

Sustainable education and information technologies

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Abstract. This article focuses on the sustainable education and information technologies. It analysis the importance of the online education and the benefits it can bring, especially in the light of the recent massive online teaching and home office working mode during the COVID-19 pandemic, The flexibility of the education tools that include the use of information and communication technologies (ICT) appears a great facet of the sustainable education that might help to contribute to mitigating the climate change and to prepare responsible citizens who would adhere to the principles of the sustainable development. The article concludes with a call to integrate the concept of sustainable information into educational programmes for computer scientists and future ICT professionals. In addition, it suggests that information technologies should find a wider use in promoting sustainable development as a part of the sustainable education.

1 Introduction

Information and communication technology (ICT) is often being used as a tool to enable the development of a sustainable education system and a more efficient and sustainable society [1]. In the education system, it represents a driving force behind the idea that the ability to convey desirable goals and values that cannot be overemphasized in society would enable expected learners to be useful to themselves and to society as a whole. It transfers desirable goals and values to education, which can then be anchored in our society through the use of the instruments available to us today [2].

As the global warming and climate change becoming worse and cause adverse effects on our socio-economic sphere, business companies worldwide must dedicate themselves to greening their IT systems in order to reduce costs. Current and future government and business workers need to be educated and informed about the importance of sustainable education systems and information technologies in their work [3]. Many scientists stress the importance of teaching students about the benefits and importance of green computing. Although the adoption of green education and information technologies in the workplace is slower than expected, given obvious trends and entrepreneurial drivers, forward-looking organizations are looking for ways to train workers today. Another green computing teaching method involves hands-on projects involving portable wireless sensor networks. Researchers

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found that introducing green computer content into basic courses increased awareness of sustainability issues, contributed to the personal introduction of green technologies and contributed to project use [4]. One can see that there are certain strategies for integrating sustainable information into the curriculum and found that integrating sustainable information contributed to understanding the sustainability of computer applications. Figure 1 that follows shows the share and number of students potentially reached by digital and broadcast remote learning policies as reported by UNICEF [5].

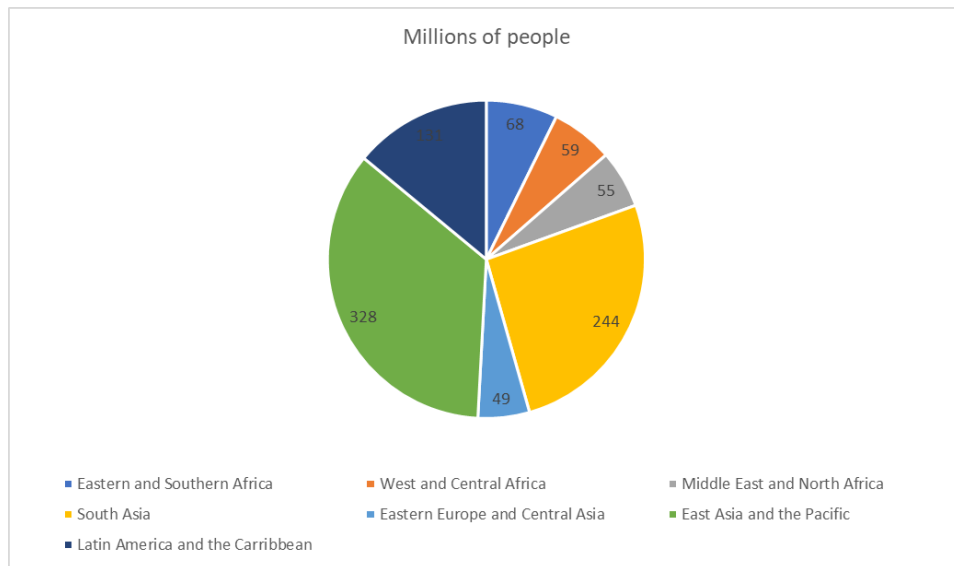


Fig. 1. Share and number of students potentially reached by digital and broadcast remote learning policies

Information science in developing countries has both social and economic dimensions. The concept of a sustainable information system was developed in the framework of the World Summit on Information Society and Information Technology and the International Conference on Sustainable Information Systems [6].

The ICT sector plays an important role in supporting industry - relevant training that promotes high-quality training programmes to prepare students for employment. There is a growing need to complement university students themselves with courses that strengthen their ongoing technical studies and ICT skills and increase their readiness for jobs in the telecommunications and ICT sectors. Bridging the skills gap between current and future workers is therefore crucial to meet the rapidly changing skills needs of a world increasingly dominated by information and communication technology [7].

There is a strong correlation between the use of environmental education and the development of cognitive skills in children and adults. Many studies show that students with a strong interest in environmental issues such as climate change, water quality, energy efficiency and environmental sustainability have developed the ability to synthesize complex information about their knowledge of the environment [8]. This is just one example of the diversity of approaches to knowledge acquisition that we are seeing in education today, particularly with regard to education for children and adults. Educational approaches that focus on experience, problem-based learning and problem-oriented learning are designed to enable individuals to actively participate in a world around them and thus to form a deeper understanding of a particular subject or area of interest. This approach to reshaping education

includes both problem-based and phenomenon-based learning methods used in countries around the world that are known for having one of the best education systems.

2 Sustainable education and distance learning

Nowadays, in the middle of the COVID-19 pandemic that sent millions of people to home offices and online working mode, there has never been a better time for students, professors, and innovators to lay the foundations for a new kind of education [9]. The introduction of online courses in the middle of the semester will allow students to compare digital with analogue versions of their courses. As a result, hybrid education models are well positioned in a post-pandemic world to respond to existing challenges, seize opportunities, and broaden the range of opportunities available to students and educators in the global education system. Second, disruptive technologies provide a global learning community with access to a wide range of resources and opportunities for innovation and cooperation. On the other hand, they disrupt the very models that try to make learning possible [10].

While some states have been praised for distance learning in the midst of the coronavirus pandemic, the transition from underclass to online education poses significant challenges. As universities begin to shift their activities online, education agencies are rushing to provide support for distance learning adaptation, as well as training for teachers, administrators, students and staff. With regard to the above, we all have to prepare for numerous steps to prepare for a large dose of online education, including a one-to-one initiative that will make notebooks available to all middle and high school students [11].

Figure 2 that follows provides the results of the United States Census Bureau Household Pulse Survey showing the percentage of households with children by reported change [12].

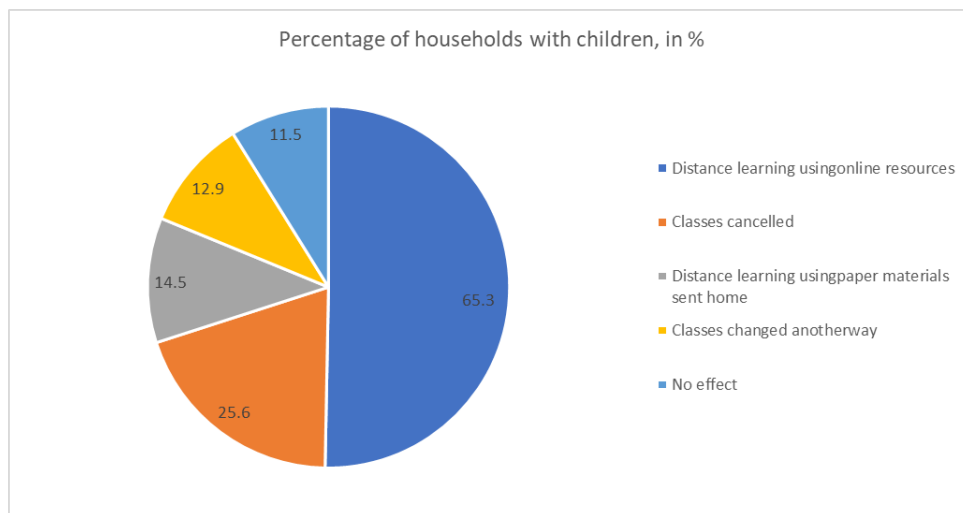


Fig. 2. Impact of pandemic on children's education in the United States

With the start of the new school year, distance learning will continue to play a role, as it is often linked to learning in the classroom. Nevertheless, educators are quick to respond to ensure that learning can continue even in less ideal circumstances. When it became necessary this spring, very few school districts were prepared for distance learning. The move towards distance learning has been challenging, with some preparatory work done, including the development of a comprehensive online education curriculum. But we all know that distance learning will remain here and educators need to optimize the experience to get the best results

for students. Most of the above would require more resources than people at university currently have. But the shift to home schooling has highlighted the importance of comparing people with lower socioeconomic status with more privileged classmates. This assessment also makes it necessary to improve online education platforms for universities to better meet the needs of students working and living in environments that can sometimes be resource-intensive - poor and poor internet connectivity. To close this capacity gap, we are thinking about the need for organizations, people, and universities to develop stronger partnerships, both globally and regionally.

3 Online education in the pandemic

In the long run, specific conditions - informed decisions and programs that take the country into account - have the potential to improve pedagogy, improve school governance, and address many other aspects of the learning experience. As countries rebuild themselves in response to COVID-19, there is an urgent need to accelerate research on how best to support high-quality education. We build on the work of international organizations such as the World Economic Forum and the United Nations Development Program to develop education strategies that can be used in a variety of contexts, from high-risk and low-income countries to high-poverty and low-education countries. Perhaps one positive outcome of this pandemic is that it will lead us to address many of the remaining global education problems sooner than expected. As more universities and students see the benefits first hand, the trend towards online learning is likely to continue well beyond the pandemics [13].

The online method of education is that it can be a highly effective alternative educational medium for mature, self-disciplined students. Online asynchronous education allows for greater flexibility and flexibility in terms of the student's learning experience and gives students control over their learning experience. However, this gives the student more responsibility and leads to more stress and stress. For students to participate successfully in online programs, they must be well organized, self-motivated, have a high level of time management skills to keep up with the course, and have a high level of motivation and motivation. The researchers go further, calling online education a pandemic of "distance learning in an emergency, as the latter is at odds with the quality of effective online learning. For this reason, online education institutions do not behave in a dependent manner on other students who are dependent learners and have the responsibility to assume the responsibilities required by an online paradigm. Before the COVID-19 pandemic, some schools ran distance learning programs that helped the higher citadel of learning with its migration process. However, many schools and universities were forced to close because the government had not announced measures to curb the spread of COVID-19, which led to the closure [14].

Previously, it had conducted a high-quality online education programme to support high learning levels in its migration processes. To limit the rapid spread of the pandemic by the global community, the only way universities have access to online learning is to use it. Large parts of the world are quarantined, and that is why many cities have turned into ghost cities. The quarantine effect is also observed in schools, colleges and universities. The coronavirus has led to the institutions moving from offline to online mode of education. Various online teaching and online learning can be described as a panacea for this crisis. This crisis will lead to institutions that were previously reluctant to change accepting modern technologies.

All in all, the COVID-19 pandemic has affected millions of students worldwide and led to unprecedented closures of university facilities. Some have continued their academic courses while avoiding gathering people in their dormitories and other public spaces such as schools and universities. Although children under 19 regularly attend online schools, a large majority of these children have no previous experience of the pandemic of distance learning. This study compares the effects of online education activities on the learning experience of

students and documents how student-centred active learning can be offered in the context of distance learning in a dental school. Learning through group discussions, which take place synchronously on an online communication platform, is a new learning method that has not been implemented in dental schools.

The American Association of Colleges and Teacher Education, which surveyed 76 percent of college graduates, is working with schools to determine the impact of online education on their students' learning experiences. In an online learning environment, students can have more control over their learning process. In K-12 education, online learning can be an important part of the learning experience for students, faculty, staff and administrative staff. The recession has forced most K-12 schools in the United States to close in recent years [15]. We are starting to wonder what kind of support schools and universities need at the moment. Many teachers and lecturers are forming working groups to figure out how to tailor their programs, including developing technologies - improved teaching solutions to address the pandemic - and moving to distance learning. Future teachers may, for example, offer virtual lessons to pupils, or offer distance tutoring or support teachers in developing learning materials.

4 Sustainable development and flexibility of education

According to the World Economic Forum's Global Competitiveness Report, the number of students enrolling in higher education worldwide is expected to reach about 300 million. This expansion has led to a diversified sector that reflects the diversity of learners entering the system, including from non-traditional groups [16]. As a result, higher education is increasingly expected to adapt to different learning needs, which means offering well-structured and flexible learning pathways that can deliver the best results. In order to strengthen equity in lifelong learning, it is recognised that the education system needs to be adapted to better support flexible learning pathways. The general premise is that life - long learning - must become more than a hopeful catchphrase if people and businesses are to thrive in a rapidly changing global economy. Access to education should be free and fair, and should provide young people with the skills they need for their lives. This is a continuation of the global push for universal access to quality education for all children. There is an urgent need to ensure high quality education to ensure that every child worldwide is taught at primary and secondary level by 2030. It is therefore necessary for the higher education system and employers to work together to introduce flexibility through accelerated degrees and to enable learners to combine study and work with work in study. Flexible learning paths between qualification and employment offer important benefits as economies recover from the COVID-19 crisis [17]. By enabling more diverse learning opportunities, learners' educational profiles can be adapted to the needs of their employers and the wider economy. Such practices have the potential to improve the employment of graduates and introduce flexibility to respond to different learning styles. The growing range of available skills of the workforce and the increasing skills of the labour market allow people to learn when they want to. Internet access offers education policy makers the opportunity to improve the quality of education for individual learners and contribute to national economic and social well-being. To ensure that implementation plans take advantage of this opportunity and remain relevant in the development of technologies and services, policymakers should monitor the development of the Internet. Internet access and its potential to transform lives and contribute to the achievement of education and other sustainable development goals. Even before the COVID-19 crisis, it was recognised that a flexible higher education system offers a variety of learning pathways to promote equity and lifelong learning. Recent research on the capacity of universities to respond to the needs of their pupils has shown, however, that greater flexibility is needed in the development of education policies and implementation plans [18].

There is little, but growing evidence that commitment to these goals, which has never been more relevant, and the modes of effective information and governance systems that best respond to crises are critical to achieving the Sustainable Development Goals (SDGs) and other education goals [19]. In this paper, we argue that it is important for students at all levels to recognize that sustainable development, democracy and peace are indivisible. EFSs at secondary level offer all students the opportunity to explore and develop strategies that enhance their knowledge and skills with democratic values and principles. It is important that future citizens act as agents of change for the common good, including economic, social and environmental justice, and that EFS can improve pupils' knowledge and skills at secondary levels, which hopefully will lead to such actions. In the digital age, citizens need to be prepared to respond to the challenges posed by social media and other forms of information and communication technology (e.g. social networks such as Facebook, Twitter, Instagram and others). This will allow young adults to address the problems they may face in the future and develop strategies for collective movements to address these problems [20]. The world urgently needs to rethink how education is delivered, how it is taught, and what skills children need to become healthy and productive members of society.

5 Concluding remarks

Overall, sustainability necessarily includes not only the need for sustainable education, but also sustainability in all areas, and this includes the challenges of globalisation. Moreover, the impact of ICT on the added value of the global education system and its old education system has remained controversial.

Sustainable education provides learners with creative problems - by solving skills needed to meet complex ecological challenges in the 21st century. We are facing the challenges of meeting the needs of a world of more than 1.5 billion people, and it is estimated that the world's population (over 7 billion) will need twice as many resources in 2030 as our planet will provide in its lifetime. The final aspect of environmental education policy is to train individuals to thrive in a sustainable society.

In order to succeed in the 21st century, citizens must have a strong relationship with nature, in which they build strong relationships with it. In addition, the current workforce needs to be retrained and retrained to adapt to the new green economy. Fortunately, the practice of sustainability, which balances the needs of today's people with the future of the people, can provide a solution to these difficult problems. This seminar will examine the role of education in developing a sustainable future for the United States and its citizens and how these ideas can be put into practice. Although there is no generally accepted definition of "sustainability," students will explore what makes them "final" and ultimately build on the class definition throughout the semester. Examples of these ideas are the development of a "thinking system" for dealing with the environment, the use of renewable energies and the application of sustainability in the education system.

Thence, effective leadership in combination with school - a broad range of effective teaching - means that students have equitable access to high-quality learning opportunities, resulting in improved outcomes that are sustainable over time. Using these approaches, many high educational institutions are successfully using environmental education to develop key 21st century skills. Environmental education can be integrated into existing curricula and helps teachers meet standards in several disciplines. This development of modern teaching methods can be supported by providing physical and digital infrastructure. Therefore, it seems that stakeholders need to integrate the concept of sustainable information into educational programmes for computer scientists.

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References

1. P. Jones, M. Wynn, D. Hillier, D. Comfort, *Indonesian Journal of Sustainability Accounting and Management*, **1(1)**, 1-15 (2017)
2. U. Yessenbekova, O. Turzhan, K. Koshanova, I. Yegemberdiyev, B. Kutym, *Media Watch*, **11(2)**, 348–355 (2020)
3. P. Kirby, *Karl Polanyi and the Contemporary Political Crisis: Transforming Market Society in the Era of Climate Change* (2020)
4. S. Sunny, C. Shu, *Small Business Economics*, **52(4)**, 905-927 (2019)
5. UNICEF, Education and COVID-19, <https://data.unicef.org/topic/education/covid-19> (2020)
6. B. De la Hoz-Rosales, J. Camacho-Ballesta, I. Tamayo-Torres, *Entrepreneurship and Sustainability Issues*, **7(2)**, 782 (2019)
7. W. Strielkowski, D. Streimikiene, A. Fomina, E. Semenova, *Energies*, **12(24)**, 4790 (2019)
8. S. Otto, P. Pensini, *Global Environmental Change*, **47**, 88-94 (2017)
9. S. Donitsa-Schmidt, R. Ramot, *Journal of Education for Teaching*, **46(4)**, 586-595 (2020)
10. A. Sangster, G. Stoner, B. Flood, *Accounting Education*, **29(5)**, 431-562 (2020)
11. L. Mishra, T. Gupta, A. Shree, *International Journal of Educational Research Open*, **1**, 100012 (2020)
12. USA Facts, 65% of households with children report the use of online learning during pandemic, <https://usafacts.org/articles/65-of-childrens-education-has-moved-online-during-covid-19> (2021)
13. J. Daniel, *Prospects*, **49(1)**, 91-96 (2020)
14. M. Savic, *World Futures Review*, **12(4)**, 385-395 (2020)
15. U. Kaden, *Education Sciences*, **10(6)**, 165 (2020)
16. M. Wotto, *Journal of Educational Technology Systems*, **49(2)**, 262-281 (2020)
17. M. Sigala, *Journal of Business Research*, **117**, 312-321 (2020)
18. C. Hodges, S. Moore, B. Lockee, T. Trust, A. Bond, *Educause Review*, **27**, 1-12 (2020)
19. O. Kostoska, L. Kocarev, *Sustainability*, **11(7)**, 1961 (2019)
20. J. Guo, N. Liu, Y. Wu, C. Zhang, *Information & Management*, **58(1)**, 103286 (2021)