
Smart Education – Road to a more sustainable society

Adrienn Jámbor*

Introduction

The 21st century demands knowledge and expertise from people in order to spend work and spare time effectively, and it is the task of education to prepare for this. Researches carried out in the theme of smart cities mostly emphasise the positive effects of smart cities regarding the solution for the sustainability of cities and also the role of higher educational institutes in innovation and promotion of smart cities. In order to tackle the challenges modern cities, face intelligent technologies, cooperation, highly educated population and effectively working institutes are needed.¹ A determining element of education is human capital as well as improving technological infrastructure for smart cities.²

The smart city – among many – is the centre of higher education and highly educated individuals which is abound of well trained labour force.³ Universities in creative cities are regarded as one of the motors of innovation for talent management, furthermore, for building a closer relationship between the commoner and the intellectual.⁴ Research universities regarding education and training play an important role in urban development as well as training workforce and economic development.⁵ High level of education makes cities more attractive, companies,

* PhD, Assistant lecturer, University of Miskolc, Faculty of Law. Department of Constitutional Law.

¹ Albert Meijer, Manuel Pedro Rodríguez Bolívar: Governing the smart city: a review of the literature on smart urban governance. *International Review of Administrative Sciences*, 82 (2016) 2, p. 393., DOI: 10.1177/0020852314564308.

² See: Andrea Caragliu, Chiara Del Bo, Peter Nijkamp: *Smart Cities in Europe. Journal of Urban Technology*, 18, 2009, pp. 65-82, DOI: 10.1080/10630732.2011.601117, Robert G. Hollands: Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City*, 23 (2008) 3., pp. 303-320, DOI: 10.1080/13604810802479126.

³ John V. Winters: Why Are Smart Cities Growing? Who Moves and Who Stays? *Journal of Regional Science*, 20 (2010) 10, pp. 2-4.

⁴ Yigitcanlar, Tan - O'Connor, Kevin - Westerman, Cara: The making of knowledge cities: Melbourne's knowledge-based urban development experience. *Cities*, 25 (2008) 2, p. 4.

⁵ Ibid. p. 12.

organizations and individuals all tend to be drawn to dynamic educational environments.⁶

An important pillar of a smart city is education, in other words shaping perspective, passing on knowledge as well as developing skills, which in regards of means need to be creative and innovative as some target groups may show significant differences in background knowledge or motivation. During the course of teaching by the “smartness” of people we mean(also) the skills of the inhabitants that help them accept the use of technology in their everyday life in light of simplifying the use of certain services.⁷

1. Digitalization and the effect of ICT on education

In the past few decades’ information technology has gone through significant changes and development, the new technologies bare great opportunities. Costs of availability can be decreased in education, quality can be improved, furthermore, people who have had no possibilities to learn due to distance or time management can join. Developing new technologies make learning more effective, flexible and convenient. Integrating Information and communication technologies (from now on: ICT) into education was one of the most important aspects of educational development in European and other developed countries. Some educational systems, however, could not adapt sufficiently to the ongoing rapid technological, scientific and economic changes in the past few years, and these systems are not competent with the needs of society anymore.⁸ In order for a society to be able to work smart city solutions, it needs to be familiar with their operation. Therefore, cities need to create the educational environments that provide more freedom in courses and improve skill learnings. Education needs to help students in understanding the world so that they could improve their abilities. The community of a smart city needs to acquire the ability to learn, adapt new ideas and realize them. People need to be able to use technology so it can be beneficial to them.⁹ Education needs to prepare city inhabitants, companies, universities as well as the leaders of the city for the operation and use of technology and also the opportunity of being a part of it.

Since ICT has a growing role in every possible area of life, education needs to make it available for everyone to acquire ICT skills. One of the main elements of

⁶ Taewoo Nam – Theresa A. Pardo: *Conceptualizing Smart City with Dimensions of Technology, People, and Institutions*. Proceedings of the 12th Annual International Conference on Digital Government Research, 2011, p. 286.

⁷ Aidana Šiurytė – Vida DAVIDAVIČIENĖ: An Analysis of Key Factors in Developing A Smart City. *Science – Future of Lithuania*, 8 (2016) 2., p 257.

⁸ Pongrácz Ildikó: Online gyerek, offline iskola – Az online zaklatás, mint az iskolai konfliktusok új dimenziója. In: Szabó Miklós (szerk.): *Doktoranduszok fóruma: Miskolc, 2018. november 22. : Állam- és Jogtudományi Kar szekciókiadványa*, Miskolc, Miskolci Egyetem, 2019.

⁹ Andrea Caragliu – Chiara Del Bo – Peter Nijkamp: i. m. p. 48.

teaching is digital literacy¹⁰, which has become a basic requirement nowadays. Teaching digital literacy must be started at the earliest age possible. A child that does not obtain the basic technological knowledge will have a significant disadvantage to their peers.¹¹ Providing equal opportunities is a constitutional requirement in modern societies as well as in Hungary, therefore in order to avoid digital inequality, equality needs to be provided in education. A large number of the young generation does not use digital technologies on a basic level, therefore it is an important task for the education to improve digital comprehension as well as the most important skills such as using the existing systems, searching for information and filtration, flexibility and adaptability. Digital literacy is necessary for lifelong learning, quality for the use of ICT, skills for acquiring knowledge, for refreshing, for learning independently as well as for working together with others.¹² A key competence for lifelong learning is digital competence which means the conscious and critical thinking use of digital technology and covers all knowledge and skills that every individual needs in the digital society. Using digital technology and contents are not only more convenient and lower cost, but also increase the level of education and improve its quality.¹³ In regards of universities this means that they develop and teach students basic competences such as problem solving, creativity, flexibility and critical thinking.¹⁴

The fast globalization, the influence of information technology, the international changes towards a knowledge-based economy, the need for social development as well as the international and regional competition all result in the changing of the education all over the world. Digitalization changes people's relationships, influences their lives and the way they communicate, study and work.¹⁵ It also results in closing of some workplaces, changing of others and establishing new ones. As a result of the effects of digitalization several workplaces and industries will change, new activities will appear, therefore, investing in digital skills and lifelong learning will have an outstanding importance. This is why it is very important to prepare people for finding their place in a fast paced changing, globalized and connected world. One of the essential factors of the smart city is creativity, so people, education, learning and knowledge play key roles in a smart city.¹⁶

¹⁰ Vinnai Edina: Az állam szerepe a digitális társadalmi leszakadás kezelésében. *Miskolci Jogi Szemle*, 15 (2020) 1. különszám, 347-356. o.

¹¹ Kőrösné Mikis Márta: *A digitális írástudás gyermekkori megalapozása: ajánlások a 3-10 éves gyermekek nevelőinek*. Országos Közoktatási Intézet, Budapest, 2006, 108. o.

¹² Gál Franciska: Milyen lesz a jövő iskolája? *Tanító*, 50 (2012) 7., 7. o.

¹³ Doug Washburn – Usman Sindhu: *Helping CIOs Understand „Smart City” Initiatives. Defining the Smart City, Its Drivers, And The Role of the CIO*. Forrester Research, 2010, p. 6.

¹⁴ Everard van Kemenade: Smart Universities Walk the Talk of Commitment. *The Journal of Quality in Education*, 9 (2017) 9, pp. 7-22, DOI: 10.37870/joqie.v7i9.9.

¹⁵ Ildikó Pongrácz: Children, online dangers and solutions. *European Integration Studies*, 15 (2019) 1., pp.112-121.

¹⁶ Taewoo Nam – Theresa A. Pardo: *Conceptualizing Smart City with Dimensions of Technology, People, and Institutions*. Proceedings of the 12th Annual International Conference on Digital Government Research, 2011, p. 285, DOI: 10.1145/2037556.2037602.

Creativity is considered key important in a smart city, so people, education, learning and knowledge play central role in a smart city.¹⁷ Cities can be divided into three groups regarding the concept of creativity: for one, there are cities that regard creativity as a tool of the development, then there are cities that look at creativity as a creative- and knowledge industry, finally there are cities whose approach is obtaining and attracting knowledge capital, in other words creative competence aims for human resources.¹⁸ Intellectual and social capitals are essential grounds of a smart city. Smart cities are about the mixture of education and training, culture and art, as well as business and trade.¹⁹ The precondition of social sustainability is an environment that contributes to the improvement of the quality of life by improving interaction between people, also communication and cultural development. Smart cities could structurally affect or improve the quality of life: information and communication technologies help cooperation, connection and division between people, social network is a popular means of bridging online and offline life.²⁰ Research universities in regards of education and training play a key role in city development with both labour force training and economic development.²¹ Universities in creative cities are considered to be one of the motors of innovation on the one hand for talent management, on the other hand as it facilitates building relationships between the citizens and scientific knowledge community.²²

Information technology and educational environment have gone through significant changes and development in the past few decades. Developing new technologies make acquiring knowledge more effective, flexible and convenient. In the education of the 21st century information has a priority role at the same time the age of information presents new challenges and pops up entirely new questions for educational institutes: the progressing of ICT changes the process of teaching-learning in its core values, it provides equal chances for anyone and everywhere to acquire knowledge, learning its use is everyone's interest today. Students today need scientific, technical, communicational and information processing skills on a higher level. Learners of today can access information anywhere, at any time in any way, therefore education need to put emphasis on developing competences relating to information management. Digital technologies make it possible for learners to study according to their circumstances. The purpose of smart educational institutes is to develop educational systems in order to advance knowledge and skills necessary in the 21st century, and also to meet the needs and challenges of the society. In parallel with improving the technology, teachers also need to be prepared for the use of the

¹⁷ Taewoo Nam – Theresa A. Pardo: *Conceptualizing Smart City with Dimensions of Technology, People, and Institutions*. Proceedings of the 12th Annual International Conference on Digital Government Research, 2011, p. 285.

¹⁸ Z. Karvalics László: A possible direction towards developing a knowledge-based city. *Információs Társadalom*, (2013) 2., pp. 9-10.

¹⁹ Tannaz Monfaredzadeh – Robert Krueger: Investigating Social Factors os Sustainability in a Smart City. *Procedia Engineering*, 2015, (118), p. 1113.

²⁰ Ibid. p. 1116.

²¹ Yigitcanlar, Tan - O'Connor, Kevin - Westerman, Cara: The making of knowledge cities: Melbourne's knowledge-based urban development experience. *Cities*, 25 (2008) 2, p. 12.

²² Ibid. p. 4.

means of ICT in the education, which requires patience, work and time to achieve efficiently.

The application of digital technology in education also makes students interested as this system is interactive and gives ground to creativity, offers new possibilities for learning and also changes teaching methods.²³ When we talk about digital education it is important that it is not the version supported by the traditional digital teaching means, but a new one in its core that creates an environment that meets the requirements of the digital age. In the digital age the socialization environment does not need a teacher/institute centered education emphasized by teaching materials, but demands competence developing student centered education.²⁴ Society and economy do not expect lexical knowledge from the workers, but some kind of availability, flexibility, and the ability for ongoing learning. Workers need to be mobile, highly educated, ICT-educated as well as ready to lifelong learning.²⁵ Furthermore, the aim of smart education is to educate a workforce that is able to acquire knowledge and skills of the 21st century. So digital learning has a key importance in all levels of education, which requires innovation in technology, pedagogy as well as organization levels.

2. Ideas on smart education

Smart education has been receiving a great attention lately. Smart technology, devices and systems offer new possibilities in the process of teaching-learning. With the use of digital technology, a high level of educational environment can be established: there is a direct connection between the what and how students learn, personalized learning method in other words learning focuses on the individual. Digital technologies make it possible for students to create their own learning environment.

The possibilities of digital cooperation have enormously increased, the gap between individuals and online teaching is much smaller than before. Modern education requires social interrelationship and adoptability for the students' learning needs and skills, however, human contact is necessary in the process. Effective teaching is not only about information flow from the teacher to the students. One of the most important skills of the fast pace changing world is adaptability and also lifelong learning. As today's students have an encounter with digital technology at a young age or in childhood, the need for developing teaching and learning, besides creating an interactive environment, increases exponentially: interest towards smart education is more intensified therefore, smart education is more and more popular.

Education has been revolutionized by technology. In the subject matter of smart or in other words intelligent education there have been several ideas worked out.

²³ Benedek András: Tanulás és tudás a digitális korban. *Magyar Tudomány*, (2007) 9., 1159-1160. o.

²⁴ Pap Dalma: Digitális környezet, mint a tanulás elsődleges közege. *Opus et Educatio*, (2007) 1., 60. o.

²⁵ Bakos Eszter: A digitális írástudás nyújtotta előnyök a munka világa szempontjából. *Pécsi Munkajogi Közlemények*, (2012) 1., 11. o.

According to one of the approaches smart education is a concept which defines learning in the digital age.²⁶ The new era idea of global education is smart learning, the purpose of which is to provide contextual, individualized, smooth learning. Smart learning has no accepted, unified definition so far. According to some perspective smart learning is not more than context-conscious, learning that is available anywhere.²⁷ In another approach, even though smart learning is based on developed IT infrastructure, the emphasis of smart learning is not only on the use of smart devices, but focuses much more on the students and the context²⁸ while in other opinions smart learning is student centered, service oriented teaching paradigm.²⁹ Smart learning environments represent a new wave of educational systems, which for the purpose of improving the learning process include pedagogy, technology as well as the two effective and efficient cooperation. A typical feature of smart learning environments is context-conscious; it can combine the classroom in its physical mean with several virtual learning environments. The developing of new technologies makes it possible for students to learn more effectively, efficiently, with more flexibility and in a more convenient way.

The main purpose of smart education is to increase students and teachers' skills. To achieve this, teachers need to have basic knowledge on smart teaching as well as applying ICT teaching-learning methods. The advantage of smart education is that it provides the students with convenient paced learning, direct interacting with their teachers and interactive lessons.

The main boosting factors of smart education are: introducing and making available smart devices and fast internet for teaching purposes.

Smart education needs to be flexible, adaptive and effective and by these it introduces a new type of learning method in the learning environment, such as: electronic learning (e-learning), mobile learning (m-learning), a learning that is present everywhere (u-learning), learning based on games (g-learning) or smart learning (s-learning). All these learning methods are the direct result of integrating smart education into the school system. Smart education uses technology, which enables students to interact with the educational community outside the classroom. Furthermore, the connectivity provided by technology enables students to work

²⁶ See: Palanivel Kuppusamy: Service-oriented Reference Architecture to Smart Education. *International Journal of Advance Scientific Research And Engineering Trends*, 5 (2020) 2., 26-42., Palanivel Kuppusamy: Emerging Technologies to Smart Education. *International Journal of Trends and Technology*, 68 (2020) 2, pp.5-16., Tore Hoel, Jon Mason: Standards for smart education – towards a development framework. *Smart Learning Environments*, 5 (2018) 3, pp. 1-25, DOI: 10.1186/s40561-018-0052-3; Mbaioosoum Bery Leouro, Mahamat Atteib Doutoum, Dionlar Lang: Smart education in Chad. *International Journal of Computer Trends and Technology*, 55 (2018) 1., pp. 17-21.

²⁷ Gwo-Jen Hwang: Definition, framework and research issues of smart learning environments - a context-aware ubiquitous learning perspective. *Smart Learning Environments*, (2014) 4., pp. 4-6.

²⁸ Ibid. pp. 4-6.

²⁹ Taisiya Kim – Ji Cho – Bong Lee: *Evolution to Smart Learning in Public Education: A Case Study of Korean Public Education*. Open and Social Technologies for Networked Learning, ed. by L. Tobias, R. Mikko, L. Mart, T. Arthur, Berlin Heidelberg, Springer, 2013, pp. 170-178.

together on projects in the classroom as well as beyond and also share information via computers and mobile devices.³⁰

In another approach in international literature, by intelligent education they mean an ICT based and sustainably organized education – mainly higher education: it is an expectation from a 21st century educational institute to maintain sustainable development and integrated ICT.³¹

According to the new UN program introduced in 2015: an action plan focusing on the establishment of a cooperating partnership of people, the planet, welfare, stabilized peace and all existing countries (from now on: Agenda 2030). One of its pillars include seventeen sustainable development goals (SDG) and 169 – including deadlines – sub-goals which should be achieved by all the countries by the year 2030. The Agenda confirms that education is social welfare and fundamental human right, furthermore it connects quality and quality teaching with education for the sustainable development and the global citizenship. From the goals SDG4 is about education, from the sub-goals 4.3 is about higher education. The inclusive, quality education for all as well as the possibility for lifelong learning are necessary for realizing sustainable development.³² By 2030 affordable and quality technical, vocational and higher educational including university education should be available for everyone. Further goal of the Agenda – education related – is that all countries need to provide all students the possibility to acquire the necessary knowledge and skills to forward sustainable development. During the realization of SDG the need to establish connection between certain goals emerged. Besides the human dimensions the goals of sustainable development focus on the integration of economic, environmental, scientific, political and governmental dimensions, there are more sub-goals to each goal. In addition to SDG4 further goals are directly connected to education as well, such as making the necessary steps to overcome climate change and its effects, improving education, consciousness, increasing of human and institutional capacity by moderating climate change, improving adaptability, decreasing effects and also predicting ahead of time.³³

Part of the governmental strategies focusing on the handling of the challenges relating to climate change is making higher education more environmentally friendly. In the recent years some English and Dutch universities carried out studies on measuring their CO₂-footprints and they have come to the conclusion that approximately 50-80% of the CO₂-footprint come from the students and their teachers commuting to and from their educational institutes as well as the outstanding effect on the environment due to the increasing number of international students traveling by air. The study has also concluded that CO₂-footprint can also be decreased by the introduction of ICT and its result of the digitalization of educational processes, for ICT makes it possible for higher education to provide high

³⁰ Jaechoon Jo, Kamuela Parker, Heuseok Lim: A Lesson Plan Platform for Smart Education. *AWERProcedia Information Technology & Computer Science*, (2013) 4., pp. 985-990.

³¹ Definition on sustainability and sustainable development see: Bándi Gyula: A fenntartható fejlődés jogáról. *Pro Futuro*, (2013) 1, 11-16. o., Fodor László: Fenntarthatósági indikátorok a jogi szabályozás hatásvizsgálatában. *Pázmány Law Working Papers*, (2012) 4., 1-2. o.

³² Jancsovicska Paulina: Fenntartható fejlődési célok. *Tájékológiai Lapok*, (2016) 2., 175-176. o.

³³ Világunk átalakítása: Fenntartható Fejlődési Keretrendszer 2030, 30. o.

level of online teaching so personal attendance is less required. Pedagogical methods using online teaching can decrease carbon-dioxide emission by decreasing the students' travel needs and accommodation costs.³⁴ Another solution to decreasing mobility could be – considering the semesters and the students – the so called blended learning as well as the higher educational institutes can also decrease effects imposed on the environment by pursuing place independency and also putting more emphasis on online teaching in their international student exchange programs.³⁵

In addition to decreasing mobility and introducing online teaching there are other moderating and attitude formatting steps to strengthen strategies facing the negative effects of environmental changes and global and local environmental challenges. Such step could be the consciously organized recycling: putting out recycle bins, discontinuing plastic, plastic water and refreshment bottles, establishing electronic systems with utilizing zero paper, for water management automated taps, as well as using eco water aerators, installing systems with solar panels for decreasing fossil energy needs, organizing teacher-student action plans, working out sustainability, environmental courses and curriculums for developing consciousness as well as organizing events in the topic and supporting researches. Therefore, the educational institute can support sustainable development not only in its operation, but in the education and research point of view as well, and by doing so it could help establish a more sustainable, equal and peaceful world.

Higher education has an advanced role in realizing the goals of sustainability and building environmental consciousness: it should represent the knowledge and values in possession of which the students could form their surroundings and the world in accordance with the requirements for sustainability. Universities should become places where sustainability and accordingly extended curriculum are not only taught, but experienced so all procedures are planned according to the principals of sustainability and carried out in all departments of the university: during the operation, organization, by the management, in the field of social life and researches. This way the university itself sets the example for the students or in other words it sets the principals of sustainable development as part of their everyday life.³⁶ Therefore the role, operation and operational principals of the institute are essential in the service of sustainable development.³⁷

³⁴ Caird Sally, Lane Andrew, Swithenby Edward, Roy Robin, Potter Stephen: Design of higher education teaching models and carbon impacts. *International Journal of Sustainability in Higher Education*, 16 (2015) 1., pp. 96-111.

³⁵ Marieke Versteijlen, Paquita Perez Salgado, Marleen Janssen Groesbeek: *Smart Education*. 4th International Conference on ICT for Sustainability, 2016, pp. 242-243.

³⁶ Fenntartható fejlődési célok oktatása – Tanulási célok. UNESCO, 2017, 36-37. o.

³⁷ Bándi Gyula: A szubszidiaritás a fenntartható fejlődés környezetvédelmi szemszögéből. *Iustum Aequum Salutare*, (2013) 2, 190. o.

Final thoughts

Overall, it could be concluded that the purpose of smart education is to provide individually organized services and smooth learning experience for all. So smart teaching-learning is a new concept which establishes a more effective and useful learning environment than the previously existing technology based educational methods, however, faces us with several challenges in the future in regards of learning methods, teaching systems and ideologies.

Education and training are the best investments in the future, they have a key role in growth, innovation,³⁸ creating jobs and furthering sustainable development. Future educational systems need to adapt to the requirements of the digital age and must provide people with the knowledge, skills and competences for the innovation and welfare. The prevalence of ICT and the wide range of connections provide enormous possibilities to overcome digital gaps and also from the perspective of developing knowledge-based society.

Establishing a more sustainable future requires universal unity in order to decrease the long term negative effects that society and the environment are facing and recognize the need for changes. Higher education can greatly contribute to the decreasing of dissonance between teaching and learning by providing sustainable development, ICT and also taking advantage of the benefits of smart learning. Universities need to commit to sustainable development, which create a platform in the curriculum, institutional management and also the services.

³⁸ Paulovics Anita, Cseh Gergely: Állam és társadalmi innováció. *Közjogi Szemle*, (2018) 4., 9. o.