partnerships can all help to shape the way trainers think. This phase is also about convincing colleagues that the direction we want to change can work, that we don't have to take on impossible burdens, and that at the end of the process, their workload will not be increased and harder but easier and more effective. But it is not enough to just say it, you have to experience it!

7. Start creating the learning environment of the future! At this stage, you don't need to call in an interior designer, but you can start thinking about how to redesign the spaces (classrooms, corridors, common spaces, restaurant, library, etc.): what new functions should be placed where, what can stay the same and what you want to rebuild, rearrange, separate, merge. This is still the phase where all ideas count, and nothing is thrown out because there is no money or it is against someone's interests.

Phase 3: Preparing the community and building commitment!

8. Create a culture of change! This seems to be the key to it all. If stakeholders feel the need for change, it is not enough. It is necessary to create an organisational climate in which members see change and its subtasks not as a task but as an opportunity. As Varga and Vercseg quote Ernst Schumacher as a guide for community developers, "Development does not begin with goods, but with people, with people's learning, organisation and discipline." (Varga and Vercseg, 2001, p. 60).

9. Employ professional learning and teaching strategies! Educators should be given space and opportunities to experiment and try out new teaching methods, adapting international experiences to their own schools and students. It is also important at this stage to measure these results; student feedback and parental feedback can help teachers.

10. Ensure sustainability! Evidence suggests that a long-term funding strategy needs to be developed that can sustain change indefinitely, ensuring that 'prosperity' does not just last until grant money runs out or the funding period expires (e.g. equipment is bought, but maintenance is not paid for). The Anywhere Anytime Learning Foundation has summarised the principles to be followed in a few points: all learners should be able to participate, it should be sustainable until an unspecified date, it should be a professional development tool purchase, and everyone who benefits should be committed! This last principle is supported by the fact that, although public education is emphasised as "free" all over the world, research shows that where, for example, digital equipment was not provided free of charge to pupils, there was less damage, equipment was better maintained and therefore less maintenance or downtime. They found that one of the biggest failures is when devices are provided for free (Microsoft, 2018, p. 38).

11. Make them understand! In this phase, the focus is on the communication strategy, which involves PR and press relations work on the specific project after laying down the organisational communication guidelines and principles. During the development and implementation of the strategy, information should be provided to all stakeholders involved in the change. Internal communication will be directed to the staff and students of the institution and, to some extent, to their parents, e.g. newsletters, student newspapers, and student radio, which

can also be web-based and can be used on the institution's social media platform. For external communication, the local media should be a strong partner, as change and the creation of new things is newsworthy and can be counted on to attract media attention. With a well-organised press network, the local media becomes an important partner in informing the local community, with messages reaching not only the parents of current pupils but also those of future pupils.

Phase 4: Make your plan real!

12. Prepare the Readiness Assessment Report! The readiness assessment is the last review of the process before the project is launched to determine whether the institution is fully prepared to implement the project and where are the points and steps that need more attention. The points covered by the assessment include organisational objectives, project expectations, management support, project governance and task allocation, decision structure, process measurement and a system of partial evaluations, etc.

13. Think about the options and the implementation of the project plan! Based on the readiness assessment report, the necessary interventions will be made, and a Gantt chart modelling the project timeline, and the interdependency of the workflows will be considered. A well-designed Gantt chart is a tool for the rapid and efficient implementation of activities, making it easier to understand and avoid events such as stagnation or lack of resources (material, human) in certain activities, which may require rescheduling and optimisation.

14. Select devices, tools, apps and key IT elements for teachers! Microsoft researchers clearly argue that teachers should be the first to receive the new tools and that their engagement should be key (Microsoft, 2018, p. 40). Teachers should experience the personal benefits of using the new tools: shorter preparation time and more engaging content that makes their lives easier overall. If this feeling does not emerge, if the tool is just another nuisance on top of a heavy workload, the project is doomed to failure.

15. Plan the infrastructure to scale! This is the phase where the plan is drawn up for the transformation of the school grounds, now in accordance with current legislation and building regulations and with the involvement of professionals.

16. Prepare the budget! The construction plan and the purchase of equipment (furniture, IT equipment for teachers and pupils), the necessary permits and licences are taken into account to prepare the project budget.

17. Establish partnerships, and mobilise existing ones! Reviewing the budget and partners will provide an opportunity to explore alternative procurement opportunities in terms of grants, sponsorship, and volunteering.

18. By the time you get to this point, both the school management and the teachers have been on several study trips and training courses, and have

first-hand experience using the IT tools previously allocated to them, so they are well aware of the IT tools they would like to use in their classroom work.

19. Understand the rules for using the tools effectively. The use of the tools should be governed by the same set of rules and contracts for teachers, pupils and their parents. The agreement should cover the following points: data security, cyberbullying, text and call initiation and style, response times, Internet access codes, app installation rules, general rules for the use of IT tools in school, rules for taking and using photos and videos, consequences of damage, repair obligations and liability.

20. Buy and install the devices! This is the point where many people (wrongly!) start the process, as it is a really spectacular step and looks good in the media. Such actions also have more political value, are better communicated, and, overall, it does not seem too difficult to choose which device to buy based on one or two quotes. However, it is worth emphasising that the previous 19 points are precisely what will ensure the long-term sustainability of the change through detailed planning of the process.

21. Review and evaluate for an adaptive change! Every process requires periodic review and evaluation of the data and results measured during the process. The results can be used to target changes.

Conclusion

The transformation of educational institutions is in the common interest of all of us, and without professional consultation with key stakeholders (such as the family, the economy and the state), the process cannot be sustained. Commitment to change is not a substitute for tactics that are driven by short-term political or economic interests. Transforming education in our region is a strategic interest and requires a long-term commitment. The road to failure is through short-sightedness, thinking in small projects, and a lack of coherence between education policy and educational practice. The procurement of IT tools and the digital learning support introduced under COVID-19, promising quick success, can lull us into the illusion that the issue is solved. When in fact, the change process can only be sustainable and successful if the whole community is behind the change and ready to embrace major changes in principle. It seeks partners in the economy, encourages collaboration and teamwork, and measures and analyses data from education.

The changed social environment of the 21st century does not leave the internal processes of institutions educating future generations untouched. Schools must not keep pace with these processes but must be a few steps ahead of them because by the time young people graduate from these institutions, they will be facing a future that is currently unimaginable. They need to be able to adapt, evaluate and redesign alternatives, to exist and create in cooperation with others from different social backgrounds, taking into account the social

and natural consequences of their actions. Among many other things, their time spent in educational institutions should help them to do this. An inspiring environment and an institutional system that supports the learner is not an end in itself, but a means.

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Summary

Evidence shows that education prepares future generations for the future, but technological innovations are reshaping the present and the near future to such an extent that it is increasingly unpredictable what exactly future generations should be prepared for. The research was guided by Microsoft's 2018 research summary, "Transforming

education – Empowering the students of today to create the world of tomorrow", which provided inspiration on the most common mistakes and how to avoid them.

The first part of the paper reviews the societal drivers and imperatives for transforming education through a complex literature review, while the second part of the paper presents a practical organisational transformation process sequence. The paper presents Hungarian examples and cases, but it can also serve as a thought-provoking tool for the wider region, where the study of the process outlined reveals a striking contrast between potential and current transformation efforts. The purchase of technological equipment and the provision of schools with new educational technology is not achieving the desired objective, as the funds are not available. It is beneficial to examine the actions of the system developers and identify any attempts to bypass important considerations, and consider the reasons why such shortcuts are not sustainable solutions.

Czynniki i ścieżki rozwoju edukacji cyfrowej – kompleksowa perspektywa od gospodarki do rozwoju społeczności lokalnej

Streszczenie

Edukacja stara się przygotowywać kolejne pokolenia na przyszłość, niemniej innowacje technologiczne wpływają na teraźniejszość i najbliższą przyszłość do tego stopnia, że to, na co przyszłe pokolenia powinny być rzeczywiście gotowe, staje się coraz bardziej nieprzewidywalne. Asumptem do podjęcia badań był projekt firmy Microsoft z 2018 roku pt. „Transforming education – Empowering the students of today to create the world of tomorrow". W podsumowaniu raportu z tych badań zapisano spostrzeżenia na temat najczęstszych błędów popełnianych w edukacji cyfrowej oraz wskazano sposoby, jak można ich uniknąć.

Pierwsza część artykułu stanowi obszerny przegląd literatury dotyczącej społecznych czynników i imperatywów rzutujących na zmiany w edukacji, natomiast druga przedstawia proces transformacji organizacyjnej od strony praktycznej. Choć w artykule omówione zostały przykłady z Węgier, może on stać się przyczynkiem do przemyśleń w szerszej perspektywie regionalnej, badanie rzeczonego procesu ujawnia bowiem uderzający kontrast pomiędzy potencjalnymi i bieżącymi wysiłkami w zakresie transformacji. Cel w postaci zakupu sprzętu technologicznego i wyposażenia szkół w nowe technologie edukacyjne nie zostaje osiągnięty, ponieważ brakuje środków finansowych.