IMPACTO DAS TECNOLOGIAS DIGITAIS NA REGULAMENTAÇÃO JURÍDICA INTERNACIONAL DA EDUCAÇÃO PARA ALCANÇAR OS PRINCÍPIOS DO DESENVOLVIMENTO SUSTENTÁVEL

IMPACT OF DIGITAL TECHNOLOGIES ON INTERNATIONAL LEGAL REGULATION OF EDUCATION TO ACHIEVE SUSTAINABLE DEVELOPMENT PRINCIPLES

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RESUMO

Objetivo: O artigo tem como objetivo analisar o impacto das tecnologias digitais na regulamentação jurídica internacional da educação para promover os princípios do desenvolvimento sustentável. Explora como a transformação digital dos sistemas educacionais influencia a implementação dos objetivos globais de desenvolvimento sustentável, com foco nas instituições de ensino superior e seu papel na promoção de práticas sustentáveis.

Metodologia: Foi utilizada uma abordagem de método misto, combinando uma revisão da literatura científica com uma pesquisa com especialistas. Os dados qualitativos e quantitativos coletados foram analisados para identificar os principais componentes da transformação das universidades sob a influência das tecnologias

digitais. Os especialistas foram consultados para avaliar a importância das regulamentações jurídicas internacionais na harmonização das práticas educacionais com os princípios de desenvolvimento sustentável.

Originalidade: O artigo oferece uma perspectiva única ao relacionar as tecnologias digitais com o marco jurídico internacional da educação voltada para o alcance dos objetivos de desenvolvimento sustentável. Destaca como a integração de ferramentas digitais na educação superior pode melhorar ou prejudicar a busca global pela sustentabilidade, fornecendo insights inovadores sobre os mecanismos legais necessários para apoiar essa transição.

Resultados: O estudo identifica componentes críticos da transformação digital nas universidades, como a necessidade de uma infraestrutura digital robusta, a inovação nos métodos de ensino digital e práticas de educação aberta. Também destaca as lacunas nas regulamentações jurídicas internacionais que precisam ser preenchidas para garantir que as tecnologias digitais contribuam de forma eficaz para a educação para o desenvolvimento sustentável (ESD).

Conclusão: Os autores concluem que, embora universidades individuais tenham feito progressos significativos na incorporação de tecnologias digitais em seus currículos, é necessário um enfoque estratégico global para alinhar as práticas educacionais com os objetivos de desenvolvimento sustentável. Isso inclui a melhoria da infraestrutura digital, o aprimoramento da capacitação de funcionários e a garantia da aplicação consistente de padrões legais e éticos na educação.

Palavras-chave: Tecnologias digitais, desenvolvimento sustentável, regulamentação jurídica internacional, ensino superior, educação para o desenvolvimento sustentável, transformação digital.

ABSTRACT

Objective: This study analyzes the impact of digital technologies on the international legal regulation of education to promote the principles of sustainable development. It focuses on how the digital transformation of educational systems influences higher education institutions in fostering sustainable practices.

Methods: A mixed-methods approach was employed, combining a scientific literature review with an expert survey involving 48 participants. Data analysis included ranking key components of universities' digital transformation and identifying necessary measures for international legal regulation aligned with Education for Sustainable Development (ESD).

Results: Key findings highlight critical components of universities' digital transformation, such as the need for robust digital infrastructure, innovation in teaching practices, and open learning initiatives. The study also identifies gaps in international legal frameworks that hinder effective integration of digital technologies in achieving ESD goals.

Conclusions: The digital transformation of education requires strategic international legal regulation to align educational practices with sustainable development objectives. This includes strengthening digital infrastructure, fostering open science, and implementing consistent legal and ethical standards to support ESD.

Keywords: Digital Technologies. Sustainable development. International legal regulation. Higher education. Education for sustainable development. Digital transformation.

INTRODUCTION

The 2030 Agenda for Sustainable Development prescribed the availability of free, fair, and high-quality primary and secondary education for all, as well as equal access to high-quality technical, vocational, and higher education, including university studies and extending to adults (Klarin, 2018). The Agenda's objectives include ensuring equal access to education at all levels and vocational training for the most vulnerable groups, including people with disabilities, indigenous peoples, and children in difficult circumstances. Implementing this plan demands continuous training of teachers, expansion of educational institutions, and the establishment of scholarship programs. These measures are designed to ensure the possibility of gaining the knowledge and skills needed to contribute to sustainable development, promote a culture of peace and non-violence, and recognize cultural diversity and the contribution of culture to social development by 2030 (Roorda & van Son, 2016).

The dissemination of the Internet and digital technology and the growing role of data against the backdrop of the demands to achieve sustainable development principles drastically change our reality (Akhmetshin et al., 2021). The totality of the changes from introducing digital technology into all spheres of social and economic life is called the digital transformation (Kaplan & Haenlein, 2016). This transformation does not boil down to technological progress but influences the process and organizational aspects of nearly all educational institutions' operations (Almaraz-Menendez et al., 2016).

It is worth pondering what role the digitalization of education should play in attaining sustainable development principles. Higher education has much to offer society in this regard, as the resolution of sustainable development challenges and consensus on environmental changes or their better understanding become achievable with an appropriate level of education (Arbuthnott, 2008). According to J. Huckle (2010), education for sustainable development (ESD) is a process that helps

people better understand the interdependence of all living things on Earth and the consequences that their actions and decisions can have for natural resources, the environment, and the global community both momentarily and in the long term. This process raises awareness of the economic, political, social, and cultural factors that support or hinder sustainable development. By developing awareness, competence, and values (Malika et al., 2022), ESD enables one to effectively participate in sustainable development at local, national, and international levels, guaranteeing a more equitable and sustainable future.

ESD empowers every person to acquire the knowledge, skills, attitudes, and values needed to shape a sustainable future. It also involves incorporating key sustainable development issues (climate change, biodiversity, poverty reduction, and the realization of sustainable consumption) into teaching and learning (Anderberg et al., 2008). ESD requires collaborative teaching and learning methods that motivate and enable learners to change their behavior in the interest of sustainable development. ESD consistently fosters critical thinking, envisioning future scenarios, and collaborative decision-making (Driskell & Chawla, 2009).

Researchers describe ESD as equally accessible at all levels and in all social contexts (family, school, work, community) and emphasize that it strengthens civic responsibility and informs people about their rights and responsibilities (Little & Green, 2009), being rooted in the principle of lifelong learning and supporting the balanced development of the individual (Ferguson et al., 2022). ESD goes far beyond environmental education as it also encompasses human rights issues, thus allowing one to resolve conflicts and better understand economics, culture, and art (Yerezhepkyzy et al., 2017).

The current ESD concept relies on the University Charter for Sustainable Development (Geneva, 1994) and the Thessaloniki Declaration (UNESCO, 1997); at the core of it lies Agenda 21 adopted in 1992 in Rio de Janeiro (Barth & Rieckmann, 2012). The University Charter prescribes that all universities and other educational institutions encourage incorporating environmental aspects and the chief principles of society's transition to sustainable development into curricula regardless of their professional specialization and nature of activities (Burmeister & Eilks, 2013).

The ESD matter was first raised globally during preparations for the World Summit on Sustainable Development in Johannesburg, held from August 26 to September 4, 2002 (Biasutti et al., 2018). That was when the concept of education for

balanced development was coined, which presupposes the popularization of knowledge about the balanced development of society and its cultural and ecological foundations among the public by all possible means: educational institutions, mass communications, theaters, books, propaganda (Down, 2015), etc. The summit emphasized that this concept of a new vision of economic education is dynamic and aims to teach humanity to take responsibility for building the future.

The proclamation of the ESD Decade in December 2002 was one of the most significant international initiatives proposing comprehensive changes in the education system (ESD Section, 2007). The main goal of the Decade was to support efforts to promote sustainable social, economic, and environmental development. The realization of these propositions was entrusted to individual UNESCO National Committees. Globally, action has been taken at three levels: the first level focuses on the promotion, coordination, and implementation of activities as part of the Decade; the second level involves consultations with other UN agencies, international organizations, governments, and non-governmental organizations to create action plans; and the third level consisting of national projects (Mochizuki & Fadeeva, 2008).

The objectives of the Decade of Sustainable Development were accomplished through the support of such subjects in education as:

- UNESCO's network of associated schools uniting 11,500 educational institutions in 182 countries. In addition to the compulsory school curriculum, they implement UNESCO programs on peace, the dialogue of cultures and civilizations, human rights, ecology, and the environment.

- A network of 700 university-based UNESCO chairs in 116 countries. They conduct research concerning various aspects of sustainable development (Leicht et al., 2018).

Developing the issue of implementing the ESD program, in May of 2002, environmental ministers of members of the UN Economic Commission for Europe (UNECE) adopted the Statement on Education for Sustainable Development (Laurie et al., 2016). Specifically, the document recognized education as a critical instrument for preserving the environment and ensuring sustainable development (Borodina et al., 2023). To support education as a cornerstone in the desired change, all countries were proposed to incorporate the sustainable development concept into their education systems at all levels – from school to university and from formal education to informal.

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To realize this statement, in March 2005 in Vilnius, the High-Level Meeting of Environment and Education Ministers adopted the UNECE Strategy for Education for Sustainable Development (Wood et al., 2016) and the Vilnius framework for its implementation. The Strategy, embodying European and world experience, suggests that ESD should encompass all elements in life. Countries should pursue its organic incorporation into educational programs at all levels, including vocational training, the training of educators, and continuous learning for specialists and executives (Novo-Corti et al., 2018).

Many UNECE member states have established national ESD policies and their implementation frameworks. Hundreds of initiatives have been launched to integrate ESD into the content and processes of formal and informal education and move from politics to practice. These documents are valuable for exchanging experience and showcasing the best ESD practices. Significant achievements have been made over the years of the Strategy's implementation in thematic areas covering policy integration, curricula, learning tools, teaching and learning materials, digital collaboration, and networking (McKeown, 2014).

Given the increasing level of digitalization in society, this study aimed to analyze the impact of digital technologies on international legal regulation of ESD.

METHODS

Proceeding from the features of the impact of digital technology on international legal regulation of ESD, we employed a quantitative-qualitative approach.

We carried out the research from November 25, 2023 to February 24, 2024. It involved a scientific literature review, the selection of an expert pool, a follow-up expert survey via email, and the processing and analysis of the survey results.

In the first stage of the study, the literary sources required to achieve the study purpose were selected. The data sample was represented by articles and reviews published in scientific periodicals indexed by Scopus and Web of Science. The search was conducted using the keywords "sustainable development", "digital technology", "education for sustainable development", and "international legal regulation" in English and Russian. The literature review allowed us to determine the key components of universities' transformation under the influence of digital technology advancement.

In the second stage, we conducted an expert survey. E-mails with the proposal to participate in the survey were sent to 55 experts; the selection criterion was the

presence of at least three publications on the research problem in peer-reviewed journals. Of these, 48 people agreed to participate in the survey, after which they were sent e-mails with the survey asking them to substantiate their answers in free form. As a result, we determined the order of importance of the components in universities' digital transformation identified through the literature review. We also answered a supplementary question that emerged after the literature analysis was completed: What are the necessary measures of international legal regulation corresponding to the components of the transformation of universities under the influence of digital technology development and aimed at achieving the principles of ESD?

After the experts' responses were obtained, a second letter was sent, asking survey participants to rank the proposed measures of international legal regulation in order of importance by assigning points. Consequently, the rank and weight of each measure were defined according to experts' points.

To make the expert survey analysis more objective, we assessed the consistency of expert opinions through mathematical processing using Kendall's concordance coefficient.

RESULTS

The analysis of scientific literature and the expert survey enabled us to formulate the key components of the transformation of universities under the impact of digital technology development and rank them by importance (Table 1).

Table 1. Key components of the transformation of universities under the influence of digital technology development

No.	Key components	Rank	Weight
1	Digital infrastructure is planned, managed, and continuously improved in accordance with the university's vision, mission, and strategy	1	0.35
2	The university is committed to digital practices in teaching, learning, and assessment	2	0.23
3	The university supports digital culture as a driver of innovation and entrepreneurship	3	0.19
4	Open learning and innovation practices are well-established across the university	4	0.13
5	The university is characterized by a dynamic digital presence that supports all its activities	5	0.10

Note: compiled based on the expert survey; the concordance coefficient W = 0.73 (p < 0.01), indicating a strong consistency of expert opinions

Proceeding from the identified components of universities' transformation owing to the development of digital technology, the experts proposed and ranked the measures of international legal regulation to ahieve ESD principles (Table 2).

Table 2. Measures of international legal regulation on the components of universities' transformation under the influence of digitalization to achieve ESD principles

Key components	Oblige university administrators to	Rank	Weight
Support of digital culture on the part of the university	Develop a strategy defining the university's goals with respect to innovation and improvements dictated by digital transformation in accordance with ESD principles	1	0.37
	Take on responsibilities with regard to maintaining a culture based on common values that simultaneously support the digital transformation and the adoption of ESD principles	2	0.26
	Have an ESD roadmap and sufficient resource distribution	3	0.21
	Assess and track the advantages and added value stemming from the digital transformation and the introduction of ESD principles in all spheres of activity	4	0.16
Planning, management, and improvement of the university's digital infrastructure	Provide an operational plan for the management, optimization, and adaptation of ICT systems and services, setting clear objectives and measuring the effectiveness of the implementation of ESD principles	1	0.41
	Provide support for and appropriate access to digital infrastructure	2	0.26
	Ensure the implementation and uniform understanding of the legal and ethical policies and standards of ESD	3	0.21
	Implement measures to protect the privacy, safety, and well-being of staff and students and facilitate their innovative and creative work for the benefit of ESD	4	0.12
Adherence to digital teaching, learning, and assessment practices	Integrate digital competencies and skills into the curriculum in the interest of ESD	1	0.32
	Support innovation through various pedagogical approaches based on the use of digital technologies to integrate ESD	2	0.28
	Provide opportunities for staff training and development for ESD integration	3	0.23
	Monitor and showcase how the ESD experience can be enriched using digital technologies	4	0.17
Implementation of open education and innovations	Develop and implement an integrated open science strategy and action plan, supported by reward mechanisms	1	0.44
	Facilitate the creation of a favorable environment to support open science and innovation in different spheres	2	0.32

	Provide guidance, training, and support in the field of open science and innovative practices	3	0.24
Dynamic digital presence	Implement communication, cooperation, and networking strategies based on digital tools in the interest of ESD	1	0.38
	Utilize digital instruments and practices for a more effective and comprehensive exchange of relevant information between staff, students, and external stakeholders in the interest of ESD	2	0.30
	Invest in human resources and encourage employees to pursue innovations for the benefit of ESD	3	0.21
	Take measures to ensure the continued relevance of the university's digital presence	4	0.11

Note: compiled based on the expert survey; the concordance coefficient W = 0.69 (p < 0.01), indicating a strong consistency of expert opinions

The development of a sustainable society should be thought of as a continuous process of learning and exploration of problems and dilemmas where the right answers and solutions change as experience is accumulated. Learning objectives under ESD should include expanding knowledge and developing specialized skills, intelligence, life attitudes, and values. ESD calls for a shift of focus to supplying the knowledge to work through problems and find possible solutions.

Characterizing the key components of universities' transformation under the influence of digital technology development (Table 1) and corresponding international regulatory measures (Table 2), our experts noted that a university's support of digital culture for ESD means that the university should embrace, explore, and promote new ways of working with digital tools and practices that stimulate innovation and combine top-down leadership with bottom-up innovation.

In planning, managing, and continuously improving its digital infrastructure for ESD, universities should integrate the design and organization of their digital infrastructure to support innovation in all areas of activity. This applies, for example, to the integration of technology and educational platforms and research and administrative systems.

A university's commitment to digital practices in teaching, learning, and assessment translates into the broader application of digital technologies. It creates opportunities for innovative planning and implementation of curricula, new teaching methods, learning processes, and assessment methods, thereby fostering digital competencies and skills and contributing to the implementation of sustainable development principles (Ferguson et al., 2022).

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The proliferation of open science is believed to increase the research system's efficiency, quality, and effectiveness, encourage using new research methods, and support innovation (Akhmetshin et al., 2024). Through open science, universities promote collaboration, faster exchange of knowledge, and new means of sharing the results of their activities (including publications, research results, and methodologies) for ESD (Little & Green, 2009).

A dynamic digital presence that supports all university activities means that universities use the power of digital technology to communicate, collaborate, and network for ESD. Through this presence, they take a coordinated approach to stakeholder relations and amplify their influence regionally, nationally, and internationally (Barth & Rieckmann, 2012).

Adopting ESD principles in a digital environment requires strong political support at all government levels (Bekezhanov et al., 2021). Policies, legislation, organizational frameworks, and curricula should embrace ESD. The key to achieving this goal is:

- the adoption of fundamental documents on ESD at all levels of education (ESD Section, 2007);

- stimulation of the development of inter-institutional and multilateral cooperation, including the establishment of consultative mechanisms (Down, 2015);

- incorporation of ESD principles into curricula and specialized courses at all levels of higher education, especially in basic teacher training (Huckle, 2010);

- improvement of the material base of education with ESD-oriented university management and reinforcement of the links between the natural, economic, political, and social sciences in interdisciplinary and specialized studies (Driskell & Chawla, 2009).

In addition to strengthening and improving ESD in individual countries, international cooperation in ESD could contribute to mutual understanding, building trust, and fostering respect for cultural values. This partnership would contribute to global peace and the well-being of humankind.

CONCLUSIONS

The objectives facing national education systems demand a dramatic redefinition of their goals as building the readiness and ability of youth to participate in social and humanistic activities for the sake of preserving the ecological quality of the environment, careful use of its natural resources, spreading the ideals of a healthy

lifestyle, and protecting human life, especially in an urbanized environment. Quality education is a precondition for sustainable social development. Education can foster the attitudes, behaviors, and lifestyles needed for a sustainable future.

Although many important ESD initiatives emerge owing to the efforts of individual universities, there are several directions requiring a global strategic approach. This includes systems to support university management, solutions for digitizing resources and promoting access to open science, the development of employees' digital competencies, and care for technological resources. These processes need to rely on careful identification of universities' needs and the potential contribution of digital solutions to their goals. These processes can be initiated by virtue of a greater recognition of the importance of digital leadership, the leading purpose of which is the achievement of ESD principles.

Higher education has an immense role in promoting ESD principles but requires public support. Universities operate in an institutional, regulatory, and financial environment shaped by state actions. Therefore, the actions taken by the state in the field of digitalization of public services, strategic planning, and the financing of digitalization projects must prioritize the needs of universities.

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