2026 15TH Mediterranean Conference on Embedded Computing (MECO)

// Including CPS & IoT - 2026

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Radovan Stojanović
Lech Jóźwiak
Budimir Lutovac

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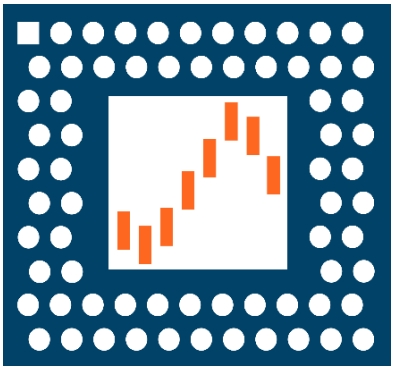

2026 15th Mediterranean Conference on Embedded Computing (MECO)

including

14th International Conference on Cyber-Physical Systems and Internet-of-Things (CPS&IOT'2026)

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Message from the Chairs and Editors

Dear Authors, Participants, Supporters, and Friends,

Since 2012, the Mediterranean Conference on Embedded Computing (MECO) has grown into a globally recognized scientific and professional event. Together with the International Conference on Cyber-Physical Systems and Internet of Things (CPSIoT), MECO has become one of the leading conferences in the fields of Embedded Systems, Cyber-Physical Systems, the Internet of Things, and Computing Technologies.

We are proud to celebrate a special milestone, the 15th edition of the MECO events, which will take place from June 9–12, 2025, in Budva, Montenegro, an ancient Adriatic city rich in history and Mediterranean charm.

This year's conference features a rigorous academic program, including more than 100 carefully reviewed papers from over 40 countries. Notably, many of these contributions come from emerging researchers, reaffirming MECO and CPSIoT as important platforms for international collaboration and early-career development, particularly for scholars from developing countries.

In addition to research presentations, the conference offers four distinguished keynote lectures, ten Expert Spotlight Tutorials, project presentations, company exhibitions, roundtable discussions, and demonstration sessions, all designed to foster innovation, collaboration, and knowledge exchange.

As a longstanding tradition, the MECO and CPSIoT events host one of the region's most recognized Summer Schools in Cyber-Physical Systems and the Internet of Things. This year, the program has been further enriched with the introduction of the Artificial Internet of Things Academy (AIoT Academy).

The MECO events are jointly supported by IEEE, EUROMICRO, MANT, MECOnet, and leading universities, including the University of Montenegro, our longstanding co-organizer, as well as universities from Eindhoven, Belgrade, and Zagreb. We also gratefully acknowledge the support of the Ministry of Education, Science and Innovation of Montenegro and our industrial sponsors, Trony Network, Simes, Elkon, and Cikom. This year, the Municipality of Budva has recognized the MECO events as an important contribution to the city's scientific and cultural heritage and has generously supported the conference.

Since its inception, MECO has enjoyed the support of the IEEE Serbia and Montenegro Section, and we are deeply grateful for its continued commitment. As always, MANT and MECOnet continue to lead with vision and dedication, demonstrating that great ideas transcend institutional size.

None of this would be possible without the dedication of our authors, reviewers, speakers, volunteers, and sponsors. Every submission undergoes a thorough peer-review process, and we sincerely appreciate the efforts of more than 300 reviewers who help maintain the high standards of our conference proceedings. MECO proceedings are indexed in IEEE Xplore, Scopus, Web of

Science, and other major scientific databases. We are particularly proud that MECO has become one of the most cited conferences in its field, and it is not uncommon for papers presented at MECO to be among the most highly cited publications in the profiles of their authors.

We hope that this year's edition will represent another important step forward in the continuing tradition of excellence and quality that defines the MECO conference and its associated events. We also look forward to reaching the next major milestone—celebrating 20 years of successful work, growth, and sustainability.

We look forward to welcoming you to Budva and wish you a productive, inspiring, and enjoyable conference experience.

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Contents

Digital Transformation in Higher Education in Armenia: The Shift from Access to Integration is Inevitable

Armen Budaghyan
Director of the Quality Assurance Centre
Yerevan State University
Yerevan, Armenia
abudaghyan@ysu.am

Lusine Fljyan
Vice-Rector for Education, Research and Internationalization, Professor Doctor of the Chair of Languages, Literature, and Journalism
Northern University
Yerevan, Armenia
vice-rector@northern.am

Serob Khachatryan
Assistant Professor of the Faculty of Philosophy and Psychology
Yerevan State University
Yerevan, Armenia
serob.khachatryan@ysu.am

Mari Santurjyan
Assistant Professor of the Faculty of Armenian Philology
Yerevan State University
Yerevan, Armenia
santmary@ysu.am

***Abstract*—The rapid development of information and communication technologies (ICT) is fundamentally transforming all spheres of human activity, including education, which plays a critical role in ensuring the effective functioning and sustainable development of modern societies. The advancement of human capital without adequate digital competencies significantly limits both individual potential and broader socio-economic progress. The COVID-19 pandemic further exposed the vulnerability of traditional education systems, demonstrating that a lack of preparedness for non-face-to-face learning can disrupt educational continuity. In this context, digital competences have emerged as a key prerequisite for ensuring resilience, quality, and inclusiveness in education systems worldwide.**

As a full member of the Bologna Process since 2015, Armenia has committed to aligning its higher education system with the priorities of the European Higher Education Area (EHEA), including enhancing digital competences among students and academic staff. This requires the systematic integration of digital technologies into teaching, learning, and assessment (TLA) processes, as well as the development and implementation of national digital competence frameworks. However, despite ongoing reforms, significant gaps persist between the availability of digital technologies and their effective pedagogical use.

This study is conducted within the framework of the ERASMUS+ Capacity Building in Higher Education project *eCAMPUS "Fostering Socially Distanced and Inclusive on Campus Education in Armenian HEIs"*, which aims to support the digital transformation of Armenian higher education by developing a digital competence framework for academic staff and introducing certified training and assessment mechanisms. The article aims to analyze the results of a large-scale survey conducted across eight major Armenian universities among teaching staff and students to assess digital competence levels, identify infrastructural and pedagogical challenges, and determine key development needs.

The findings indicate that, although digital technologies are increasingly adopted in Armenian higher education, their use remains uneven and largely limited to basic functions. Teachers' digital competences are often fragmented, and advanced pedagogical applications - such as digital assessment, personalized learning, and AI-supported teaching - are insufficiently developed. In addition, infrastructural limitations and the lack of systematic professional development hinder the effective integration of digital tools into the educational process.

Keywords—education, digital, competence, teacher, student, transformation, pedagogical, Armenia

I. INTRODUCTION

In higher education, if teachers are not adequately equipped with digital skills, this directly hinders the quality of education and reduces its competitiveness, attractiveness, and capacity for innovation. The teachers who are not proficient in applying digital technologies to classroom activities risk falling behind not only their students, who are often more digitally fluent, but also their colleagues, institutional expectations, and the evolving demands of modern education systems. In the long term, such limitations extend beyond the institutional level and may hinder the development of human capital, thereby constraining countries' broader economic progress. And this problem has become more pronounced during the COVID-19 pandemic, revealing that their competencies are fragmented and that many of them simply replicated face-to-face methods in online environments. The pandemic also showed that any crisis can seriously disrupt the educational process, forcing higher education institutions to adopt alternative teaching methods as traditional teaching may be temporarily or entirely infeasible. This experience highlighted the urgent need for more systematic, resilient, and pedagogically grounded integration of digital technologies in higher education [1].

Effective digitalization in higher education depends largely on the development of digital competencies of teachers, allowing them to rethink TLA methods, rather than simply transferring traditional approaches to the digital environment. Therefore, assessing the state of digital competencies, identifying gaps, and understanding the situation of teachers and students are becoming standard prerequisites for supporting systemic and pedagogical innovation in the digital transformation of higher education institutions.

The transition to a digital society requires not only the introduction of technologies but also a profound structural transformation. As Confalonieri (2015) has pointed out, "the path to a digital society consists of two interrelated developments. The first concerns the achievement of digital performance, while the second involves the concrete transformation of the industrial digital DNA necessary for a

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digital future." This distinction emphasizes that digital transformation in higher education must go beyond the operational use of digital tools and address the pedagogical, institutional, and competence-based foundations that shape TLA practices [2].

The aim of this article is to examine the current state of digital competences related to TLA in eight Armenian higher education institutions, based on empirical data collected within the framework of the Erasmus+ eCAMPUS project, and to determine the priority for the reintegration of digital technologies into higher education practice.

To achieve this goal, the study pursues the following objectives:

1. To analyze the current level and extent of digital competence use among academic staff and students of higher education institutions in Armenia.
2. To identify the perceived needs and interests of teachers and students in further developing digital competences in teaching, learning, and assessment.
3. To reveal the main gaps that hinder the effective and pedagogically sound integration of digital technologies in higher education and provide evidence-based directions for capacity building and institutional transformation in higher education in Armenia.

This study contributes to the growing body of research on digital transformation in higher education by providing empirical evidence from a national-level needs analysis conducted across eight Armenian higher education institutions. The findings offer a structured understanding of current practices, competence gaps, and development priorities, thereby supporting data-driven decision-making for institutional and system-level digitalization strategies.

The survey provides valuable data to understand the digital competency needs within the Armenian higher education system, serving as a foundation for further quantitative and qualitative research and for the development of targeted policies and capacity-building initiatives.

The study is intentionally limited to these aspects to focus on the core dimensions that most directly influence the integration of digital technologies into TLA and to improve the quality of the educational process. It provides a structured understanding of both existing practices and the gaps that hinder the meaningful, learner-centered integration of digital technologies in higher education. Future studies may expand this work by examining additional aspects such as learning outcomes, institutional strategies, governance models, and the long-term impact of digital transformation; however, the present one prioritizes the most immediate factors shaping digital TLA practices and their further development.

II. Literature Review

The importance of digital technologies in higher education had been recognized long before the COVID-19 pandemic; however, the global crisis accelerated the identification of weaknesses within education systems and revealed that many were not adequately prepared to transition to online formats to ensure the continuity of the educational process. This exposed systemic gaps, such as poor digital competencies among academic staff and students, limited infrastructure, and equity and access divides [3].

Several studies have demonstrated the magnitude of the problem, as UNESCO reported that more than 1.5 billion students were affected by the closure of educational institutions during the pandemic, which accelerated the acquisition of digital competencies by both teachers and students [4]. Moreover, the rapid transition revealed disparities in access to digital materials and differences in digital competencies among teachers and students.

The very concept of digital competences has also evolved in response to shifts in the paradigm of digital globalization and the emergence of new tools. DigiComp which is widely used in Europe has developed its fifth version of 3.0, and even the name itself has been modified from "developing and understanding the digital competence" to the framework "for living, working and learning", thus, highlighting that the digital competences are no longer limited to technical skills, but encompass a broader set of cognitive, social, and ethical abilities required for effective participation in contemporary digital environments [5]. In this sense, digital competences have become a transversal and lifelong dimension of human capital, essential for navigating complex socio-economic systems, fostering innovation, and ensuring responsible engagement in digital society, thereby enabling the solution of problems in complex ecosystems.

The continuous advancement of technology and the evolving nature of digital competences require coordinated support at the EHEA level. This need is clearly reflected in the policy trajectory of the Bologna Process, which has increasingly moved beyond structural harmonization toward the quality, inclusiveness, resilience, and digital modernization of higher education. In this context, the Rome Ministerial Communiqué reaffirmed the EHEA's commitment to building a more inclusive, innovative, interconnected, and resilient higher education system, while placing greater emphasis on innovative learning and teaching practices and on the capacity of higher education institutions to respond to contemporary societal and technological challenges. As a result, digitalization in higher education should be understood not as a separate technical agenda, but as an integral component of the broader Bologna reforms aimed at enhancing the quality, relevance, and future-readiness of higher education across Europe.

The Rome Ministerial Conference underlined the imperative of supporting higher education institutions in developing digital skills and competences for all members of the academic community [6], as the "potential impact of AI and digital innovations on higher education is profound, promising to revolutionize teaching and learning" [7].

Digital competence in Armenian higher education is a systemic prerequisite for improving educational quality, institutional resilience, and national competitiveness in line with the country's political agenda. The State Programme for the Development of Education of the Republic of Armenia until 2030 [8] and the Digitalization Strategy of Armenia 2021–2025 [9] emphasize the integration of digital technologies, the development of ICT infrastructure, and the strengthening of digital skills across all levels of education. These policy priorities position universities as key actors in advancing digital transformation and fostering innovation-oriented learning environments. However, despite this strategic orientation, the transition toward digitally mature higher education systems in Armenia remains uneven.

This background helps explain why higher education institutions must now move beyond ad hoc digitalization toward more structured competence frameworks and quality assurance mechanisms.

Existing scholarly research on Armenia remains limited but points in a consistent direction. Tovmasyan's study of Armenian students' experiences with AI and digital technologies in higher education found that universities have begun incorporating digital and AI-related tools, yet substantial challenges remain regarding satisfaction, effective use, and future-oriented improvement. The educational value of these tools depends on how well institutions support meaningful pedagogical application. Therefore, the Armenian case is not one of digital absence, but of incomplete digital transformation [10]. Harutyunyan (2024) analyzes digital literacy in Armenian society and helps contextualize universities within the broader national digital environment. It is useful to argue that higher education institutions operate within a broader ecosystem in which digital skills are unevenly distributed, affecting both student readiness and the demands placed on universities [11].

Scholarly studies focusing on the development of digital competences in the context of higher education systems in the Bologna member states, and in Armenia in particular, confirm that universities are expected to increasingly incorporate digital and AI technologies into TLA. At the same time, the literature emphasizes that the effectiveness of such integration depends on the level of digital competence among academic staff and students, as well as on the availability of institutional support and pedagogical redesign. This suggests that digital transformation in Armenian higher education is still evolving and requires systematic competence development, structured training programs, and institutional frameworks aligned with the priorities of the Bologna Process.

III. METHODOLOGY

The study is based on a quantitative research design that uses results from an online survey conducted among teachers and students at eight Armenian universities. The survey participants comprised 588 teachers and 1316 students:

TABLE I. THE NUMBER OF TEACHER AND STUDENT SURVEY RESPONDENTS FROM PARTICIPATING UNIVERSITIES

N	Armenian HEIs	Teachers' responses	Students' responses
1	Yerevan State University (YSU)	211	164
2	Armenian State Pedagogical University (ASPU)	38	394
3	Yerevan State Medical University (YSMU)	109	118
4	Northern University (NU)	31	336
5	National Polytechnic University of Armenia (NPUA)	27	106
6	National University of Architecture and Construction of Armenia (NUACA)	17	1
7	Armenian State University of Economics (ASUE)	121	181
8	Brusov State University (BSU)	34	16
	Total	**588**	**1316**

The survey was distributed to respondents via official institutional email addresses to ensure a broad reach among all participants. Only valid responses were included in the analysis, excluding the incomplete and omitted answers. Data from the target groups were collected via Google Forms, which helped identify digital and infrastructural gaps, training needs, and barriers to technology adoption. Two distinct survey instruments were developed to capture responses from both groups. The questionnaires incorporated both parallel questions for comparative analysis and role-specific inquiries tailored to each respondent group. The instruments included closed-ended questions (multiple choice, Likert-scale items) for quantitative analysis and open-ended questions to capture qualitative insights.

The questionnaires were organized into six semantic sections:

TABLE II. THEMATIC SECTIONS OF THE QUESTIONNAIRES

N	Name of the Section
1	General Information
2	Digital Competencies and Technologies in Teaching, Learning & Assessment (TLA)
3	Technologies and Facilities Supporting Digital TLA
4	Teaching and Learning (Study) Materials
5	Main Obstacles to Digital TLA
6	Additional Information Provided by Teachers and Students

The study has several limitations such as selection bias (the survey's online mode may have led to respondents with relatively higher baseline digital literacy levels participating); respondent rate limitations (the non-selective distribution method yielded widely varying response rates across institutions, potentially leading to unrepresentative sample sizes at each university); demographic analysis constraints (the current dataset does not permit segmentation by key demographic variables, including age, gender, academic rank, or disciplinary affiliation, limiting the depth of analytical insights. Despite these methodological limitations, the survey provides valuable baseline data for understanding digital competency needs within Armenia's higher education institutions.

IV. DISCUSSIONS

The results of the research show that the digital transformation in the higher education system is uneven and predominantly fragmented. Although the frequency of technology use has increased considerably, especially after the COVID-19 pandemic, the data collected show the opposite: a considerable gap between the accessibility of digital technologies and their real integration into the TLA process. In other words, digital technologies are widely used; however, their impact on changes in teaching and learning practices has remained limited.

A. Digital Competencies and Technologies in Teaching, Learning & Assessment (TLA)

The results show that digital competencies and technologies in TLA are used primarily for communication and organizational purposes, while their pedagogical use remains limited and uneven. Both teachers and students most frequently reported using digital tools for communication (about 90% of teachers and 70% of students), whereas substantially fewer respondents indicated their use for feedback (around 32% teachers and 28% students), active student engagement (57% teachers vs 32% students), or individualized learning trajectories (around 22% students). A consistent perception gap is also evident, with teachers

reporting higher levels of pedagogical integration than students, particularly in aligning digital resources with learning objectives (80% of teachers vs 58% of students) and providing counseling support (over 60% of teachers vs 38% of students). In contrast, the needs analysis reveals that students report higher demand across all competencies, especially for effective use of digital tools (≈2.2 students vs ≈1.8 teachers) and communication-related technologies, indicating a gap between current practice and expected digital learning environments. Hybrid learning remains both rarely used and rated as low priority, suggesting structural or regulatory constraints. Overall, the findings indicate that digital technologies are present but not yet systematically integrated into pedagogical practice, with a clear mismatch between current use and the perceived need for further development (Fig.1).

Fig. 1. Needs of Teachers on a Descending Scale Compared to Students.

B. *Technologies and Facilities Supporting Digital TLA*

The survey measured two distinct but complementary dimensions of digital transformation: actual use and perceived usefulness of technologies that support teaching, learning, and assessment (TLA). The first question (3.1) asks respondents to indicate which technologies they currently apply, thereby capturing the operational level of digital adoption across LMS platforms, AI tools, assessment systems, collaboration tools, infrastructure, and hardware. The second question (3.2), in contrast, asks respondents to evaluate how useful these same technologies are for TLA, which reveals perceived pedagogical value rather than frequency of use.

The results demonstrate that the use of technologies and infrastructure supporting digital TLA remains uneven: teachers most frequently report the use of smartphones (around 80%), followed by personal computing devices such as laptops and tablets (around 71%), whereas students most commonly identify Learning Management Systems (LMS) as their primary digital environment. High usage is also observed for virtual classrooms, printers/scanners, chat tools, and presentation technologies, indicating that digital infrastructure is primarily used for communication, content delivery, and organizational support. In contrast, technologies with stronger transformative potential - such as LMS analytics, AI-based feedback tools, e-portfolios, semantic search tools, VR technologies, and speech recognition - remain below 20% usage in both groups. This pattern suggests that digital technologies are predominantly applied to replicate traditional teaching practices rather than to enable data-driven, personalized, or interactive learning models. The limited adoption of analytics and AI feedback tools is particularly notable, as these technologies are central to contemporary digital pedagogy and learning monitoring. Overall, the results indicate that while infrastructure is available and basic technologies are widely used, their pedagogical potential remains underutilized, and the transition toward advanced digital TLA practices remains incomplete (Fig. 2).

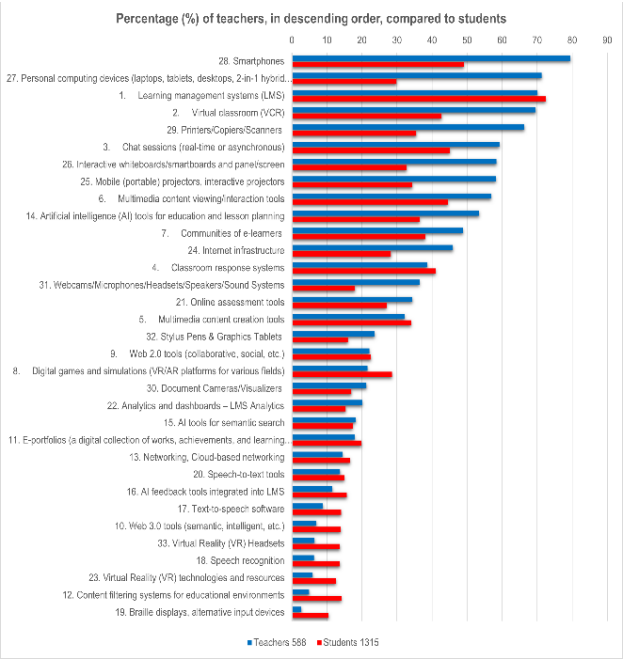

Fig. 2. Percentage (%) of teachers compared to students

Concerning the usefulness of technologies and infrastructure supporting digital teaching, learning, and assessment. Teachers considered the computer and the students' LMS the most useful technologies for TLA. Teachers ranked interactive whiteboards, smart screens, and LMS in 2nd, 3rd, and 4th place. Students ranked smartphones and printers, copiers, and scanners in 2nd and 3rd places. Attributing high usefulness to the latter means that printed materials are still widely distributed among Armenian students. Several students who participated in the survey noted that old forms of teaching still prevail.

Thus, we see a discrepancy between the frequently used tools and those useful for teachers and students, indicating a serious mismatch between access-driven digitalization and the pedagogically meaningful digital integration of tools in TLA. The pedagogical impact of the tools is frequently very low. Conversely, if a technology is rated as highly useful but rarely used, this points to barriers such as lack of training, infrastructure, or institutional support.

C. *Teaching and Learning (Study) Materials*

Unlike the high alignment between students' demands and the teaching and learning materials used by teachers at European universities (EUROSTUDENT 2024) [12], the survey reveals a clear mismatch between teachers' and students' responses regarding the use of teaching and learning materials at the surveyed institutions in Armenia. The students rate the availability of teaching materials as moderate. The largest difference is in the use of scientific journals and articles. Around 80% of teachers reported using them in the

TLA, while only 40% of students selected this option. In 23 of 24 categories of teaching materials, there is a mismatch between the teachers' and students' responses. Regarding the usefulness of these materials, both target groups rated them very highly. For Armenian students, lecture notes remain most valued, while in European universities, they are among the most valued. However, online repositories of teaching materials dominate the European pattern.

D. Main Obstacles for Digital TLA

The lack of digital infrastructure and equipment is the main obstacle to digital TLA. This obstacle was chosen by around 70% of teachers and 57% of students. The second major obstacle is the low level of teachers' digital competencies (around 62%), which students also cite as their second-largest obstacle (around 51%). 55% of teachers and 35% of students mentioned students' insufficient digital competencies as an obstacle.

The topics of the previous training are more tool-oriented than pedagogy- or policy-oriented. The results of recent European research emphasize that constructive alignment, digital assessment, learning analytics, and inclusion are the main topics of training activities at European universities. The European University Association (EUA) report emphasizes that digitally organized teachers promote student engagement rather than merely operating digital tools, and the digital assessment should be coherent with the curriculum as a core alignment of digital transformation and the inclusion of AI, VR/AR in training topics reflects emerging European priorities [13].

E. Additional Suggestion

The additional suggestions from teachers and students reinforce the interpretation that digital transformation is still at an intermediate stage, where awareness of digitalization exists, but systemic implementation remains incomplete. Teachers' responses emphasize the urgent need for regular, mandatory professional development; credit-based recognition for participation in training; and focused capacity building in AI, LMS use, and interactive digital pedagogy. Students focus on the urgent need for updated materials, an interactive learning environment, and improved access to digital resources. Both the teachers and students highlighted the importance of infrastructure modernization, including smart classrooms. Upgraded computer labs and remote participation options. These recommendations mirror digital campus strategies. The Digi-HE study reports that many European universities prioritize "smart classrooms, improved connectivity and digital learning spaces" as part of institutional digital transformation strategies [14].

V. CONCLUSION

The study examined the current state of digital competences, infrastructure, and digital resources supporting teaching, learning, and assessment in Armenian higher education institutions.

The findings indicate that the use of digital technologies has significantly expanded; however, the growth is uneven and is largely operational rather than transformative, and the analysis of data collected from teachers and students from eight Armenian universities and their show that the further development of digital competencies is needed in relation to AI, interactive learning, digital assessment, and collaborative environments.

The results of the discussion make it possible to identify a three-level gap in digital transformation: access gap - partially overcome, competence gap - persists, and pedagogical integration gap - remains the most critical. Thus, further development of digital transformation should be in developing pedagogical models and the systematic formation of digital competences.

Overall, the results suggest that Armenian higher education is transforming from access-driven digitalization to pedagogically meaningful integration and sustained institutional strategies.

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