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Digital Transformation of the Educational Process in Higher Education: A Socio-Technical Perspective

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Abstract **Purpose.** *This study investigates the digital transformation of the educational process in higher education institutions from a socio-technical and institutionalization perspective, focusing on the determinants and tensions shaping educational digitalization in the post-pandemic context.*
Design/methodology/approach. *The study adopts a qualitative interpretive single-case study design. Data triangulation combined analysis of strategic and regulatory documents with semi-structured interviews of key stakeholders representing academic, managerial, technical, and student perspectives.*
Findings. *Educational digitalization emerged as a path-dependent and negotiated socio-technical process. The findings reveal tensions between organizational structures and technological capabilities, managerial practices, and stakeholder expectations. Four key tensions were identified: (1) standardization versus teaching autonomy, (2) flexibility versus educational quality, (3) technological capabilities versus digital competencies, and (4) central coordination versus local adaptation. The study also identifies a readiness–implementation gap, showing that high technological readiness does not prevent organizational disruption, as successful digitalization depends on aligning technologies with organizational routines, governance structures, and human competencies.*
Practical implications. *The findings support HEIs in developing context-sensitive digital strategies that require not only technological investment, but also organizational coordination, pedagogical support, and continuous competency development. Universities should move beyond tool-oriented implementation towards integrated, context-sensitive digitalization.*
Social implications. *The findings highlight how digital transformation can enhance the accessibility and flexibility of higher education, while simultaneously creating new organizational and competency-related inequalities.*
Originality/value. *The study shifts attention from institution-wide digital transformation towards institutionalization of the educational process. It conceptualizes educational digitalization as a process shaped by persistent socio-technical tensions in the post-pandemic era.*

Keywords digital transformation in higher education, educational digitalization, socio-technical systems, post-pandemic university, case study research digital transformation in higher education, educational digitalization, socio-technical systems, post-pandemic university, case study research

INTRODUCTION

Digital transformation has become one of the most significant forces reshaping contemporary organizations, especially higher education institutions (HEIs) (Kraus et al., 2022; Reis & Melão, 2023; Feliciano-Cestero et al., 2023; Prinsloo, 2026). In higher education, digital technologies increasingly influence both administrative processes and core academic activities related to teaching and learning. Universities are therefore under growing pressure to integrate digital solutions into educational processes, while simultaneously preserving the institutional values and organizational practices associated with traditional models of higher education (Benavides et al., 2020; Haleem et al., 2022).

Existing research suggests that digital transformation in HEIs extends beyond technological adoption, and involves broader organizational, cultural, and institutional change (Aditya et al., 2022; Robertsone & Lapina, 2022). Most studies examine HEIs' digital transformation at the institutional level, focusing on universities as monolithic organizations adapting to technological

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change (Marks et al., 2021; Gerón-Piñón & Solana-González, 2022). These studies predominantly conceptualize digital transformation as a managerial or technological process. They pay less attention to how organizational tensions emerge within everyday educational practices (ie., the interconnected set of teaching, learning, and organizational and administrative activities). As a result, there is limited understanding of the determinants of digital transformations in HEIs, as well as what tensions emerge when centralized strategies meet the deeply embedded professional norms of academic staff and students. More specifically, existing research provides limited insight into how determinants of educational digitalization interact and generate socio-technical tensions. Understanding these interactions is particularly important in the post-pandemic context, where digital practices are increasingly embedded in everyday educational activities.

Although research has extensively examined remote emergency education as a response to the COVID-19 crisis, less is known about how universities navigate the digital transformation of the educational process in the post-pandemic phase. In this new context, the increasing attention gained by the digitalization of the educational process highlights didactic issues, such as resilience (Tsz & Ng, 2025) and adaptation strategies (Callaghan et al., 2025) of university students in the post-pandemic era. At the same time, the educational reality needs long-term strategies. Emerging evidence suggests that the “return to normal” is not a reversal of digitalization, but rather a complex reconfiguration of educational practices and pedagogical innovation in post-pandemic higher education (Oben, 2026).

To ensure terminological clarity, in this study, the term *digital transformation of the educational process* is used interchangeably with educational digitalization. Education digitalization denotes broad organizational and cultural changes enabled by digital technologies (Tashakori & Sobhanifard, 2026). In contrast, the *digitalization of the educational process* refers to the use of digital technologies in educational processes. Hence, the digital transformation of the educational process requires a fundamental change in both operational processes and organizational culture.

Consequently, this study addresses the following research questions:

RQ1: *What determinants shape the digitalization of the educational process in HEIs in the post-pandemic context?*

RQ2: *How do the determinants shape the digitalization of the educational process?*

To answer these questions, the study adopts a qualitative case study approach focusing on a large public university in Poland. This case is particularly revelatory due to the institution’s twenty-year experience in digital initiatives, allowing for an analysis of how long-term path dependences interact with the “shock” of the pandemic. Drawing on semi-structured interviews with key organizational actors, ranging from university authorities to student representatives, and supported by a systematic analysis of 36 strategic documents, the study examines how various conditions influence the development of digital practices.

This article offers a substantial contribution to the literature on digital transformation in higher education. First, it shifts analytical attention from the institution-level to the educational process as a distinct socio-organizational domain, demonstrating that digitalization is not a uniform process across the university environment. Second, it conceptualizes the digital transformation of the educational process as a path-dependent process. Third, the study identifies the main determinants of the digitalization of the educational process and the tensions underpinning the dynamics of the process in the post-pandemic era.

By examining these dynamics, the study contributes to a more nuanced understanding of how universities institutionalize digital practices in the post-pandemic environment and provides insight context-sensitive digital transformation strategies in higher education.

THEORETICAL BACKGROUND

Educational digitalization in higher education

Digital transformation has become one of the most significant developments affecting higher education institutions (HEIs) worldwide (Benavides et al., 2020; Haleem et al., 2022; Prinsloo, 2026). It has become evident that technological challenges are important factors that will guide HEIs in the upcoming years (Rof et al., 2022; Hannan, 2023). HEIs are under growing pressure to institutionalize digital forms of education while maintaining educational quality, organizational coherence, and the professional autonomy traditionally associated with academic work.

Existing studies emphasize that digital transformation in HEIs extends beyond the implementation of technological tools, and involves broader organizational adaptation (Aditya et al., 2022; Robertsone & Lapina, 2022). Universities represent highly complex organizational environments, characterized by decentralized governance structures, heterogeneous disciplinary

cultures, and relatively high levels of academic autonomy. As a result, the digitalization of educational processes frequently generates tensions between technological standardization and locally embedded teaching practices.

These challenges became particularly visible during the COVID-19 pandemic, when universities were forced to rapidly transition to remote and hybrid forms of education. Although many HEIs had previously implemented digitalization initiatives, the pandemic accelerated the large-scale adoption of digital technologies under conditions of limited organizational preparation (Kopp et al., 2019; Turnbull et al., 2021). The rapid shift towards digital education exposed significant differences in institutional readiness, digital competencies, organizational support, and technological capabilities across universities. At the same time, this shift revealed significant differences in institutional readiness and organizational adaptation among universities.

In the post-pandemic context, digitalization has increasingly become a long-term organizational challenge rather than a temporary emergency solution. Universities are expected to maintain digital infrastructures. In addition, HEIs should integrate digital technologies into everyday educational practices and organizational routines. Universities must balance flexibility with teaching quality, institutional coordination, and academic autonomy. Consequently, the digitalization of educational processes should be understood as a socio-technical process shaped by the interaction between technological systems, organizational arrangements, and the practices of university actors.

A socio-technical perspective on educational digitalization

The digitalization of educational processes in HEIs can be analyzed through the lens of Socio-Technical Systems Theory (Trist & Bamforth, 1951; Appelbaum, 1997), which conceptualizes organizations as systems composed of interdependent social and technical subsystems. From this perspective, digital transformation cannot be explained solely by technological implementation, as the effectiveness of digital solutions depends on their alignment with organizational structures, institutional regulations, human competencies, and broader environmental conditions (Münch et al., 2022).

Within HEIs, the technical subsystem includes digital platforms, learning management systems (LMS), communication technologies, and information technology (IT) infrastructure supporting teaching and learning activities. The social subsystem encompasses organizational procedures, leadership practices, institutional regulations, and the competencies and attitudes of academic staff and students. The digitalization of the educational process depends on the alignment between technological capabilities and organizational adaptation, rather than technology alone.

A sociomaterial perspective (Orlikowski, 2007) further complements the socio-technical approach by emphasizing that technologies are not neutral tools, but instead actively shape organizational practices, interactions, and institutional routines. In the context of HEIs, digital platforms, LMSs, and communication technologies influence how the educational process is organized and how educational quality is evaluated. Consequently, the tensions accompanying educational digitalization emerge not only from organizational arrangements but also from the mutual constitution of social and material elements within everyday academic practices.

Adopting a socio-technical perspective enables a more comprehensive understanding of the interdependencies between the technological, organizational, and social factors shaping digital education. From this perspective, digital transformation in HEIs can be understood as a process of negotiating competing organizational, pedagogical, and technological logics.

Standardization versus teaching autonomy

The implementation of digital educational systems often requires standardized organizational procedures related to course management, assessment methods, and communication. Universities increasingly seek to coordinate educational processes through centralized digital infrastructures. However, such standardization may conflict with disciplinary diversity and the “academic freedom” inherent in higher education. Academic teachers often adapt digital tools to local pedagogical practices, which can diverge from institutionally preferred standards. Thus, digitalization involves permanent negotiation between organizational coordination and professional teaching autonomy.

Flexibility versus educational quality

Digital technologies enable more flexible forms of education, such as asynchronous learning, hybrid teaching, and remote access to educational resources. While these solutions improve accessibility (Aditya et al., 2022; Robertsone & Lapina, 2022), they also trigger concerns regarding educational quality, student engagement, and the limitations of online interaction. The digitalization of the educational process involves balancing demands for flexibility with the need to preserve the rigour and meaningful academic interaction characteristic of traditional models.

Technological capabilities versus digital competencies

The successful implementation of digital education depends on the availability of advanced technological infrastructure and on the specific competencies of the university actors (López Flores et al., 2025). Although many HEIs have significantly expanded their technical subsystems by investing in LMSs and digital teaching tools, the presence of infrastructure does not automatically ensure its effective use. Academic staff and students differ substantially in their digital literacy (Cook et al., 2023), willingness to adopt new technologies, and ability to integrate digital tools into everyday pedagogical routines. Tensions frequently emerge between the institutional drive for technological advancement and the actual capacity (or readiness) of organizational actors to integrate these systems into everyday practice. Thus, a gap often arises between the institution's technological capabilities (what the system can do) and the digital competencies of its members (what they are actually prepared to do), which requires ongoing organizational support and training.

Central coordination versus local adaptation

Digitalization also generates fundamental tensions between institutional-wide coordination and the need to adapt digital practices to local disciplinary contexts. Universities often implement centrally coordinated strategies to ensure administrative efficiency and system interoperability (Kopp et al., 2019; Marks et al., 2021; Robertsone & Lapina, 2022). However, faculties and departments operate under distinct educational requirements and traditional academic norms. Centrally designed digital solutions, such as unified course templates or assessment protocols, may not fully correspond to the specific teaching realities of a particular field (e.g., laboratory-based sciences vs. humanities). The digital transformation of the educational process, therefore, requires a continuous process of negotiation and local adaptation to prevent a mismatch between central organizational objectives and faculty-level needs.

Analytical implications for the study: visualizing the socio-technical framework

The socio-technical perspective adopted in this study conceptualizes the digitalization of educational processes as a negotiated organizational process. Rather than a linear implementation, the process is a socio-technical evolution where universities must balance competing expectations. To capture these dynamics, the study proposes a model in which the educational process is located at the intersection of two interdependent subsystems (Figure 1). This framework conceptualizes digital transformation as a negotiated and path-dependent process in which universities continuously balance competing organizational, pedagogical, and technological demands. As shown in the framework, the technical subsystem (infrastructure and digital tools) and the social subsystem (actors, regulations, and institutional culture) are in a state of constant interaction. The way these tensions are managed influences how digital transformation develops within the university.

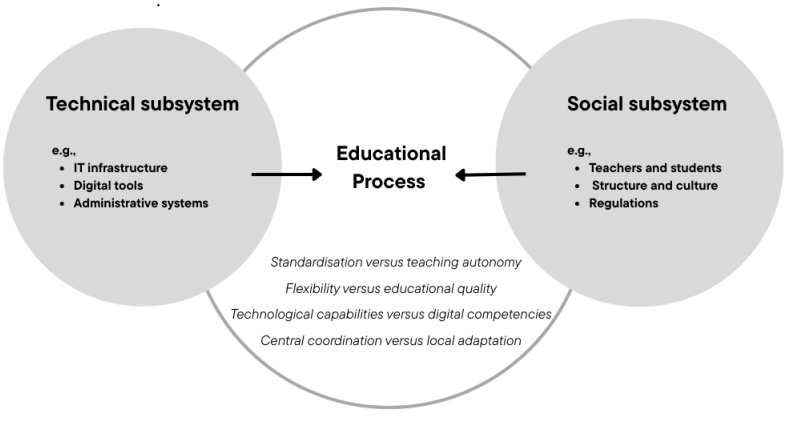


Figure 1. Socio-technical framework of educational digitalization

RESEARCH METHODOLOGY

Research design

This study adopts an interpretative qualitative approach using a single case study design. Case studies are particularly suitable for examining complex organizational phenomena within their real-life contexts (Siggelkow, 2007; Gustafsson, 2017). The interpretative design enables analysis of how socio-technical tensions are experienced and managed in everyday organizational practices. To ensure completeness, the study employed data triangulation, combining multiple sources of evidence in strategic, operational, and technological dimensions.

Case selection

The case was selected to enable an in-depth examination of the digitalization of educational practices within a complex organizational environment (Eisenhardt, 2021; Bouncken et al., 2026). The analyzed university constitutes an information-rich case (Yin, 2015) within the Central and Eastern European higher education context, combining a long history of digital investment with rapid post-pandemic reconfiguration.

The study focuses on a large public university in Poland that has systematically implemented digital transformation initiatives for more than two decades. During this period, the institution has developed digital infrastructures, organizational regulations, and support mechanisms to integrate digital technologies into teaching and learning activities.

Several factors informed this selection. First, the organizational complexity. The university operates through a highly differentiated organizational structure consisting of 16 faculties representing diverse disciplinary cultures.

Second, the scale. Serving approximately 35,000 students, the university faces significant pressure to standardize digital systems while maintaining flexibility.

Third, institutional maturity. The university was among the early adopters of digital technologies within the Polish higher education sector. The COVID-19 pandemic further accelerated the implementation of remote and hybrid education, requiring the rapid scaling of digital infrastructures and organizational procedures supporting online teaching. The post-pandemic return to predominantly on-site education created new tensions regarding the long-term role of digital technologies, making the case particularly suitable for examining digitalization as a process of institutional adaptation.

Data collection

Data were collected in two iterative stages using document analysis and semi-structured interviews. In the first stage, an analysis of 36 organizational documents (strategic plans, rector's ordinances, and internal procedures) was conducted to identify the formal mechanisms and institutional expectations regarding digital transformation.

The second stage consisted of semi-structured interviews with key organizational actors (elite informants) directly involved in governance, IT support, legal administration, and student representation (see Table 1). In accordance with the key informant interview approach (Lokot, 2021; Solarino & Aguinis, 2021), participants were selected based on their direct involvement in educational coordination, digital infrastructure, organizational support, or governance processes related to digital transformation. Interviews explored experiences of implementing digital educational practices, perceived challenges, and interpretations of socio-technical tensions. Each interview lasted at least 30 minutes and was conducted by two researchers to enhance analytical consistency and reduce potential interviewer bias.

Sampling and data adequacy

Purposive sampling was used to recruit participants. This approach enabled access to information-rich participants involved in both strategic and operational aspects of educational digitalization. To ensure analytical diversity, participants were selected from multiple organizational levels and functional areas of the university. The interviewees included individuals involved in university governance, faculty-level educational management, IT support, legal administration, operational support units, and student representation. This diversity enabled the analysis of the interpretation and management of socio-technical tensions across different organizational contexts within the institution.

The final criterion for completing the interviewee selection process was data saturation (Mwita, 2022; Bouncken et al., 2026). Data collection continued until no substantively new insights emerged. Saturation was reached after seven interviews, with no new themes emerging beyond the fifth interview. The subsequent interviews yielded no new conceptual codes or sub-categories. Thus, the final sample consisted of seven elite informants occupying structurally significant positions within the university and possessing extensive knowledge of institutional digitalization processes (Solarino & Aguinis, 2021).

Table 1. The characteristics of elite interviewees

Interviewee	Interviewee's gender	Interviewee's position	Experience in current position (in years)	Roles and responsibilities in digital transformation processes
A	Female	Representative of the Legal Advisers' Team management	4	Responsible for formal and legal matters, e.g., giving opinions on the Rector's notices and orders, receiving and processing legal problems raised by faculty and students.
B	Female	Associate dean for teaching in one of the faculties	3	Organization and management of the educational process, including its supervision, i.e. conducting and organizing online classes, ensuring the achievement of learning outcomes and introduction of technological teaching solutions.
C	Male	Representative of the Teaching Support Center management	12	Participation and coordination of processes, e.g., design of educational services, recruitment and support for implementation of the educational process.
D	Female	Representative of the Students' Self-government	2	Recipient of educational services as a student; opinion-giving on issues connected to the organization of the educational processes.
E	Male	Representative of the Informatics Center management	10	Providing IT tools and training for employees and students during the digitalization of educational processes.
F	Male	Head of the Multimedia and Computer Laboratory in one of the faculties	14	Supporting activities related to digital transformation, maintaining access to the Internet and tools. Technical support for employees and students (including training), creating new digital tools and solutions.
G	Male	Representative of the university's authorities responsible for teaching	7	Participation in all educational processes and their digital transformation, decision-making and directional role.

Table 2. Codebook sample

Aggregate dimension	Second-order theme	First-order concepts	Definition	Example indicators / quotations
Process tensions	Standardization vs teaching autonomy	Unified procedures; mandatory platforms; restricted flexibility	Conflict between institutional standardization and lecturer autonomy	Templates limit individual teaching styles
	Flexibility vs educational quality	Easier access; asynchronous learning; concerns about outcomes;	Tension between accessibility and maintaining educational standards	Flexibility increased, but engagement decreased
	Technological capabilities vs digital competencies	advanced systems; insufficient training; adaptation difficulties	Misalignment between technologies and users' competencies	The tools were available, but the staff lacked experience
	Central coordination vs local adaptation	Central policy; faculty-specific needs; local practices	Tension between centralized governance and local educational needs	Faculty needs differed from university-wide policies

Data analysis and validation

Several strategies were used to improve the credibility and confirmability of the findings. Data triangulation was applied by combining interview data with organizational documents. The inclusion of respondents representing different organizational levels and institutional functions enabled the cross-verification of interpretations and organizational perspectives. Finally, interviews were conducted by two researchers to minimize potential observer bias.

The analysis followed abductive and iterative logic, combining inductive exploration with concepts derived from Socio-Technical Systems Theory literature. The transcripts and documents were independently coded by three researchers using thematic analysis (Braun & Clarke, 2006).

The analysis involved first-order coding (34 codes), second-order themes (12), and theoretical aggregation. In the initial stage, first-order codes were developed inductively from empirical material to capture raw participant experiences and perceived challenges related to educational digitalization. In the subsequent stage, the emerging themes were iteratively interpreted

through the socio-technical perspective adopted in the study. Through iterative abstraction, the codes were aggregated into four themes representing broader organizational dynamics and socio-technical tensions.

Document analysis was used both to contextualize the digital transformation processes within the HEIs under study and to support the development of the coding framework for interview analysis. Institutional documents, including internal regulations, quality assurance policies, and reports related to educational digitalization, were analyzed to identify key organizational priorities, governance mechanisms, and implementation practices. The insights derived from the document analysis informed the initial coding structure and sensitized the analysis to recurring themes and tensions subsequently explored in the interview material. In addition, document analysis supported interpretation of the interview data by providing organizational and regulatory context for the experiences reported by respondents. This enabled the integration of institutional developments identified in documentary sources with the perceptions of organizational actors involved in educational digitalization.

FINDINGS

Institutional trajectory of educational digitalization

The findings indicate that the digitalization of the educational process in the analyzed university evolved as a long-term socio-technical transformation rather than as a mere reactive shift caused by the COVID-19 pandemic. Document analysis revealed a multi-level process in which technological infrastructures, organizational regulations, governance mechanisms, and educational practices gradually co-evolved (Table 3).

At the institutional level, systemic changes in administrative processes and organizational worflows operationalized the transformation process. Early institutional investments, such as the establishment of the Center for Distance Learning in 2005, created the foundations for subsequent initiatives. A key milestone was the implementation of the Electronic Document Management system, formalized by Rector's Decision No. 10/2019 and Ordinance No. 40/2020. These regulations marked a deliberate transition to a digital-first administrative model, introducing structured procedures for digital document circulation, data management, and process automation. The implementation process was coordinated by a dedicated Steering Committee responsible for supervising data migration and ensuring organizational readiness for digital workflows.

At the operational (micro) level, the regulatory framework was adapted to address the immediate challenges posed by the COVID-19 pandemic. National emergency legislation (e.g., Journal of Laws 2020, item 374) created the legal basis for university-level regulations introducing remote work and remote education. Rector's ordinances (e.g., No. 127/2020 and No. 151/2020) established institutional rules governing telework, digital communications, and online teaching. Subsequently, these central regulations were translated into practice through faculty-level directives issued by deans and administrative units. For example, faculty-specific communications regulated the organization of online examinations, virtual student services, and the use of digital platforms in teaching activities. The longitudinal mapping of the university's regulatory framework (Appendix) further supports this interpretation.

Table 3. Analytical framework for regulatory-oriented document analysis

Regulatory Level	Document Types	Key Legal Acts & References	Analytical Purpose (Rationale)
MACRO (National)	Statutory Law & National Regulations	Act on COVID-19 (Journal of Laws 2020, item 374); Law on Higher Education and Science (Law 2.0).	Identify external legal boundaries and the state-mandated transition to remote public administration.
MEZZO (Institutional)	Senate Resolutions & Development Strategies	Senate Resolution No. 11/IV/2005 (Est. of Center for Distance Learning); JU Strategy 2030.	Assess long-term institutional readiness and the historical trajectory of adoption of e-learning (path dependency).
	Rector's Ordinances & Systemic Decisions	Rector's Decision No. 10/2019 (Electronic Document Management Implementation); Ordinance No. 151/2020 (Remote Work Regulations).	Evaluate the formalization of the digital operating model and the transition from paper-based to digital-first workflows.
OPERATIONAL (Micro)	Dean's Communications & Faculty Directives	Management & Social Communication Faculty Directives (2020–2022); Chancellor's Communiqués on administrative support.	Investigate the actual implementation of digital protocols at the departmental level and faculty-specific adaptations.

The COVID-19 pandemic significantly accelerated these institutional and operational developments; it functioned as a catalyst, intensifying existing trajectories rather than an origin point. As one interviewee observed: “Digital transformation has occurred not only in the area of education but also in the broadly understood functioning of the whole university” (E).
All participants acknowledged the inevitability of digitalizing the educational process, recognising that, despite its challenges, it is organizationally necessary to continue this transformation.
As one respondent reflected: “It’s supported by the world; the world’s going this way whether we want it [to] or not and so we’ll have to do it… We wondered how we could try to fight it at all, try to, maybe not fight it at all; on the contrary, we want to cope with it” (G).
These responses suggest that while the process is externally driven by global trends and technological imperatives, the internal challenge lies in managing adoption strategically and sustainably, rather than merely reacting to external pressures. The institutional trajectory outlined above provides context for understanding the determinants identified in the interviews. While the document analysis highlights the organizational evolution of digitalization, the interview data show how these developments were experienced and interpreted by key organizational actors.

Key determinants of educational digitalization in higher education

The main focus of the study was on the determinants shaping the digitalization of the educational process. Based on the interviews, these determinants were grouped into four main themes: expectations associated with educational digitalization, its drivers and constraints, and the resulting organizational challenges.
The identified expectations reflected attempts to reconcile market demands with the aspirations of HEIs, including greater flexibility of the educational process, enhanced competitiveness, and increased organizational efficiency. At the same time, the interviewees identified several barriers to digitalization, which were grouped into four categories: regulatory, resource-based, managerial, and societal. For example, the digitalization of the educational process was constrained by the limited availability of IT professionals, who often perceived employment in the public sector as unattractive: “Particularly Polish universities experience that. There is a lack of specialists, of IT employees. (...) We’d like to organize many things, but it takes two to three times longer because there are no employees to do it” (G).
The barriers also stemmed from societal factors, particularly attitudes towards organizational change. Interviewees highlighted the difficulty of overcoming resistance and fostering acceptance of new organizational realities: “It is a huge difficulty, if we talk about difficulties ahead of us, to bring about a mindset change, for people to become aware and accept that the world has changed” (B).
At the same time, the interviewees identified several drivers of digital transformation, including regulatory, organizational, individual, social, and market-related factors. Particular importance was attributed to university initiatives aimed at mobilizing academics and students, strengthening their sense of participation in transformation processes, and supporting the well-being of the academic community.
The findings also revealed a set of challenges associated with the digitalization of the educational process, affecting both decision-makers and participants in the educational process. These challenges were grouped into five categories: personal, cultural, legal, organizational, and technological.
Overall, the findings demonstrate that the digital transformation of the educational process requires continuous balancing between technological opportunities, organizational constraints, and academic practices, which manifests itself in four major socio-technical tensions.

Tension One: Standardization versus teaching autonomy

Understanding the consensus on the digitalization of the educational process requires a careful examination of tensions. Our findings indicate that respondents articulated multiple, interrelated expectations for the educational process, reflecting efforts to reconcile institutional aspirations with evolving market demands.
The first tension concerns the relationship between institutional standardization and academic autonomy. The university progressively introduced centrally coordinated systems, including learning management platforms and formal regulations for online education (e.g., remote examination procedures), to ensure organizational coordination, legal compliance, scalability, and consistency of educational processes across faculties.
However, interviewees repeatedly emphasized that educational practices differed substantially across disciplines, types of courses, and faculty contexts. This means that centrally designed digital procedures often require local adaptation within faculties and teaching units. This tension became particularly apparent when discussing the post-pandemic scope of remote teaching (or hybrid education). While administrative and support processes were widely seen as suitable for permanent digitalization, opinions regarding teaching activities were considerably more divided.

As one respondent noted: “With respect to the areas such as preparing the teaching offer, recruiting students or improving curricula, the pandemic was not such an influential factor… However, it changed most in the context of distance education” (C). Interviews revealed that digitalization could not be implemented uniformly. Its appropriateness depended on disciplinary specificity and pedagogical requirements. Thus, institutionalization required a constant balance between organizational consistency and the autonomy of academic staff to design educational delivery. Rather than eliminating diversity, digital transformation intensified discussions about who should define appropriate forms of educational delivery within the university.

Tension Two: Flexibility versus educational quality

A second major tension emerged between the flexibility of the organization enabled by technology and concerns about educational quality and academic identity.

Interviewees consistently recognized that digital technologies increased the flexibility of educational processes. Remote and hybrid teaching enabled universities to maintain educational continuity, reorganize schedules more efficiently, and improve accessibility for students and academic staff.

As respondent B explained the impact on scheduling and accountability: “The disappearance of the necessity to make up for lost classes or lectures… Nowadays, the tools at our disposal allow us to keep them in the schedule”.

Similarly, digital education was perceived as increasing the international accessibility and competitiveness of the university: “It has opened the boundaries of education. We’ve stopped being hermetic in terms of offering our teaching only to Polish students… We are open to practically the whole world” (B).

In addition, it reduces restrictions on access to study programs and syllabi. As another respondent signaled: “Students or candidates for studies can get acquainted with the university’s offer…later they will come and enroll in some kind of program” (C). It may also reduce inequalities, allowing for the inclusion of those temporarily unable to participate in teaching and learning on an on-site basis.

“Digitalization has made it possible, to some extent, to involve people previously excluded in the education process and I think this is an enormous advantage” (B).

At the same time, despite these benefits, interviewees expressed fears that convenience might erode the traditional understanding of studying as a collective intellectual experience. Interviewees expressed strong concerns regarding the consequences of excessive digitalization on educational quality, interpersonal interaction, and the social dimension of academic life. That phenomenon was described as the “convenience trap”: “Why should I come to class when I can achieve the same effect sitting at my private desk...The idea of studying gets a bit lost here” (B).

The findings further indicate that these concerns extended beyond teaching effectiveness itself and involved broader questions regarding academic culture and institutional identity. The above respondent continued: “What awaits us is a reworking of the view of what studying is, what the university is, what the academic community is first and foremost” (B).

Consequently, these findings suggest that digitalization is not just a technical shift but a transformation that affects the social foundations of education. Institutionalizing digital teaching requires balancing the demand for “anytime, anywhere” access with the need to preserve interpersonal interaction and academic community.

Tension Three. Technological capabilities versus digital competencies

The findings also highlighted a gap between the university’s technological readiness and the actual organizational capability to use it. Although the institution had invested in infrastructure long before the pandemic, the rapid transition exposed uneven levels of digital literacy among staff.

Several interviewees observed: “While the infrastructure was there, suddenly everyone had to operate fully remotely” (paraphrased from multiple interviews).

The rapid expansion of digital education exposed limitations in staff preparedness, uneven levels of digital competencies, and difficulties in coordinating digital practices across organizational units.

Several respondents stressed that many academics previously used digital technologies only to a limited extent and that the pandemic forced rapid competency development. One stated, “The pandemic did force us to acquire these skills… It is a civilizational leap in terms of the approach of lecturers, their competencies, their skills, and the way they teach” (B).

While the pandemic forced a “civilizational leap” in competencies, respondents highlighted a persistent lack of methodological support. Infrastructure alone was insufficient without coherent pedagogical models: “There was no methodology for the teaching process using digital tools… without that, in the long run, you will not enjoy many of the benefits promised by these technologies” (E).

The findings suggest that the technological infrastructure alone was insufficient for a successful digital transformation. This highlights that success in that field depends more on organizational learning and the ability of staff to integrate tools into pedagogy, than on the mere possession of hardware or software.

Tension Four: Central coordination versus local adaptation

The final tension involves the friction between central governance and faculty-level reality. While university-level regulations ensured operational continuity and data security, their effectiveness depended on local interpretation.

Faculty-level directives translated institutional regulations into operational educational practices, including procedures for remote examinations, student services, and hybrid teaching arrangements. Interviewees repeatedly emphasized that local organizational contexts strongly influenced how digital solutions were implemented and perceived.

This tension was exacerbated by legal and ethical ambiguities, such as copyright issues and the limits of institutional surveillance. Interviewees referred to unresolved issues concerning copyright, privacy, online examinations, and academic responsibilities in digitally mediated teaching environments. One respondent pointed out the lag between regulation and practice: “Regulations don’t match the reality… they are much slower to act” (G).

Similarly, another interviewee highlighted the ethical dilemma of digital presence: “The question is whether, as an employer, we have to force an academic to turn on their camera” (A).

It suggests that central coordination was necessary to ensure institutional coherence during rapid digital transformation. However, at the same time, effective implementation required substantial local adaptation and continuous negotiation between university-level governance structures and faculty-specific teaching conditions. In other words, implementation required a compromise-oriented communication between the "top-down" drive for coherence and the "bottom-up" need for faculty-specific flexibility.

Readiness–implementation gap in educational digitalization

Across all identified tensions, the findings revealed a readiness–implementation gap. Institutional readiness (infrastructure) did not eliminate implementation difficulties (social and organizational disruption). Although the university possessed relatively advanced digital infrastructures and prior digitalization experience before the pandemic, the transition to large-scale digital education still generated significant organizational disruption and uncertainty. Institutional digital readiness did not eliminate implementation difficulties because digital transformation depended on technological infrastructure, organizational coordination, institutional regulations, professional practices, and cultural adaptation.

The study suggests that educational digitalization is a negotiated socio-technical process rather than a straightforward transition. The implementation of digital education required universities to continually balance competing demands related to organizational standardization, educational flexibility, technological capability, academic autonomy, and institutional coordination.

Ultimately, the institutionalization of digital education is an ongoing compromise-oriented process through which universities redefine their workflows, as well as the traditional academic roles and practices in a digitally mediated environment.

DISCUSSION AND CONCLUSIONS

This study contributes to the literature on digital transformation in higher education by conceptualizing the digitalization of the educational process as an ongoing process of organizational change. Unlike studies examining digital transformation at the institutional level (e.g. Benavides et al., 2020; Robertsone & Lapina, 2022), this study shifts attention to the educational process as the locus where digital practices are enacted and negotiated.

The determinant categories and the socio-technical tensions identified in the study represent two complementary levels of analysis. The findings resulted in a typology of determinants comprising four categories: barriers, drivers, expectations, and challenges related to educational digitalization. This extends existing research (Benavides et al., 2020; Robertsone & Lapina, 2022) by identifying key areas in which barriers and drivers of educational digitalization emerge. Consistent with earlier studies, educational digitalization remains constrained by managerial factors, such as the absence of a comprehensive vision (Marks et al., 2021; Aditya et al., 2022) and resource-related limitations (Aditya et al., 2022; Robertsone & Lapina, 2022). At the same time, challenges previously associated with emergency remote education, including feelings of isolation and perceived stress (Lischer et al., 2022; Wong & Yuen, 2022), appear to have evolved into a weakened sense of academic community and deteriorating interpersonal relations.

The findings demonstrate that educational digitalization generates persistent tensions between organizational coordination and local academic practices. HEIs increasingly rely on standardized digital infrastructures and governance mechanisms, while teaching

practices remain shaped by disciplinary diversity, pedagogical preferences, and local educational contexts. At the same time, digital technologies increase flexibility and accessibility while raising concerns about educational quality, academic identity, and academic community. These findings suggest that digital transformation is shaped by ongoing negotiation between organizational and pedagogical logics. From a sociomaterial perspective, the identified tensions emerge through the entanglement of digital platforms, organizational arrangements, and pedagogical practices. Digital systems simultaneously enable and constrain action, shaping how autonomy, quality, flexibility, and coordination are enacted within educational processes.

The findings further reveal a readiness–implementation gap. Although the university possessed relatively advanced digital infrastructures before the pandemic, large-scale implementation exposed limitations in digital competencies, pedagogical preparedness, and organizational coordination. This suggests that technological readiness alone is insufficient for successful digital transformation; success depends on the alignment of technologies, organizational routines, and human competencies.

Theoretical Contributions

The study has three key contributions. First, the study contributes to Socio-Technical Systems Theory by conceptualising educational digitalization as a negotiated process shaped by interactions between social and technical subsystems. By identifying four recurring socio-technical tensions, the study shifts attention from technology adoption to the ways digitalization is enacted and contested within educational practices.

Second, the study identifies a readiness–implementation gap, showing that digital infrastructure alone does not ensure the effective implementation of digitally mediated educational practices. The findings reinforce Socio-Technical Systems Theory by demonstrating that technological investments remain underutilized unless accompanied by changes in organizational routines and pedagogical mindsets.

Third, the findings point to a potential “convenience trap”, extending post-pandemic scholarship by highlighting a long-term cultural risk. While digital tools increase accessibility and flexibility, they may simultaneously weaken the social embeddedness of higher education by transforming studying into a more individualized and transactional activity. This raises concerns about the gradual erosion of academic community and the collective dimensions of university life.

The proposed framework explains how digitalization emerges through the interaction of determinants, organizational tensions and implementation dynamics.

Practical implications

The study provides several implications for higher education management. First, HEIs should move beyond technology-centered approaches to digitalization. Successful digital transformation requires balancing technological investment with organizational coordination, pedagogical support and competency development. In particular, universities need to reconcile administrative standardization with the autonomy required by diverse disciplinary and teaching contexts.

Second, the identified readiness–implementation gap suggests that investments in digital infrastructure alone are insufficient. Universities should complement technological development with continuous support for academic staff, focusing not only on how to use digital tools but also on how to integrate them effectively into teaching and learning processes. This requires pedagogical support, training in digital teaching methods, and the development of digitally enhanced educational models adapted to local needs.

Third, digital strategies should explicitly address the tensions identified in this study, particularly those between flexibility and educational quality, technological capabilities and digital competencies, and central coordination and local adaptation. Effective digital transformation depends on managing these tensions rather than attempting to eliminate them through uniform solutions.

Finally, HEIs should ensure that digitalization supports rather than undermines interpersonal interaction and the academic community. As digital technologies become increasingly embedded in educational processes, maintaining opportunities for collaboration, engagement, and meaningful academic relationships remains essential. This is especially important in the context of emerging technologies such as artificial intelligence and learning analytics, which may further intensify existing socio-technical tensions within higher education.

Limitations and future research

This study has several limitations. First, it is based on a single qualitative case study conducted within one public university in Poland. Although the selected university represents a particularly information-rich case due to its organizational complexity and long-term digitalization trajectory, the findings should not be interpreted as universally representative of all HEIs.

Second, the study adopts an organizational and managerial perspective focused primarily on actors involved in governance, administration, and the implementation of digital transformation processes. Consequently, the findings provide limited

insight into the everyday experiences of ordinary academic staff and students participating in digitally mediated education. Future studies could therefore examine how socio-technical tensions are experienced across broader groups of educational actors.

Third, the study was conducted within a specific institutional and national context that is crucial for interpreting the findings (Avgerou, 2001; Davison & Martinsons, 2016). The Polish higher education system operates within a relatively centralized legal framework (Budzanowska-Drzewiecka et al., 2023; Antonowicz et al., 2024, 2023), and faces distinct demographic and competitive pressures, including declining student enrollment (Antonowicz et al., 2020) and growing internationalization challenges (Antonowicz et al., 2019). Moreover, Polish legal regulations continue to impose limitations on the extent of fully remote education. These contextual conditions shape how educational digitalization unfolds and may differ substantially from conditions present in other higher education systems.

Future research could examine how socio-technical tensions evolve across different institutional contexts and how emerging technologies, particularly generative artificial intelligence, reshape the balance between standardization and autonomy, flexibility and quality, and central coordination and local adaptation. More broadly, future studies should move beyond viewing digital transformation as technological implementation and explore how universities continuously negotiate its organizational, pedagogical, and cultural consequences.

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Appendix

Regulatory milestones in the university's digital transformation.

Year	Key Document /Legal Act	Transformation Phase	Strategic Significance
2005	Senate Resolution No. 11/ IV/2005	Pre-pandemic Incubation	Early institutionalization of e-learning; establishment of the Center for Distance Learning (CZN) as a dedicated support unit.
2017	JU Organizational Regulations (2017)	Structural Baseline	Established the traditional administrative framework and IT governance before the large-scale digital shift.
2019	Rector's Decision No. 10/2019	Systemic Transition	Formal initiation of the Electronic Document Management (EZD) project; appointment of the Steering Committee to oversee digital workflows.
2020 (Mar)	Chancellor's Communiqué No. 8/2020	Emergency Adaptation	Immediate operational shift to remote administrative communication and restricted physical access during the first lockdown.
2020 (Apr)	Rector's Ordinance No. 40/2020	Systemic Transition	Pilot implementation of the EZD system, accelerating the transition to a paperless office under crisis conditions.
2020 (Dec)	Rector's Ordinance No. 151/2020	Institutionalization	Formalization of ‚Remote Work Regulations'; establishing legal standards for data security and teleworking duties.
2021/22	Faculty-level Directives (WZiKS)	Operationalization	Translation of central mandates into faculty-specific protocols for remote examinations and virtual student services.
2021-30	University Strategy 2030	Future Vision	Strategic consolidation of digital maturity as a long-term developmental pillar of the institution.