# Impact of E-learning on the environment and the optimization of the use of natural resources

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**Abstract.** Online education, also called e-learning, has several advantages in terms of environmental impact and optimization of resources. Over the past few years there has been a huge shift towards e-learning platforms as a place for learning and education. During these days of confinement due to the COVID19 virus, students, administrators, practitioners, administrators and others visited these platforms more than ever. E-learning allows learners to access courses and educational resources from anywhere, eliminating the need to physically travel to a learning location. That reduces fuel consumption and greenhouse gas emissions associated with travel. For That reason, That article proposes a reflection on the concept of e-learning or computerized learning environment with the aim of allowing the involvement of users in the preservation of the environment and the optimization of the use of natural resources. . The learning environment is defined in that article as a real or virtual place bringing together one or more systems that interact with a common objective, which is learning. The use of Learning and not teaching with environment confirms the fact that knowledge is made by a community of learners more than by the transmission of knowledge from the teacher to the student. Meanwhile, the learning environment is computerized when some or all of the interactions between the subsystems are supported by computing resources. Indeed, the environment hosts several activities in addition to the tools and equipment necessary for their realization. The concept of an open environment offers an interesting avenue for that purpose. It should be noted that e-learning does not completely replace traditional forms of education, but complements and diversifies learning options. Adopting e-learning in education can bring significant benefits in terms of environmental impact and value for money, while providing more flexible and accessible learning opportunities.

**Keywords:** E-learning, environment, optimization, use of natural resources

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## 1 INTRODUCTION :

Online learning platforms require IT infrastructure, but they can be more energy efficient compared to traditional classrooms. Online courses save energy used for lighting, heating or air conditioning of premises. E-learning allows students to take courses on their own schedule, reducing scheduling conflicts and unnecessary travel. It also allows resources to be grouped together and made accessible to a greater number of learners, which optimizes the use of educational resources. E-learning facilitates access to education for people who cannot physically travel to a place of learning, whether due to geographical constraints, mobility limitations or other obstacles. That makes it possible to democratize access to education and reach a wider audience. Within education, there has been a severe talk about Computer Based Learning Environment (CBLE) as a new tool to foster learning. Meanwhile, there are various concepts and techniques used to provide the same service. These terms vary in the words that are used, but share the same outcome. That outcome is the use of technology for the sake of facilitating learning. Some examples of these concepts include Computer Enhanced Learning Environment as well as Technology Intensive Learning Environment (TILE) proposed by (Salomon, 1994), Enriched Learning and Information Environment (ELIE) suggested by Goodrum, Dorsey and (Schwen, 1993), and Computer Based Learning Environment proposed by (Salomon, 1992). That diversity in terms of naming educational applications may have several reasons. That paper tries to discuss the difference between e-learning expressions. It also targets the significance of these educational changes so as to provide a reflection on the appropriate meaning of computerized learning environment. Moreover, computerized learning environment is discussed in That paper with regard to its uses for educational purposes as identified in several studies and fields. By reducing travel, paper consumption and the use of other material resources, online education helps reduce the overall carbon footprint of the education system. That promotes environmental sustainability and the preservation of natural resources.

## 2 E-LEARNING AS AN INSTRUMENT FOR PRESERVING THE ENVIRONMENT:

The concept of e-learning, also known as e-learning, refers to the use of information and communication technologies to facilitate distance learning. It is based on the use of online tools and platforms for the transmission of knowledge, interactions between learners and trainers, as well as the assessment of skills. E-learning allows learners to access courses and educational resources anytime and from anywhere, as long as they have an internet connection. That provides increased flexibility and accessibility, allowing learners to engage in learning activities at their own pace and within their own constraints. E-learning platforms often offer interactive features such as online discussions, discussion forums, live chats, webinars, etc. That allows learners to interact with trainers and other learners, promoting the exchange of ideas, collaboration and social learning. E-learning uses a variety of educational media such as videos, presentations, animations, simulations, interactive quizzes, etc. These multimedia formats enrich the learning experience, make the content more attractive and promote a better understanding of the concepts. E-learning platforms often offer tools to track and assess learner progress. Trainers can monitor learner activities, rate their performance, and provide personalized feedback to help them progress in their learning. Overall, there is an increasing talk about creating learning environments instead of the use of teaching methods to influence knowledge because of the active role of the learner in constructing knowledge based on cognitive and constructive perspectives (Collins, Greeno and Resnick, 1994). That is to say, that learning environments are very important in the learning process. E-learning often allows personalization of learning based on learners' needs and preferences. Learning paths can be tailored based on each learner's specific skill level, interests, and goals, which promotes more focused and effective learning. E-learning promotes lifelong learning by providing opportunities for continuous learning and professional development. Learners can access regularly updated resources and courses to stay current in their field of study or career. E learning has many advantages, such as flexibility, accessibility, interaction and personalization, which makes it a popular alternative to traditional learning methods. It is widely used in the fields of formal education, professional training, personal development and corporate training.
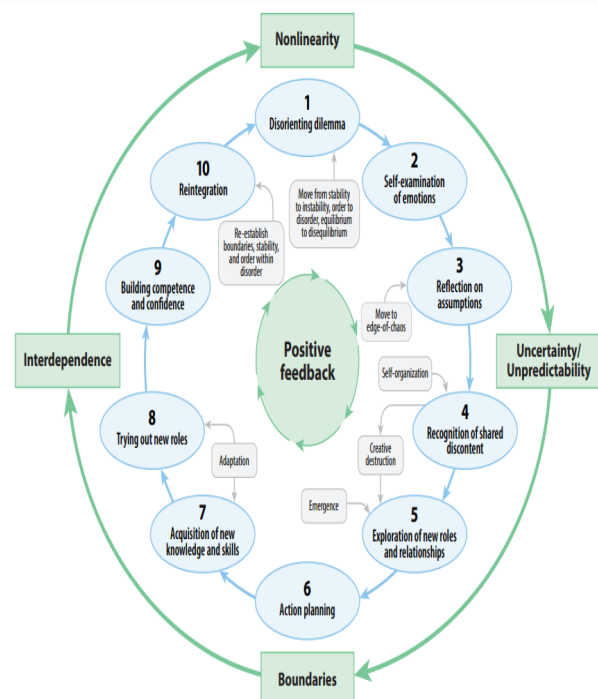


**Fig.1.** Transformative learning from a complexity framework.

Source : Marty Jacobs ,2019

E-learning can be considered as an instrument for preserving the environment thanks to several aspects, it allows learners to access courses and educational resources remotely, without having to physically travel to a place of learning. . That reduces greenhouse gas emissions from travel, helping to reduce air pollution and carbon footprint. By using digital learning media rather than physical media such as paper, books and school supplies, e-learning saves natural resources. Less paper used means fewer trees felled and less energy consumed in the production and distribution of physical educational materials. E-learning can be done using computers and electronic devices, which can be more energy efficient compared to traditional classrooms. E-learning platforms can be optimized for reduced power consumption, helping to conserve energy resources. The use of digital media in e-learning reduces the production of waste such as notebooks, textbooks and printed sheets. That contributes to the reduction of solid waste, thus avoiding environmental pollution and the need for its proper disposal.

E-learning can be used to make learners aware of environmental issues and the importance of preserving the environment. Online courses can incorporate learning modules on environmental issues, sustainability strategies, and good green practices, thereby promoting environmentally responsible awareness and behavior. E-learning makes environmental education more accessible to a wide audience. Online courses on environmental topics can be taken by people in different geographic regions, eliminating distance barriers and enabling more people to access environmental knowledge and skills. By combining the benefits of online learning with an environmentally-focused educational approach, e-learning can play an important role in preserving the environment by promoting more sustainable educational practices and raising awareness among learners about environmental issues.

## 3 CONTRIBUTION OF E-LEARNING TO THE OPTIMIZATION OF THE USE OF NATURAL RESOURCES:

Optimizing the use of natural resources has become a necessity due to environmental challenges and increasing pressures on our planet. Optimizing the use of natural resources helps preserve the environment by reducing pressure on ecosystems and minimizing damage to biodiversity. By using resources more efficiently, we can prevent environmental degradation, destruction of natural habitats and loss of species. The ecological footprint measures the impact of a person, organization or activity on the natural resources needed to support their way of life or functioning. Optimizing the use of resources reduces the ecological footprint by minimizing the excessive consumption of resources and promoting

sustainable practices. Many natural resources are finite and non-renewable, such as fossil fuels, minerals, and some types of fresh water. By optimizing their use, we can extend their lifespan and ensure their availability for future generations. It also promotes economic resilience by avoiding shortages and price spikes. Many natural resources are finite and non-renewable, such as fossil fuels, minerals, and some types of fresh water. By optimizing their use, we can extend their lifespan and ensure their availability for future generations. It also promotes economic resilience by avoiding shortages and price spikes.



**Fig.2.**Sustainable Utilization of Natural Resources

The environment is defined as a place that gathers one or more systems based on the systems' theory perspective. On the other hand, a set of components make up a system, which generates a response under the effect of a stimulus. More importantly, the actions of This system are oriented toward a common objective. Besides, learners and teachers within This perspective are seen as a system making a classroom. Meanwhile, each of them is considered as a component or subsystem orienting their actions toward the development of new knowledge. For instance, learners could persuade teachers through suggesting topics and asking questions to affect their behavior. Similarly, teachers could provide instructions and offer challenges to engage learners in the process of finding solutions. The term environment reflects the new paradigm that animates the world of education by suggesting a learning model based on exploration, initiative, and freedom of choice. Based on his definition, a learning environment is somewhere that allows learners to draw resources so as to construct meaningful solutions for the problems. The word constructivist seems only one way to emphasize the importance of offering learners the opportunity to carry out relevant and authentic learning activities that help them build their knowledge and develop their skills.

Optimizing the use of natural resources can also lead to significant financial savings. Efficient use of resources

reduces the costs associated with their extraction, processing and use, which can have a positive impact on individual, organizational and government budgets. Optimizing the use of natural resources is a key component of sustainable development. By adopting sustainable resource management practices, we can meet present needs without compromising the ability of future generations to meet their own needs. Optimizing the use of natural resources is essential to preserve the environment, reduce our ecological footprint, save limited resources, mitigate climate change, achieve financial savings and promote sustainable development. It is imperative to ensure a viable and prosperous future for present and future generations.
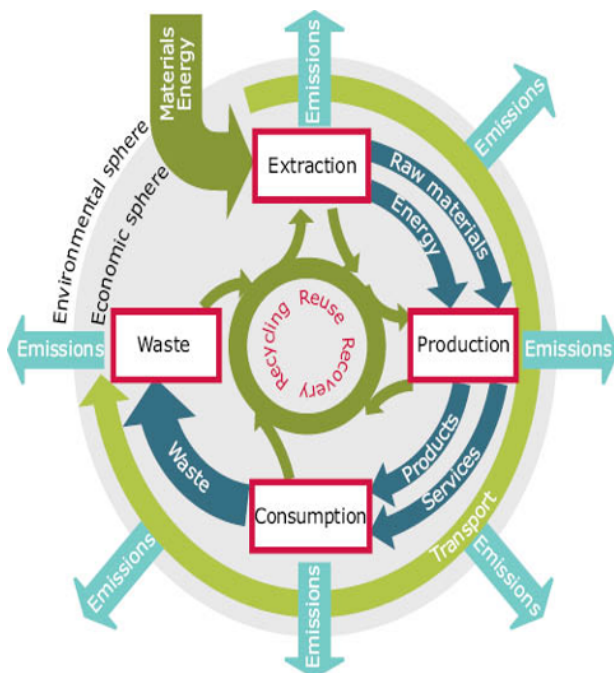


**Fig. 3.** Life-cycle chain

Source: EEA, ETC Sustainable Consumption and Production.

E-learning can contribute to optimizing the use of natural resources in several ways. E-learning promotes the use of digital media such as electronic documents, online presentations and electronic books. That drastically reduces the demand for paper, helping to preserve trees and minimizing the environmental impact of tree felling, transportation and converting cellulose into paper. Compared to traditional learning methods that require classrooms to be lit, heated or cooled, e-learning requires less energy to create a learning environment. Learners can take online courses from home or any other location of their choice, reducing the energy consumption associated with physical educational infrastructure. E-learning allows learners to access courses and educational resources without having to physically travel to a place of learning. E-learning provides flexibility and accessibility to learners, allowing them to study at their own pace and convenience. Learners can access course materials, lectures, and assessments from anywhere with an internet connection, eliminating the need for commuting

or being restricted by geographical location. E-learning can be a cost-effective alternative to traditional education. It eliminates expenses related to transportation, accommodation, and physical learning resources. Additionally, online courses are often more affordable compared to traditional in-person programs, making education more accessible to a wider range of learners. E-learning platforms offer a variety of multimedia resources such as videos, interactive modules, quizzes, and discussion forums. These resources engage learners and cater to different learning preferences, enhancing the overall learning experience. E-learning enables learners from different geographic locations and backgrounds to connect and collaborate. Online discussion forums and virtual classrooms provide opportunities for knowledge sharing, exchanging perspectives, and engaging in collaborative projects with peers from around the world. That can reduces transport-related greenhouse gas emissions, helping to preserve the environment by reducing air pollution. E-learning requires the use of technological infrastructures such as computers, servers, networks and online platforms. However, these resources can be optimized for energy-efficient use and to meet the needs of large numbers of learners, reducing the demand for technology resources and optimizing their use. E-learning makes it possible to offer learning opportunities to a wider audience, regardless of their geographical location. That reduces the need to build and maintain physical educational infrastructure, which saves natural resources and promotes a more equitable distribution of educational opportunities. By combining the advantages of e-learning with eco-responsible educational practices, e-learning can help optimize the use of natural resources. It offers a sustainable alternative to traditional learning methods, reducing paper and energy consumption and minimizing the environmental impact associated with travel and the construction of physical infrastructure.

Risk management is essential to ensure the sustainability of drinking water. It is important to identify potential risks that can impact the quality and availability of drinking water. That can include risks related to water contamination, overexploitation of water resources, climate change, natural disasters, aging infrastructure, etc. Once the risks have been identified, it is necessary to assess their probability of occurrence and their severity. That allows risks to be prioritized and appropriate management measures to be determined. Risk assessment can be based on technical studies, statistical analyses, predictive models and environmental assessments. Risk management involves the implementation of prevention and control measures to reduce the probability of occurrence of risks and minimize their impact. By implementing a robust risk management process, organizations can proactively address potential risks, reduce their impact, and enhance their overall resilience. That allows them to make informed decisions, protect their assets, and ensure the successful achievement of their objectives. That may include measures such as protection of water sources, implementation of water quality monitoring procedures,

adoption of sustainable agricultural practices to reduce water pollution, proper waste management and sewage, etc. Risk management also includes contingency planning to deal with critical situations such as sudden water contaminations or water shortages. It is important to put in place emergency response plans, early warning systems, communication and coordination procedures with stakeholders to ensure an effective response in the event of a crisis. Risk management requires continuous monitoring of water quality, water sources and infrastructure. That allows early detection of signs of potential problems, identification of risk areas and appropriate preventive or corrective action. Public awareness and education are key elements of risk management. Informing communities about the risks associated with drinking water, good water use practices, responsible behaviors and prevention measures helps to build resilience and stakeholder participation. Risk management is essential to ensure the sustainability of drinking water. It involves the identification, assessment and management of potential risks, the implementation of prevention and control measures, emergency planning, continuous monitoring and public awareness. A proactive approach to risk management helps preserve the quality of drinking water, protect public health and ensure the sustainability of water resources.

# 4 E-LEARNING AS OPTIMIZATION AWARENESS TOOLS ON ENERGY CONSUMPTION:

Energy optimization awareness tools play a crucial role in promoting energy efficiency and sustainable practices. These systems allow real-time monitoring and analysis of energy consumption in different environments such as buildings, factories or homes. They provide information on energy consumption patterns, identify high consumption areas and enable rapid interventions to optimize energy efficiency. Energy audits identify inefficiencies and energy waste in a specific building or process. They provide the equipment, systems and operations to identify areas where energy saving measures can be implemented. That helps organizations prioritize energy optimization strategies. EMS software enables organizations to effectively track, analyze and manage their energy consumption. They help monitor energy usage, set goals, identify deviations, and implement energy-saving measures. EMS provides actionable insights and translates decision making to optimize energy consumption. These energy efficiency labels and certifications, such as Energy Star or LEED, provide information about the energy performance of appliances, buildings or products. These labels encourage consumers to make informed choices by producing energy-efficient options, which helps reduce energy consumption. Awareness campaigns and educational programs play a vital role in promoting the optimization of energy consumption. These initiatives aim to inform and educate individuals, households and businesses on the

importance of energy conservation, efficient practices and the benefits of optimizing energy consumption. such as smart meters, smart thermostats and automated energy management systems, enable real-time monitoring, control and optimization of energy consumption. These technologies allow users to make informed decisions and manage their energy consumption. But the most important thing is that E-learning could easily simplify all the interactions of all the parties to reduce the cost and the time of raising awareness of the optimization of energy consumption as well as the preservation of energy use of natural resources.

E-learning can play an important role as an awareness tool for optimizing energy consumption. Here are some ways e-learning can help raise awareness. Online training modules can be developed to provide detailed information on energy efficiency best practices. These modules can cover topics such as energy management in buildings, efficient use of electrical appliances, renewable energy sources, etc. Learners can follow these modules at their own pace, gaining precise knowledge about energy consumption and ways to optimize it. E-learning can incorporate simulations and interactive models to illustrate the impacts of energy consumption on the environment and the economy. These visual tools help learners understand the consequences of their energy choices and make more informed decisions to reduce their energy footprint. E-learning can feature case studies and practical examples that highlight best practices in optimizing energy consumption. That allows learners to see how other individuals, businesses or communities have managed to reduce their energy consumption and save money. Quizzes and interactive assessments built into online courses can help test learners' knowledge of optimizing energy use. That reinforces key concepts and encourages critical thinking about how to save energy as described in figure 4.
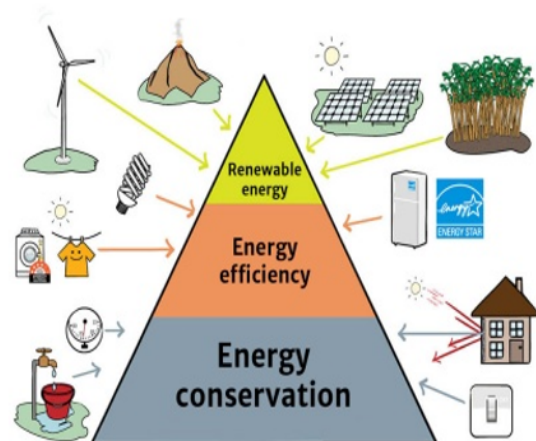


**Fig. 4.** Energy Sustainability Pyramid

E-learning facilitates the creation of online learning communities where learners can share their experiences, ask questions and exchange ideas on optimizing energy consumption. That promotes collaboration and mutual learning, while creating a culture of energy efficiency

awareness. By using e-learning as an awareness tool for optimizing energy consumption, it is possible to reach a wide audience and promote responsible behavior in terms of energy. That contributes to creating a society that is more aware of the importance of conserving energy resources and implementing concrete measures to reduce our environmental footprint.

The orientation of e-learning can have a significant impact on energy optimization. E-learning allows learners to access online courses and resources from anywhere, eliminating the need to physically travel to a learning location. That reduces energy consumption related to travel, such as the use of vehicles or public transport. Traditional educational institutions require physical facilities, such as classrooms, offices, and training centers, which require energy for lighting, heating, air conditioning, etc. E-learning makes it possible to reduce these physical infrastructure needs, which translates into energy savings. E-learning requires the use of technologies such as computers, servers, online platforms, etc. However, by adopting efficient power usage practices, such as the use of low-power devices, power management, and server optimization, it is possible to minimize the footprint. energy of these technologies. E-learning promotes the virtualization of resources, which means that courses, documents, teaching materials and interactions can be done digitally. That reduces paper consumption and printing requirements, helping to conserve natural resources. E-learning can include modules or courses on energy efficiency, thereby raising awareness of good practices in the responsible use of energy. That can encourage them to apply these principles in their daily and professional lives, contributing to better overall energy optimization directing E-leaning towards energy optimization can reduce travel, save energy in learning infrastructures, use technology resources efficiently, virtualize resources and raise awareness to energy efficiency. That helps reduce the environmental footprint of education and promote more sustainable use of energy resources.

## 5 CONCLUSION:

In conclusion, the use of e-learning plays an essential role in protecting the environment and reducing energy consumption. E-learning helps raise public awareness of environmental issues and the need to reduce our energy consumption. Through online training modules, interactive simulations and case studies, learners can gain in-depth knowledge of best practices in environmental protection. E-learning provides flexible access to educational resources, allowing learners to learn at their own pace and from any location. That reduces physical travel and thus contributes to reducing transport-related carbon emissions. Thanks to the virtualization of courses and educational materials, e-learning saves natural resources such as paper and water. Digital assets can be reused and updated easily, reducing

waste. By eliminating physical travel, e-learning contributes to reducing the energy consumption associated with transport. In addition, by making learners aware of energy efficiency practices, e-learning encourages the adoption of eco-responsible behaviors in their daily and professional lives. E-learning facilitates the creation of online learning communities where learners can exchange ideas, share experiences and collaborate to find innovative solutions for environmental protection. That promotes the dissemination of good practices and encourages the active commitment of all players in the preservation of the environment. By combining accessibility, flexibility, optimization of resources and reduction of energy consumption, e-learning offers an effective means of raising awareness, educating and mobilizing individuals for the protection of the environment. It plays a key role in creating a more sustainable society, where everyone is aware of their impact on the environment and takes steps to reduce their energy consumption.

## References

[1]. Ouadoud, M., Chkouri, M. Y., & Nejjari, A. (2018). LeaderTICE: a platforms recommendation system based on a comparative and evaluative study of free e-learning platforms. International Journal of Online and Biomedical Engineering (iJOE), 14(01), 132-161.

[2]. Porter, S. E., & Robinson, J. (2011). Hermeneutics: An introduction to interpretive theory. Grand Rapids, MI: William B. Eerdmans.

[3]. Marty Jacobs (2019), Applying a systems and complexity framework to transformative learning , June

[4]. Nicolaides, A., & Dzubinski, L. (2016). Collaborative developmental action inquiry: An opportunity for transformative learning to occur? Journal of Transformative Education, 14(2), 120-138. doi:10.1177/1541344615614964

[5]. Barakat, Y. , Bourekkadi, S. , Khoulji, S. , Kerkeb, M.L. (2021). What contributions of Artificial Intelligence in Innovation? E3S Web of Conferences, , 234, 00105

[6]. Ouadoud, M., Chkouri, M. Y., Nejjari, A., & El Kadiri, K. E. (2016). Studying and Analyzing the Evaluation Dimensions of E-learning Platforms Relying on a Software Engineering Approach. International Journal of Emerging Technologies in Learning, 11(1).

[7]. Simonsen, B., & Illeris, K. (2014). Transformative learning in youth. In D. Andritsakou & L. West (Eds.), What's the point of Transformative Learning? Proceedings of the 1st Conference of ESREA's Network "Interrogating Transformative processes in Learning and Education: An Internatioal Dialogue" (pp. 359-365).

[8]. Henri, F. and Lundgren-Cayrol, K. (1997) Apprentissage collaboratif à distance, télécon-

férence et télédiscussion. Internal Report 3 (version 1.7). Montreal: LICEF (online publication): http://www.licef.teluq.uquebec.ca/Bac/fiches/ f48.htm

[9]. Jonassen, D.H. (1994). Toward a constructivist design model. Educational Technology, 34(4), 34-37.

[10]. Bourekkadi, S. et al. (2021). Intelligent technology solutions at the service of energy consumption management . E3S Web of Conferences, 234, 00108

[11]. Land, S.M. et Hannafin, M.J. (1996). Student-centered learning environments: Foundations, assumptions and implications. Proceedings of the 18thNational Convention of the Association for Educational Communications and Technology. Indianapolis. 395-400.

[12]. Southern, N. L. (2015). Framing inquiry: The art of engaging great questions. In G. R. Bushe & R. J. Marshak (Eds.), Diaolgic organization development: The theory and practice of transformational change (pp. 269-289). Oakland, CA: Berrett-Koehler.

[13]. Zapata, M. A. (2013). Five years later: How California community members acted on transformative learning achieved in a participatory planning process. Planning Theory & Practice, 14(3), 373-387. doi:10.1080/14649357.2013.816764

[14]. Woolfolk, A. (2005). Educational Psychology, 9th ed, (Active Learning Edition). Boston: Pearson/Allyn & Bacon.