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Enhancing Digital Teaching Competence through Modular Curriculum Innovation

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Abstract: In response to the growing need for digitally competent educators in higher education, this study presents the development of a modular digital pedagogy curriculum designed to enhance teaching and learning effectiveness. The curriculum was created within the framework of a transnational Erasmus+ project, incorporating the contributions of academic experts from multiple institutions. It addresses key areas such as digital literacy, e-learning design, online assessment, and emerging technologies in education. Organized into flexible, competency-based modules, the curriculum supports both initial teacher training and continuing professional development. The design process was grounded in evidence-based practices, needs analysis, and iterative peer feedback. This article outlines the structure, rationale, and pedagogical underpinnings of the curriculum, highlighting its potential to equip educators with the skills necessary for navigating digitally enriched teaching environments in higher education. The modular format allows for adaptive use across disciplines, institutions, and learning contexts, fostering scalable and sustainable integration of digital pedagogy.

Keywords: Digital pedagogy, modular curriculum, higher education, teaching competence, educational innovation.

I. INTRODUCTION

The rapid digital transformation of higher education has profoundly reshaped the roles of educators and the competencies required for effective teaching. As digital technologies become increasingly embedded in pedagogical practices, the need for higher education institutions to equip faculty and future educators with robust digital teaching competences has become both urgent and essential. However, many educators still face challenges in designing, implementing, and assessing learning activities that leverage digital tools in pedagogically sound ways. Addressing this gap requires structured, flexible, and accessible professional learning opportunities that align with contemporary educational demands.

In response to this need, a transnational team of experts developed a modular digital pedagogy curriculum as part of a European Erasmus+ initiative. The curriculum is designed to foster digital competence among educators by providing structured learning pathways across key thematic areas such as digital pedagogy foundations, digital resource creation, online assessment, inclusive digital learning environments, and the use of emerging technologies. Each module is competency-based, allowing for flexible implementation in both pre-service teacher education and in-service professional development. This modular structure supports scalability and adaptability across diverse institutional and disciplinary contexts.

The curriculum was developed through a participatory and iterative design process, grounded in international frameworks such as the European Digital Competence Framework for Educators (DigCompEdu), and informed by current research and stakeholder feedback. The aim was not only to improve technical proficiency but to foster critical digital pedagogical thinking—empowering educators to choose, adapt, and reflect on digital tools and strategies that enhance student learning.

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This article presents the rationale, structure, and development process of the modular curriculum, highlighting its innovative approach to building digital teaching competence in higher education. In doing so, it contributes to the growing field of digital pedagogy and offers practical insights for curriculum developers, teacher educators, and institutional leaders committed to advancing digital education.

II. LITERATURE REVIEW

A. The Evolving Landscape of Higher Education and Digital Pedagogy

The nature and structure of higher education have been fundamentally reshaped by the integration of digital technologies, which have emerged not merely as tools for content delivery but as agents of pedagogical transformation. The shift from traditional face-to-face instruction toward digitally enriched and hybrid learning models has challenged institutions to reimagine how learning occurs, who facilitates it, and in what environments (Redecker & Punie, 2017). While this transformation had been underway for some time, the global COVID-19 pandemic catalyzed the process, exposing both the opportunities and limitations of institutional readiness. As a result, universities were compelled to scale up digital solutions rapidly, making digital literacy and pedagogy not a choice but a necessity (Bozkurt et al., 2020).

Digital pedagogy, in this context, has evolved from a supplementary dimension of teaching to a core pedagogical paradigm. It transcends the instrumental use of tools and instead emphasizes how digital technologies can be purposefully integrated into instructional design, collaborative learning, assessment strategies, and student engagement models (Siemens, 2005; Ertmer & Ottenbreit-Leftwich, 2010). Moreover, digital pedagogy calls for a critical, inclusive, and student-centered approach that empowers both educators and learners to actively participate in co-constructing knowledge in digital spaces. As the European Commission (2022) asserts, digital competence is now a foundational component of educator professionalism, embedded within broader policy goals for digital transformation in education. Consequently, efforts to support educators must address not only technical skill development but also reflective practice, pedagogical agility, and ethical digital engagement.

B. Digital Competence Frameworks for Educators

In response to the growing demand for structured digital competence development, a number of national and supranational frameworks have emerged, providing coherent models to guide policy, curriculum design, and professional development. Among these, the **Digital Competence Framework for Educators (DigCompEdu)** has gained prominence across Europe for its comprehensive articulation of the knowledge, skills, and attitudes required of digitally competent educators (Redecker, 2017). DigCompEdu outlines 22 competencies organized under six overarching dimensions: professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and facilitating learners' digital competence.

The framework not only maps educators' digital maturity but also functions as a development tool, guiding the creation of training programs and curriculum aligned with evolving educational needs. Studies (e.g., Cabero-Almenara et al., 2022) have shown that integrating DigCompEdu into teacher education can promote reflective digital practice and foster a strategic, intentional use of technologies to enhance pedagogy. Similarly, Tondeur et al. (2017) highlight the importance of embedding digital competence frameworks into teacher preparation programs to bridge the gap between policy aspirations and classroom realities. At the institutional level, such frameworks support coherence between micro-level practices and macro-level digitalization strategies, ensuring that educators are adequately prepared to navigate and contribute to digitally rich learning ecosystems.

Furthermore, DigCompEdu offers a language for cross-national dialogue on digital teaching competence, facilitating comparative research, benchmarking, and policy development. By grounding curriculum innovation in such frameworks, institutions can ensure that digital pedagogy development is not isolated or ad hoc, but part of a structured, evidence-based response to global educational transformations.

C. Modular Curriculum Design: Flexibility, Scalability, and Innovation

As higher education systems seek to respond flexibly to diverse learner needs and the demands of lifelong learning, **modular curriculum design** has become a preferred strategy. A modular curriculum is typically composed of discrete, self-contained units that can be delivered independently or as part of a larger program, offering educators and institutions greater control over the pace, content, and depth of learning (Harden & Stamper, 1999). This flexibility is particularly beneficial in digital education, where teaching staff may have varying levels of digital competence, time availability, and institutional support.

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Modular curricula also facilitate **competency-based education (CBE)**, in which learning is structured around demonstrable outcomes rather than time-bound progress. In this model, educators can engage with targeted content aligned with their professional development needs and progress toward mastery through personalized pathways. As the OECD (2021) notes, modularity supports stackable learning experiences and micro-credentials—an increasingly important dimension in the context of open and distributed learning environments.

Research by Boud and Solomon (2001) underscores the pedagogical value of modularity in fostering autonomy and contextualized professional learning. In the context of digital pedagogy, modular approaches enable educators to experiment with new strategies in manageable segments, apply them in practice, and reflect on their impact. Furthermore, in a cross-institutional or transnational setting, modular curricula support harmonization and interoperability, allowing for shared development, co-teaching, and mutual recognition of learning across borders.

The modular approach also aligns with current movements toward open educational resources (OER) and open education practices (OEP), enabling curriculum content to be reused, adapted, and contextualized by a broad audience. Thus, modularity enhances not only flexibility and scalability but also sustainability and innovation in curriculum design.

D. Challenges in Digital Pedagogy Implementation

Despite the proliferation of frameworks, tools, and curriculum models, significant **barriers to digital pedagogy implementation** persist across higher education systems. These challenges range from infrastructural deficits to institutional inertia and pedagogical conservatism. In particular, disparities in access to high-quality digital infrastructure and tools create uneven learning environments, both within and across institutions (Koehler et al., 2014; Bates, 2015). Moreover, many educators report feeling underprepared to integrate digital tools meaningfully into their teaching, citing limited time, inadequate support, and a lack of incentives for engaging in professional development.

Effective digital pedagogy requires more than infrastructure; it requires a **culture of innovation**, institutional vision, and leadership that values reflective teaching and continuous learning (Salmon, 2011). Research by Laurillard (2012) and Howard et al. (2022) suggests that when professional learning is embedded in authentic contexts and aligned with educators' disciplinary and pedagogical identities, engagement is stronger and the transfer of skills is more likely. However, such approaches necessitate investment in sustained, practice-oriented training programs that move beyond one-time workshops and instead foster communities of inquiry and practice.

In this regard, curriculum models that prioritize adaptability, relevance, and collaboration—such as modular, co-designed frameworks—can serve as catalysts for transformation. They help address the complex and situated nature of digital pedagogy by allowing educators to connect new knowledge with their lived teaching experiences, and by encouraging experimentation and reflection. Nonetheless, institutional commitment to professional development, time allocation, and recognition of teaching excellence remain key levers for overcoming systemic challenges.

E. Toward a Competency-Oriented, Practice-Based Curriculum

Recent scholarship has increasingly emphasized the need for **competency-oriented, practice-based curricula** in digital pedagogy, particularly in teacher education and academic development programs. Such curricula are designed not only to transmit knowledge but also to foster capabilities that are demonstrable, transferrable, and contextually grounded (Beetham & Sharpe, 2013). Key pedagogical principles underpinning these approaches include authentic learning, experiential design, collaborative reflection, and iterative feedback.

The value of co-design in curriculum development has also been well-documented (Cochrane et al., 2019). Engaging educators, instructional designers, and stakeholders in the design process enhances the relevance, usability, and sustainability of the final product. It also fosters a sense of ownership and shared purpose, which are critical for successful curriculum adoption and scaling. Furthermore, embedding authentic scenarios, toolkits, and flexible assessments within digital pedagogy modules ensures that educators can experiment in low-stakes environments and gradually build pedagogical fluency.

The Erasmus+ modular curriculum developed in this study aligns with these emerging principles. It presents a structured yet adaptable solution grounded in DigCompEdu and designed through participatory processes across diverse institutional contexts. The curriculum emphasizes both the pedagogical and ethical dimensions of digital competence, making it suitable not only for technical upskilling but also for cultivating reflective, inclusive, and critically engaged educators. As digital transformation continues to reshape the academic landscape, initiatives like this provide a viable roadmap for institutions seeking to build capacity, ensure instructional quality, and promote innovation in higher education.

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III. METHODOLOGY

This study employed a design-based research (DBR) approach to develop and refine a modular digital pedagogy curriculum tailored for higher education contexts. The development process was carried out within the framework of an Erasmus+ project, involving academic partners from multiple European institutions (Greece, Latvia, Lithuanian, Romania and Türkiye). The DBR methodology was chosen to allow for iterative cycles of analysis, design, implementation, and revision, grounded in real-world educational settings and informed by stakeholder feedback. The process was collaborative and multidisciplinary, integrating expertise from the fields of educational sciences, instructional design, digital technologies, and higher education pedagogy.

The curriculum design began with a comprehensive needs analysis, including literature reviews, institutional surveys, and expert consultations to identify key competency areas in digital pedagogy. Drawing on the European Framework for the Digital Competence of Educators (DigCompEdu) and similar international benchmarks, the team defined learning outcomes and core content areas for each module. The modular structure was intentionally selected to ensure flexibility, adaptability, and scalability, enabling institutions to adopt the curriculum in full or in part, according to their specific needs. Each module includes learning objectives, theoretical content, digital tools, interactive activities, and assessment strategies aligned with adult learning principles and competency-based education.

Throughout the development process, the modules were piloted and peer-reviewed across participating institutions. Feedback from higher education instructors, instructional designers, and pre-service teacher educators was gathered through focus groups and structured evaluations. This feedback informed several rounds of refinement to improve the clarity, relevance, and usability of the materials. The final version of the curriculum reflects a shared European vision for digitally competent educators and serves as a practical framework for embedding digital pedagogy into higher education programs.

IV. RESULTS AND DISCUSSION

A. Key Findings from Curriculum Development

The development of the modular digital pedagogy curriculum resulted in a pedagogically grounded, flexible, and competency-based framework structured around critical domains relevant to contemporary higher education. Reflecting the rapidly changing demands of digital teaching and learning environments, the curriculum was conceptualized through a transnational, interdisciplinary design approach, aligning closely with the European Framework for the Digital Competence of Educators (DigCompEdu). The final version comprises eight interrelated modules covering essential thematic areas: digital pedagogy foundations, instructional design for technology-enhanced learning, use of interactive tools, online assessment and feedback strategies, digital inclusion and accessibility, and integration of emerging technologies such as augmented reality, artificial intelligence, and gamification.

Each module is constructed with clearly defined learning outcomes, pedagogical content knowledge, curated digital tools, and practice-oriented teaching strategies. Assessment guidelines are embedded within each unit to promote reflective learning and formative evaluation. The modular structure is competency-based and allows both vertical and horizontal integration across academic programs. One of the major strengths of the curriculum lies in its adaptability to a wide range of learning contexts, academic disciplines, and institutional priorities. Designed for use in both pre-service teacher education and in-service professional development, the curriculum can be delivered in full or adapted through standalone modules, making it especially suitable for institutions seeking flexible, scalable approaches to digital transformation in teaching.

The structure of the curriculum supports both synchronous and asynchronous learning formats and can be effectively implemented across various delivery models, including face-to-face, blended, hybrid, and fully online modes. This responsiveness to diverse educational settings enhances its potential for widespread adoption across European higher education institutions and beyond. The emphasis on modularity not only fosters ease of integration but also encourages institutional innovation by allowing curriculum planners to tailor content based on learner needs, institutional goals, and national digital education policies.

B. Insights from Piloting and Stakeholder Feedback

To ensure practical relevance and usability, the curriculum underwent a comprehensive piloting phase across partner institutions, involving both academic instructors and pre-service students. Structured feedback mechanisms—including surveys, focus groups, and peer review—were employed to assess the clarity, coherence, accessibility, and pedagogical robustness of each module. Stakeholders consistently expressed high levels of satisfaction with the curriculum's

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balanced integration of theory and practice. Instructors particularly appreciated the clear progression of concepts and the availability of adaptable teaching resources, which facilitated implementation across various disciplines and institutional structures.

Participants in pilot studies highlighted the curriculum's capacity to foster not only technical proficiency with digital tools but also critical pedagogical reasoning. The inclusion of real-world case examples, interactive tools, and scenario-based activities allowed learners to engage in meaningful pedagogical reflection. These elements helped bridge the gap between abstract theoretical models and the practical realities of digital teaching. Furthermore, the alignment with widely accepted digital competence frameworks, such as DigCompEdu, reinforced the credibility and transferability of the modules across national and institutional borders.

Feedback also revealed variation in perceived value among modules. Modules such as *Online Assessment and Feedback* and *Digital Inclusion and Accessibility* were frequently cited as particularly timely and impactful, especially in light of recent shifts to emergency remote teaching during the COVID-19 pandemic. These modules addressed not only the technical mechanics of digital teaching but also the ethical and inclusive dimensions, including accessibility for students with special educational needs and considerations around data privacy and digital wellbeing. However, reviewers also underscored the need for continued updates to reflect rapidly evolving technologies and pedagogies, highlighting the importance of treating the curriculum as a dynamic and living document.

The iterative co-design approach employed throughout the development process enabled continuous refinement of content based on stakeholder input. This process reflects principles of participatory curriculum design, emphasizing responsiveness, relevance, and collaboration. The incorporation of feedback loops from multiple stakeholder groups ensures that the final product is both theoretically robust and practically grounded—a vital consideration for curriculum implementation in diverse and evolving higher education landscapes.

C. Discussion and Implications

The findings of this initiative underscore the significant potential of modular, research-informed curriculum design in promoting digital teaching competence across higher education. The curriculum exemplifies a shift from traditional, static training models toward more flexible, learner-centered, and scalable forms of professional development. Its structure supports both lifelong learning and micro-credentialing trends in higher education, enabling educators to engage in modular learning experiences that can be documented and recognized progressively over time.

One of the most critical implications of the curriculum is its alignment with the broader discourse of pedagogical transformation in the digital age. Digital competence is increasingly understood as a multidimensional construct that includes not only the technical ability to operate tools but also the pedagogical capacity to select, integrate, and reflect upon digital practices in meaningful ways. This curriculum contributes to that understanding by promoting a model of digital pedagogy that is reflective, inclusive, and ethically informed. It positions educators not merely as implementers of digital tools but as designers of transformative learning experiences.

Moreover, the curriculum addresses institutional needs for scalable and context-sensitive digital pedagogy solutions. As higher education systems across Europe and globally strive to meet the challenges posed by technological innovation, inclusivity mandates, and global disruptions such as pandemics, frameworks like this provide a strategic foundation for capacity-building. The emphasis on modularity, co-creation, and adaptability ensures relevance across varying national educational systems, institutional sizes, and levels of digital readiness.

In conclusion, the modular digital pedagogy curriculum developed through this Erasmus+ initiative offers a timely, innovative, and research-based response to the challenges of digital transformation in higher education. It demonstrates how collaborative curriculum development, grounded in pedagogical theory and stakeholder engagement, can yield a product that is both academically rigorous and practically implementable. Future research should investigate the longitudinal impact of curriculum adoption on teaching practices, student engagement, and institutional innovation. Furthermore, continuous dialogue with educational stakeholders will be essential to ensure the curriculum remains responsive to the rapidly changing landscape of digital teaching and learning.

V. CONCLUSION

The development and implementation of the modular digital pedagogy curriculum presented in this study offer a comprehensive and scalable solution to one of the most pressing challenges facing higher education today: the need to enhance digital teaching competence among academic staff and future educators. In an era marked by rapid

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technological change, global crises, and shifting learner expectations, equipping educators with the capacity to design and deliver digitally enriched, pedagogically sound learning experiences is no longer optional—it is imperative.

This study contributes to the growing body of scholarship advocating for structured and flexible professional development in digital pedagogy. The curriculum's modular design, grounded in established frameworks such as DigCompEdu and informed by the principles of competency-based education, ensures its relevance and adaptability across a variety of institutional, national, and disciplinary contexts. Its development through a design-based, participatory process underscores the importance of collaboration and responsiveness in educational innovation. Feedback from pilot implementations demonstrated strong alignment with the needs of both pre-service and in-service educators, confirming the curriculum's utility in addressing real-world teaching challenges.

One of the key contributions of the curriculum lies in its capacity to move beyond the narrow conceptualization of digital competence as mere technological proficiency. Instead, it embraces a more holistic vision that encompasses pedagogical adaptability, critical reflection, inclusivity, and ethical awareness in digital learning environments. By integrating these dimensions into a modular and practice-oriented structure, the curriculum empowers educators not only to adopt digital tools, but to do so thoughtfully, strategically, and with a focus on enhancing student engagement and learning outcomes.

The curriculum's flexibility also responds to the institutional need for scalable solutions that can be tailored to local educational cultures and evolving technological landscapes. Its potential for integration into pre-service teacher training, staff development programs, and micro-credentialing schemes makes it a valuable resource for institutional transformation. Moreover, the emphasis on continuous updating and co-design ensures that the curriculum remains a living document—capable of evolving alongside the changing demands of the digital age.

While the results of this project are promising, they also point to important avenues for future research and development. Longitudinal studies are needed to evaluate the long-term impact of the curriculum on teaching practice, student achievement, and organizational change. Additionally, further exploration into cross-cultural implementation and the role of institutional support structures in sustaining digital pedagogy innovation will be essential for broader adoption and effectiveness.

In sum, this article presents a research-informed, practice-oriented response to the growing demand for digitally competent educators in higher education. The modular curriculum not only addresses current gaps in digital pedagogy preparation but also models a flexible, collaborative, and forward-looking approach to curriculum design. As digital transformation continues to reshape the landscape of higher education, tools such as this curriculum will be vital for ensuring that educators are not only digitally literate but also pedagogically empowered.

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