Research Article

Daniela Florina Stancu[1]*, Rodica Andreea Munteanu[2], Irina Roxana Petrescu[3]

Comparison of Romania's Digital Education Model with Other Eastern European Countries

*Corresponding Author: **Daniela Florina Stancu**: University of Craiova, Romania; daniela.florinas@yahoo.com
Rodica Andreea Munteanu: University of Craiova, Romania; rodica.amnu@yahoo.com
Irina Roxana Petrescu: University of Craiova, Romania; irianaroxpet@yahoo.com

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Abstract: This study presents a comparative analysis of Romania's digital education model in relation to other Eastern European countries, namely Poland, Hungary, the Czech Republic, and Russia. The research employs a descriptive qualitative approach, analyzing secondary data such as academic publications, government policies, and institutional reports. The findings reveal that while Romania has made significant strides in aligning its education system with European Union standards—through initiatives like SmartEDU and integration with the Bologna Process—its implementation remains inconsistent, especially in rural regions. Compared to Poland and the Czech Republic, which demonstrate strong infrastructure, decentralized governance, and sustained teacher training, Romania's digital integration is hampered by bureaucratic inertia, infrastructure gaps, and a lack of equitable access. Hungary shows a more centralized governance model, while Russia presents significant regional disparities. Notably, Romania has shown promise in informal education, such as the Romanian Science Festival, helping bridge digital divides through community-led innovation. The paper concludes that for Romania to advance its digital education goals, it must prioritize teacher training, infrastructure development, and localized policy execution. This study contributes to understanding how post-communist education systems navigate digital transformation amid structural and socioeconomic constraints.

Keywords: digital education, Romania, Eastern Europe, education reform.

Introduction

In the past two decades, the digital transformation of education systems has become a defining characteristic of global educational reform. Across Europe, especially in Eastern Europe, this transformation has occurred unevenly, reflecting historical, political, and socioeconomic disparities among countries. Romania stands out as a compelling case study in this regard: it is a post-communist country that has sought to modernize its education system and align it with European Union (EU) standards while navigating persistent infrastructure gaps, governance challenges, and regional inequalities (Stroe, 2022).

The digital education model in Romania, while making progress, reflects both the opportunities and limitations faced by countries in transition. Compared to other Eastern European nations such as Hungary, the Czech Republic, and Poland, Romania's approach has oscillated between centralized policymaking and periods of increased autonomy (Reisz, 2006). This dynamic, influenced heavily by the country's post-1989 political transition and accession to the EU in 2007, continues to shape Romania's ability to implement sustainable digital education reforms.

After the collapse of communist regimes in 1989–1991, Eastern European countries embarked on large-scale political and economic transformations. Education was among the most affected sectors due to its foundational role in shaping human capital for new democratic societies. In Romania, this transition was particularly turbulent due to the violent nature of its regime change and the severe recession that followed (Stănescu, 2017). The Romanian education system had to move from rigid central planning toward more open, decentralized, and

modern frameworks aligned with EU norms (Deca, 2015).

In contrast, other countries such as the Czech Republic and Hungary undertook similar reforms but with differing ideological orientations and paces. Hungary aligned more closely with the Humboldtian model, emphasizing academic autonomy and research, whereas Romania leaned on the Napoleonic system, with greater central control (Vasilache et al., 2012).

Digital education, or e-learning, began emerging in Eastern Europe in the late 1990s, catalyzed by internet access, EU funding, and growing private sector interest. Romania's approach has been shaped by a combination of national policy initiatives and European programs such as the Digital Education Action Plan (DEAP) and Erasmus+.

Goldbach & Hamza-Lup (2017) observed that the digital learning landscape in Eastern Europe is fragmented, with Romania adopting a mid-range strategy—more aggressive than Bulgaria but less advanced than Russia or Estonia (Goldbach & Hamza-Lup, 2017). Romania's adoption of online learning systems has been influenced by the rapid proliferation of mobile and internet technology, though implementation remains uneven between urban and rural regions.

The concept of "Education 4.0"—the fusion of digital technologies, artificial intelligence, and personalized learning into mainstream education—has become increasingly influential. Romania's progress toward this model has been cautious. While policy frameworks have been developed to promote digital competencies, coding curricula, and online learning platforms, practical implementation lags behind regional leaders like Poland or Estonia (Stroe, 2022).

Several structural barriers hinder Romania's full embrace of Education 4.0. These include a lack of high-speed internet in rural schools, outdated hardware, inadequate teacher training, and low digital literacy rates among parents and students. Despite these challenges, the Romanian government has introduced initiatives such as the National Strategy for Digital Agenda and the SmartEDU program.

One of the most persistent challenges facing Romania is the urban–rural digital divide. While urban centers like Bucharest, Cluj-Napoca, and Iași are hubs of innovation and digital integration, rural regions continue to suffer from poor infrastructure, teacher shortages, and low school attendance rates (Cristache et al., 2015). This is not unique to Romania, but its severity is particularly marked when compared with the Czech Republic or Slovenia, where rural digital inclusion has been more effective.

Educational programs like the Romanian Science Festival are helping bridge this gap by bringing STEM activities and online mentorship to underserved communities (Kruk et al., 2022).

Romania's EU accession in 2007 marked a turning point in educational reform. The Bologna Process—aimed at harmonizing higher education across Europe—was adopted to standardize degrees, credits, and quality assurance systems. Romania's integration into this framework has improved international collaboration and student mobility, though critics argue that reforms have often been superficial or politically driven (Dobbins, 2011).

Moreover, programs like Erasmus+ and Horizon Europe have encouraged partnerships between Romanian and Western institutions, offering both exposure and pressure to modernize academic structures (Ungureanu et al., 2020).

A comparative lens reveals several insights:

a) Hungary has a more centralized and politicized education system, with some recent setbacks in academic freedom.
b) Czech Republic has focused more on quality assurance, teacher autonomy, and technological investment (Vasilache et al., 2012).
c) Poland has been recognized for its national broadband plan and successful implementation

of digital textbooks and remote teaching platforms.

Romania's model sits somewhere in the middle—progressive in policy but inconsistent in implementation, especially at the local level.

While formal education struggles with reform, Romania has seen impressive growth in informal STEM education. The Romanian Science Festival, for example, has reached thousands of students through webinars, mentorship, and science events, especially in underserved areas (Kruk et al., 2022). These efforts, while not a substitute for systemic reform, demonstrate Romania's potential to innovate from the bottom up.

Despite numerous policy initiatives, Romania's digital education model remains constrained by governance inefficiencies, infrastructure limitations, and unequal access. Compared to its Eastern European neighbors, Romania shows promise but lacks consistent execution. This paper aims to:

1. Critically analyze Romania's digital education model in the context of regional transformation.
2. Compare Romania's strategies, achievements, and challenges with those of select Eastern European countries.
3. Propose actionable insights for improving digital education policy and implementation in Romania.

Method

This study employs a qualitative, descriptive-comparative research design aimed at analyzing Romania's digital education model in contrast with those of other Eastern European countries. The approach focuses on policy analysis, literature synthesis, and comparative frameworks, without primary data collection or statistical modeling.

The research follows a document-based analysis, relying on peer-reviewed articles, institutional reports, government policy documents, and EU frameworks relevant to digital education and higher education reform. The core aim is to understand how Romania's digital education policies and practices align or diverge from those of neighboring countries such as Hungary, the Czech Republic, Poland, and Russia.

No original survey or interview data were collected. Instead, this research adopts a comparative policy analysis lens, using themes such as infrastructure readiness, curriculum digitization, teacher training, policy governance, and rural–urban digital divides to structure the comparison.

The countries selected for comparison share similar post-socialist educational reform trajectories and have been subject to EU or Bologna Process harmonization. These include:

a) Hungary – for its similar governance model and historical influences.
b) Czech Republic – as a regional leader in quality assurance and digital implementation.
c) Poland – recognized for infrastructure readiness and national digital strategy.
d) Russia – as a non-EU comparator with rapid digital education expansion.

Data were extracted from academic databases, including Scopus-indexed journals and peer-reviewed open-access repositories, through the use of the Consensus academic search engine. Thematic analysis was employed to identify key patterns, contrasts, and gaps in national digital education models. Particular attention was given to post-2000 developments to ensure contextual relevance to Education 4.0 and EU integration processes.

Results and Discussion

Policy and Strategic Frameworks

Romania's digital education evolution is largely driven by EU initiatives and national strategies like the SmartEDU program. The

country's integration into the Bologna Process and Digital Education Action Plan provided a roadmap for modernization (Stroe, 2022). However, implementation has been uneven due to political shifts, bureaucratic delays, and inconsistent funding.

Compared to this, Poland and the Czech Republic have more structured and sustained policies. Poland's national broadband plan and centralized digital textbook platforms demonstrate a proactive and scalable model (Dudok, 2019). The Czech Republic also displays a strong legal-regulatory framework for digital education, underpinned by curricular autonomy and teacher agency.

Hungary, on the other hand, presents a centralized, state-dominated governance approach. Despite advanced infrastructure in urban areas, the education system has regressed toward a state-controlled model, reversing some of the decentralization seen in the 2000s (Kováts et al., 2017).

Russia has taken a unique path by investing heavily in national digital education platforms like "Moscow Online School", though adoption varies significantly across regions.

Infrastructure and Digital Access

Romania's most pressing challenge remains digital infrastructure, especially in rural areas. As highlighted by Goldbach & Hamza-Lup (2017), Romania's fast urban digital growth masks persistent gaps in rural internet access, electricity stability, and device availability.

By contrast, Poland's robust digital infrastructure, built on EU and national investments, ensures near-universal internet coverage in schools. The Czech Republic has also made significant progress by integrating schools into high-speed broadband networks, enabling smoother digital content delivery.

In Hungary, disparities remain between metropolitan centers and rural regions, although the government has made efforts to provide subsidized laptops to students and teachers.

Curriculum and Pedagogical Models

Romania has revised its curriculum to include digital competencies and basic coding, though implementation varies by school and region. There is a reliance on textbook-based instruction, and digital tools often serve as supplementary rather than core resources (Wetzl, 2010).

Poland and the Czech Republic embed digital pedagogy more deeply into curriculum planning. Poland's Ministry of Education offers centralized platforms where digital materials align with national curricula. The Czech system emphasizes project-based and student-centered learning, facilitated by digital technology.

Hungary, despite its centralized structure, has a fragmented digital curriculum with inconsistent teacher support. Russian education policy promotes digital content but struggles with translating it into localized pedagogical practice across a vast geography.

Teacher Training and Capacity Building

In Romania, teacher readiness remains a bottleneck. Although training programs exist, many teachers, especially in rural areas—lack the skills or confidence to integrate digital tools effectively (Cristache et al., 2015).

The Czech Republic and Poland have made significant strides in providing structured, state-supported training for digital teaching. These programs include continuous professional development, digital pedagogy courses, and peer mentorship.

In Hungary, teacher training has not kept pace with digital curriculum reforms, leading to uneven adoption. Russia has launched federal training programs, but implementation often suffers from local capacity limitations.

Governance Models: Centralization vs. Autonomy

Romania's digital education governance has oscillated between centralization and decentralization. While national frameworks exist, local implementation is frequently hindered by bureaucratic inefficiencies and lack of local autonomy (Reisz, 2006).

In contrast, the Czech Republic and Poland exhibit higher levels of school-level autonomy and decentralization. Schools are empowered to adopt digital tools based on their context and community needs.

Hungary represents the most centralized model among the comparison group. The state exercises direct control over school operations, often limiting innovation and flexibility (Kováts et al., 2017).

Equity and Access

Romania's digital divide is exacerbated by socioeconomic disparities. The poorest regions—especially in the northeast and south—lack consistent access to devices and connectivity, affecting student performance and dropout rates (Pantilie, 2015). While policies acknowledge this divide, budget constraints hinder consistent resource allocation.

In Poland and the Czech Republic, equity is addressed through inclusive policies such as free laptop programs, subsidized internet, and accessible educational platforms. Hungary's social divide remains sharp, particularly among Roma populations, reflecting deeper systemic challenges (Óhidy, 2023).

Russia's regional inequality is stark—while urban centers offer advanced digital learning environments, rural areas often operate with minimal infrastructure.

Informal and Non-Formal Digital Education

Romania has seen promising developments in informal education through initiatives like the Romanian Science Festival, which reaches thousands of students via live STEM events and virtual mentorship (Kruk et al., 2022). These efforts help compensate for the formal system's shortcomings, especially in underserved communities.

Poland and the Czech Republic also support a vibrant non-formal education ecosystem, often backed by EU or private funding.

Crisis Response and Resilience

The COVID-19 pandemic tested the resilience of digital education systems. In Romania, rapid transitions to online learning highlighted gaps in infrastructure, teacher capacity, and student engagement (Stroe, 2022). Emergency remote teaching often lacked interactivity or consistency.

Poland was better prepared, quickly expanding its national e-learning platform. The Czech Republic also managed a smoother transition, supported by school autonomy and teacher networks.

Hungary and Russia faced significant variation in response quality, largely shaped by local governance capacity and socio-economic inequality.

Summary Table – Comparative Overview

Category	Romania	Poland	Czech Republic	Hungary	Russia
Infrastructure	Uneven; rural areas lag behind	Strong, widespread	Strong with broadband rollout	Moderate; rural gaps persist	Wide gaps between urban and rural
Curriculum	Updated, limited implementation	Digitally integrated	Student-centered, flexible	Centralized and rigid	Central guidelines, inconsistent use

Category	Romania	Poland	Czech Republic	Hungary	Russia
Teacher Training	Inconsistent, underfunded	Comprehensive, ongoing	Structured, well-supported	Limited and outdated	Nationwide programs, uneven results
Governance	Mixed central/local	Decentralized	Autonomy-based	Highly centralized	Federally driven
Equity Policies	Fragmented, regionally biased	Inclusive digital access	Strong policies on inclusion	Socioeconomic gaps, esp. Roma	Major regional disparities
Non-formal Education	Emerging through NGOs	Active and supported	Active partnerships	Fragmented	Sporadic initiatives

Conclusion

This study has provided a comparative analysis of Romania's digital education model in the context of Eastern European education systems, particularly those of Hungary, Poland, the Czech Republic, and Russia. Through a review of existing literature, policy documents, and empirical analyses, we have assessed multiple dimensions of digital education including infrastructure readiness, curricular integration, teacher preparedness, governance structures, equity policies, and informal education development.

Romania's digital education reform has made notable progress since the country's accession to the European Union. Alignment with EU standards and frameworks—such as the Bologna Process and the Digital Education Action Plan—has stimulated the development of policy documents and pilot programs aimed at increasing digital competencies and educational access. Programs like SmartEDU and various digital curriculum revisions demonstrate a formal commitment to modernization. However, in practice, these efforts often remain inconsistently implemented due to fragmented governance, insufficient teacher training, and severe rural–urban disparities in access to technology and connectivity (Stroe, 2022).

When compared to regional peers, Romania occupies a mid-range position. Poland and the Czech Republic show more advanced and consistent integration of digital tools into pedagogy, supported by strong infrastructure, sustained teacher development programs, and higher levels of school-level autonomy (Dudok, 2019). These countries benefit from clearer strategic direction and more stable education governance. Hungary, while having invested in digital education infrastructure, is moving toward a more centralized model of governance, which some argue stifles institutional innovation and responsiveness (Kováts et al., 2017). Russia presents a hybrid case—rapid technological rollouts in urban centers contrast sharply with poor adoption in remote regions, reflecting the country's massive geographic and administrative diversity.

Romania's biggest strength lies in its vibrant informal education sector, exemplified by grassroots initiatives like the Romanian Science Festival (Kruk et al., 2022). These efforts successfully bring STEM and digital literacy to underserved communities and demonstrate the value of community-driven innovation in education.

Nonetheless, if Romania is to close the digital education gap with regional leaders, several key steps are essential:

a) Strengthening local implementation capacity by empowering schools and municipalities with both decision-making power and resources.
b) Investing in teacher training and support, especially in rural areas, to ensure technology is used pedagogically—not just administratively.

c) Ensuring digital equity through national programs that provide devices, connectivity, and inclusive learning materials.
d) Encouraging cross-sector partnerships between government, NGOs, and private actors to drive innovation from both the top down and the bottom up.

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