Advancing Pedagogical Competence Curriculum Development for University Teachers in the Digital Transformation Age

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Abstract

The rapid digital transformation in higher education requires university teachers to develop advanced pedagogical competence that integrates authenticity, collaboration, data-informed decision-making, digital innovation, and reflective praxis. This research aimed to: 1) examine pedagogical competence requirements of university teachers in the digital transformation age; 2) develop a curriculum framework to advance pedagogical competence; and 3) evaluate its quality and effectiveness. The study employed research and development (R&D) design in four phases: foundational pedagogical anchors, curriculum design, curriculum quality dimensions, and effectiveness and impact. Research participants included 10 experts for in-depth interviews, 7 experts for a focus group, and 120 university teachers to assess effectiveness. Instruments included interview forms, focus group protocols, and a curriculum evaluation framework, with validity examined by experts. Data was analyzed using content analysis, mean, standard deviation, and t-test dependent. The results revealed that the developed curriculum framework consisted of objectives, guiding pedagogical principles, competence development strands, five integrated activities (Explorer, Collaborator, Integrator, Reflector, Innovator), strategic enablers for each phase, and evaluation dimensions. The quality of the curriculum was rated at the highest level across accuracy, relevance, feasibility, and benefits. Effectiveness testing indicated that university teachers who participated in the activities demonstrated significant improvement ($p < .01$) in pedagogical competence growth, curriculum quality outcomes, professional engagement, institutional and student impact, and sustainability and scalability. The findings confirm that the developed curriculum framework effectively advances pedagogical competence for university teachers in the digital transformation age.

Keywords: Pedagogical Competence; Curriculum Development; University Teachers; Digital Transformation; Higher Education

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Introduction

The accelerated pace of digital transformation has reshaped higher education worldwide, creating complex demands for teaching and learning in universities. The integration of advanced technologies, diverse digital platforms, and new instructional modalities has transformed not only how knowledge is delivered but also the core competencies required of university teachers. UNESCO (2021) emphasized the necessity of equipping educators with digital and pedagogical skills that ensure accessibility, inclusivity, and innovation in higher education. Similarly, the International Society for Technology in Education (ISTE, 2021) identified educator standards to strengthen professional practice through digital integration, collaboration, and lifelong learning. Despite these global imperatives, numerous studies continue to report that many educators exhibit limited competence in leveraging digital tools, designing adaptive learning environments, and fostering reflective teaching practices in rapidly changing contexts (Basilotta-Gómez-Pablos et al., 2022; Kapasheva et al., 2024).

In this transformation age, university teachers must possess not only digital literacy but also advanced pedagogical competence - a holistic capacity that integrates authentic teaching, collaborative inquiry, data-informed decision-making, digital innovation, and reflective praxis. Previous studies in pre-service teacher education demonstrated the value of phenomenon-based learning, work-integrated learning, and technology-mediated pedagogy for strengthening learning management competencies (Silander, 2015; Kramer & Usher, 2011; Sentriyo et al., 2023). However, research on curriculum development for university-level educators remains limited, despite their pivotal role in shaping institutional transformation and student success in higher education.

Therefore, it is necessary to create a curriculum framework that systematically advances pedagogical competence for university teachers. This research was designed as a research and development (R&D) study, structured into four phases: curriculum design for university teachers, curriculum quality dimensions, and effectiveness and impact. In-depth interviews with experts, focus group discussions, and empirical testing with university teachers provided comprehensive data to inform the development process.

Research Objectives

The objectives of this research were fourfold: (1) to examine the pedagogical competence requirements of university teachers in the digital transformation age; (2) to develop a curriculum framework to advance pedagogical competence; (3) to identify and evaluate four curriculum quality dimensions, namely relevance, rigor, impact, and feasibility, in order to assess the overall quality and effectiveness of the developed curriculum.

Conceptual Framework

The research studied the concepts used for developing the curriculum, i.e., (1) Data-Informed Pedagogy (Ifenthaler et al., 2019); (2) Phenomenon-Based Pedagogy (Adipat, 2024); (3) Work-Integrated Pedagogy (Frison, 2023); (4) Technology-Mediated Pedagogy (Cao et al., 2025); and (5) Pedagogical Competence for Digital Resilience (Kapasheva et al., 2024). These concepts were synthesized to construct a curriculum framework aimed at advancing pedagogical competence for university teachers in the digital transformation age. The framework consists of four phases: Foundational Pedagogical Anchors, Curriculum Design for University Teachers, Curriculum Quality Dimensions, and Effectiveness & Impact. The structure of these interrelated phases is presented in Figure 1.

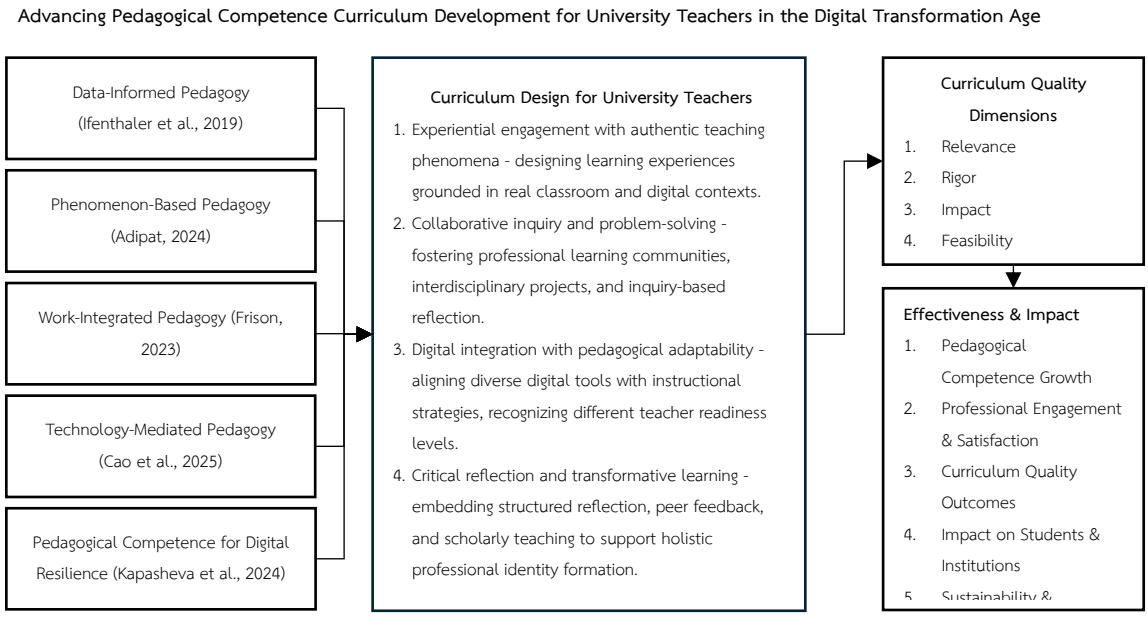

Figure 1 Conceptual Framework

Research Methodology

This study employed a research design, aiming to develop and evaluate a curriculum framework to advance pedagogical competence for university teachers in the digital transformation age. The methodology was structured into four phases: (1) Foundational Pedagogical Anchors, (2) Curriculum Design for University Teachers, (3) Curriculum Quality Dimensions, and (4) Effectiveness and Impact.

Phase I: Foundational Pedagogical Anchors

This phase investigated the theoretical and practical bases for pedagogical competence in the digital transformation age.

- Participants: 10 experts selected by purposive sampling, consisting of curriculum and instruction specialists, digital education experts, and higher education administrators.

- Instruments: A structured interview protocol validated by 7 experts, with an Index of Item-Objective Congruence (IOC) between 0.80 - 1.00.

- Data Analysis: Content analysis was applied to synthesize expert perspectives on essential pedagogical anchors.

Phase II: Curriculum Design for University Teachers

Based on findings from Phase I, a draft curriculum framework was developed.

- Core Components: Objectives, guiding pedagogical principles, competence development strands, integrated activities (Explorer, Collaborator, Integrator, Reflector, Innovator), strategic enablers, and evaluation dimensions.

- Process: The draft curriculum was reviewed and refined through a focus group of 7 experts, including senior university educators, curriculum designers, and specialists in instructional technology.

- Instruments: Focus group issues and draft framework documents, validated with IOC between 0.80 - 1.00.

- Outcome: A revised curriculum framework ready for pilot implementation.

Phase III: Curriculum Quality Dimensions

The developed framework was evaluated for quality and appropriateness.

- Participants: A panel of experts (different from Phase II) assessed the curriculum against four quality dimensions: relevance, rigor, impact, and feasibility.

- Instruments: A 3-point trichotomous scale assessment form validated by specialists, with IOC between 0.80 - 1.00.

- Data Analysis: Mean and standard deviation were used to determine overall quality levels.

Phase IV: Effectiveness and Impact

The curriculum framework was applied with a sample of 120 university teachers selected through stratified random sampling from population of Mahasarakham University. The curriculum was implemented over a total duration of 12 weeks.

- Procedure: Participants engaged in the designed activities (Explorer, Collaborator, Integrator, Reflector, Innovator) through structured workshops and implementation tasks.

- Evaluation Dimensions: (1) Pedagogical competence growth, (2) curriculum quality outcomes, (3) professional engagement and satisfaction*, (4) impact on students and institutions, and (5) sustainability and scalability.

- Instruments: Competence tests and evaluation forms, validated by experts (IOC = 0.80 - 1.00; reliability = 0.76 - 0.85 was obtained from 30 university teachers who are not sample group).

- Data Analysis: Dependent t-test and one-sample t-test were used to compare pre- and post-participation results against the 95% criterion. Significance was set at $p < .01$.

Ethical Considerations

The study was reviewed and approved by the institutional ethics committee. Participation was voluntary, with informed consent obtained from all experts and university teachers. Data confidentiality and anonymity were strictly maintained.

Data Analysis

Data analysis in this research was conducted using both qualitative and quantitative approaches, aligned with the research design.

Qualitative Data Analysis

- Data obtained from in-depth interviews with 10 experts and a focus group of 7 experts were analyzed using content analysis.

- The analysis process included transcription, coding, categorization, and synthesis to identify key themes related to foundational pedagogical anchors, curriculum design elements, and strategic enablers.

- Findings from this stage guided the development and refinement of the curriculum framework.

Quantitative Data Analysis

Quantitative data were derived from curriculum quality assessments and curriculum implementation with 120 university teachers.

- Curriculum Quality Evaluation

    - Mean and standard deviation (SD) were calculated to assess overall quality levels in terms of relevance, rigor, impact, and feasibility.

- Effectiveness Testing

    - University teachers' pedagogical competence was measured before and after participation in the curriculum activities.

    - A dependent t-test was used to compare pre- and post-participation scores.

    - Statistical significance was set at $p < .01$.

Validation of Instruments

- All research instruments (interview protocols, focus group guidelines, quality assessment forms, and competence tests) were validated by experts, yielding an Index of Item-Objective Congruence (IOC) between 0.80 - 1.00.

- Reliability of the quantitative instruments was established, with Cronbach's alpha values ranging from 0.76 - 0.85, indicating acceptable internal consistency.

Research Results

The results of this research are presented in accordance with the research objectives and the four phases of the curriculum development process.

Pedagogical Competence Anchors

The findings from in-depth interviews with 10 experts revealed that pedagogical competence for university teachers in the digital transformation age must integrate five key anchors:

1. Data-Informed Pedagogy - application of learning analytics and evidence-based insights for instructional improvement.

2. Phenomenon-Based Pedagogy - engagement with authentic, ill-structured problems across disciplines.

3. Work-Integrated Pedagogy - connection between academic knowledge and professional practice.

4. Technology-Mediated Pedagogy - flexible use of diverse digital tools and platforms.

5. Pedagogical Competence for Digital Resilience - adaptability, ethical practice, and sustainability in teaching innovation.

These anchors provided the theoretical foundation for the developed curriculum framework.

Curriculum Design for University Teachers

Based on the findings from focus group discussions with 7 experts, the developed curriculum framework consisted of the following components:

- Objective: To advance university teachers' pedagogical competence in the digital transformation age.

- Guiding Pedagogical Principles: authenticity, collaborative inquiry, digital integration, reflective praxis, and data-informed decision-making.

- Competence Development Strands: authentic teaching challenges, digital pedagogy integration, collaborative inquiry projects, reflective practice, and digital resilience.

- Activities: Explorer, Collaborator, Integrator, Reflector, and Innovator.

- Strategic Enablers: expert workshops, design studios, digital pedagogy labs, peer review, coaching, and institutional support.

The structure of these components and their interconnections are presented in Figure 2, which illustrates how objectives, principles, competence strands, activities, and strategic enablers are systematically integrated into the curriculum design. This figure highlights the process of linking theoretical anchors with practice-oriented activities to foster pedagogical competence development.

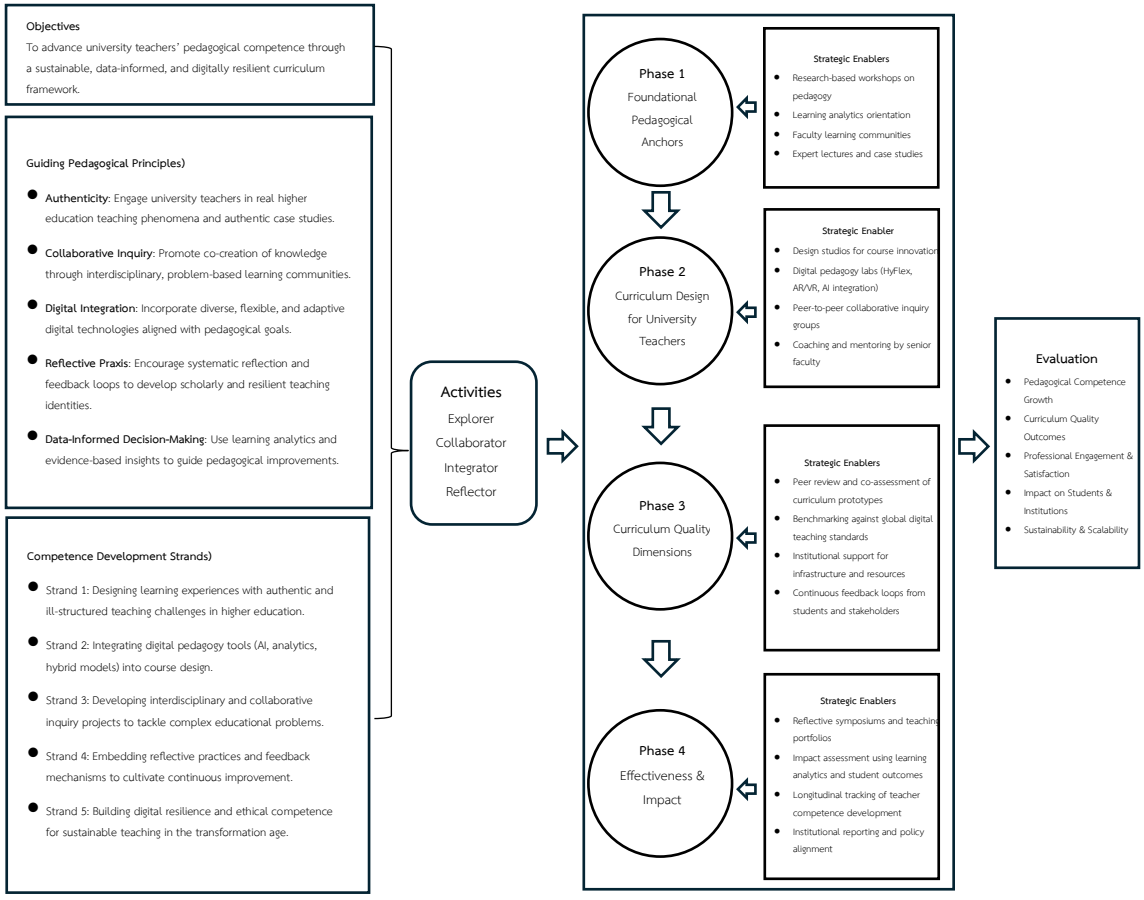

Figure 2 Curriculum Framework for Advancing Pedagogical Competence in the Digital Transformation Age

Curriculum Quality Dimensions

The assessment by a panel of experts indicated that the curriculum was rated at the highest level across all dimensions:

- Relevance - alignment with higher education needs in the digital transformation age.
- Rigor - evidence-based, theoretically robust, and pedagogically grounded.

- Impact - significant potential benefits for teachers, students, and institutions.

- Feasibility - adaptable and scalable for diverse higher education contexts.

Overall, mean scores for curriculum quality ranged in the highest category ($\bar{X}$ = 4.59 - 4.84, SD = 0.37 - 0.64), confirming the curriculum's validity and applicability. Importantly, the Item-Objective Congruence (IOC) scores for the evaluation instruments ranged between 0.86 - 1.00, demonstrating strong content validity. These details are presented in Table 1.

Effectiveness and Impact

Data from 120 university teachers demonstrated significant improvement after participation in the curriculum activities (Explorer, Collaborator, Integrator, Reflector, Innovator).

- Pedagogical Competence Growth: Post-participation scores were significantly higher than pre-participation scores ($p < .01$).

- Curriculum Quality Outcomes: Participants improved in their ability to design, implement, and evaluate digitally enhanced teaching.

- Professional Engagement: University teachers reported increased confidence, reflective practice, and deeper engagement in teaching roles.

- Impact on Students and Institutions: Implementation of the curriculum fostered student-centered, technology-integrated environments and institutional innovation.

- Sustainability and Scalability: Evidence indicated potential for long-term adoption, cross-departmental use, and policy alignment in higher education.

Furthermore, all Evaluation Dimensions Scores, when comparing pre- and post-participation results, showed statistically significant differences at $p < .01$ across all evaluation criteria, as presented in Table 2.

The results confirmed that the developed curriculum framework was effective in advancing pedagogical competence for university teachers in the digital transformation age.

Table 1 The results of Item-Objective Congruence (IOC) scores from experts.

Questions	Expert							Total Score	IOC	Result
	1	2	3	4	5	6	7			
Pedagogical Competence Growth										
Confidence in integrating digital tools into teaching practice has increased.	+1	+1	+1	+1	+1	+1	+1	7	1.00	Conguent
Ability to design student-centered and active learning activities has improved.	+1	+1	0	+1	+1	+1	+1	6	0.86	Conguent
Use of data-informed strategies for evaluating and improving teaching has developed.	+1	+1	+1	+1	0	+1	+1	6	0.86	Conguent
Capacity to integrate authentic, real-world problems into curriculum has strengthened.	+1	+1	+1	+1	+1	+1	+1	7	1.00	Conguent
Reflective teaching practices have become more systematic and effective.	+1	0	+1	+1	+1	+1	+1	6	0.86	Conguent
Curriculum Quality Outcomes										
Curriculum content is relevant to the teaching needs of university educators in the digital age.	+1	+1	+1	+1	+1	+1	+1	7	1.00	Conguent
Curriculum design is rigorous, evidence-based, and theoretically grounded.	+1	+1	0	+1	+1	+1	+1	6	0.86	Conguent
Curriculum components are coherent and logically structured.	+1	+1	+1	0	+1	+1	+1	6	0.86	Conguent
Curriculum is feasible for implementation in diverse higher education contexts.	+1	+1	+1	+1	0	+1	+1	6	0.86	Conguent
Curriculum demonstrates potential to enhance teaching quality and student learning outcomes.	+1	+1	+1	+1	+1	+1	0	6	0.86	Conguent
Professional Engagement & Satisfaction										
Engagement with professional teaching responsibilities has been enhanced.	+1	+1	+1	+1	+1	+1	+1	7	1.00	Conguent
Motivation to innovate in teaching practices has increased.	+1	+1	+1	+1	0	+1	+1	6	0.86	Conguent
Satisfaction with curriculum activities and learning experiences is high.	+1	+1	+1	0	+1	+1	+1	6	0.86	Conguent
Collaboration and knowledge exchange with peers have been supported.	+1	+1	+1	0	+1	+1	+1	6	0.86	Conguent
Professional identity as a university teacher has been strengthened.	+1	+1	+1	+1	+1	+1	+1	7	1.00	Conguent

Questions	Expert							Total Score	IOC	Result
	1	2	3	4	5	6	7			
Impact on Students & Institutions										
Capacity to create student-centered learning environments has improved.	+1	+1	0	+1	+1	+1	+1	6	0.86	Conguent
Support for students' learning outcomes has been enhanced.	+1	+1	+1	+1	+1	+1	+1	7	1.00	Conguent
Institutional capacity for teaching and learning innovation has been strengthened.	+1	+1	+1	0	+1	+1	+1	6	0.86	Conguent
Curriculum aligns with institutional policies and strategic goals.	+1	+1	+1	+1	0	+1	+1	6	0.86	Conguent
Quality of education at the institutional level has been positively influenced.	+1	+1	+1	+1	+1	+1	+1	7	1.00	Conguent
Sustainability & Scalability										
Curriculum framework can be sustained long-term within higher education practice.	0	+1	+1	+1	+1	+1	+1	6	0.86	Conguent
Curriculum is adaptable to changing technologies and learning environments.	+1	+1	+1	0	+1	+1	+1	6	0.86	Conguent
Framework can be applied across disciplines and departments.	+1	+1	0	+1	+1	+1	+1	6	0.86	Conguent
Institutional support mechanisms exist to sustain curriculum implementation.	+1	0	+1	+1	+1	+1	+1	6	0.86	Conguent
Curriculum framework has potential for national or international scalability.	+1	+1	+1	+1	+1	+1	+1	7	1.00	Conguent

Table 2 Statistical Comparison of Evaluation Dimension Scores Before and After Participation

Evaluation	Evaluation Dimensions Scores	*n*	$\bar{x}$	*SD*	*MD*	*t*	*p*
Pedagogical Competence Growth	Pre-Participation Score	120	49.23	4.39	28.53	11.96**	.000
	Post-Participation Score	120	77.77	6.92			
Curriculum Quality Outcomes	Pre-Participation Score	120	47.78	4.76	30.20	14.17**	.000
	Post-Participation Score	120	77.98	6.94			

Evaluation	Evaluation Dimensions Scores	*n*	$\bar{x}$	*SD*	*MD*	*t*	*p*
Professional Engagement & Satisfaction	Pre-Participation Score	120	49.03	4.44	30.68	14.73**	.000
	Post-Participation Score	120	79.71	6.66			
Impact on Students & Institutions	Pre-Participation Score	120	51.90	5.06	27.49	11.27**	.000
	Post-Participation Score	120	79.39	7.01			
Sustainability & Scalability	Pre-Participation Score	120	49.49	4.80	31.81	13.81**	.000
	Post-Participation Score	120	81.30	6.55			

From Table 2, all dimensions showed statistically significant growth at the .01 level, confirming the curriculum's effectiveness in fostering both immediate skill acquisition and long-term professional engagement.

Discussion of Research Findings

The findings of this study confirm that the developed curriculum framework is both valid and effective in advancing the pedagogical competence of university teachers in the digital transformation age. The statistically significant improvements across all evaluation dimensions ($p < .01$), as shown in Table 2, underscore the robustness of the design and its alignment with the needs of higher education.

Pedagogical Competence Growth

The increase in pedagogical competence scores (from 49.23 to 77.77, $t = 11.96$) indicates that the curriculum effectively enhanced university teachers' ability to design, implement, and reflect on innovative teaching practices. This aligns with Ifenthaler et al. (2019), who emphasized the value of data-informed pedagogy for improving instructional quality, and resonates with the old research on pre-service teachers, which also demonstrated significant gains in competence through structured, activity-based learning

However, this study extends the findings by showing that similar approaches can be successfully adapted to university-level educators, who face more complex demands in digital ecosystems.

Curriculum Quality Outcomes

The improvement in curriculum quality outcomes (from 47.78 to 77.98, $t = 14.17$) reflects the success of embedding rigor, relevance, impact, and feasibility as core quality dimensions. The high ratings by experts (IOC = 0.86–1.00) reinforce the credibility of the framework. This finding supports the curriculum development principles of Posner (2004) and Glatthorn et al. (2019), while extending

the old research by demonstrating that systematic curriculum design principles, when paired with digital integration, can generate transformative results for higher education

Professional Engagement and Satisfaction

The significant growth in professional engagement and satisfaction (from 49.03 to 79.71, t = 14.73) highlights the curriculum's role in strengthening teacher motivation, reflective practice, and identity formation. This result resonates with Basilotta-Gómez-Pablos et al. (2022), who reported that digital competencies foster greater professional confidence. Compared with the old study, where satisfaction was measured primarily in relation to activities, the current research advances the discussion by situating professional engagement within a broader ecosystem of institutional transformation.

Impact on Students and Institutions

Sustainability and Scalability

The strongest improvement was found in sustainability and scalability (from 49.49 to 81.30, t = 13.81), showing that the curriculum design is adaptable, resilient, and positioned for long-term impact. This finding is consistent with Kapasheva et al. (2024), who emphasized the importance of digital resilience in sustaining educational innovation. It also represents a clear advancement from the previous findings, where sustainability was not addressed explicitly, thus adding a vital dimension to the discourse on curriculum development in the digital era.

Overall Contribution

In sum, the results provide strong evidence that the developed curriculum framework is theoretically grounded, empirically validated, and practically effective. By integrating data-informed, phenomenon-based, work-integrated, technology-mediated, and resilience-oriented pedagogies, the framework addresses the multi-dimensional challenges of digital transformation in higher education. Compared to the old research, which demonstrated effectiveness for pre-service teachers, the present study extends the scope to university educators, confirming that curriculum development grounded in authentic practice and digital innovation can foster competence, quality, engagement, impact, and sustainability simultaneously.

Thus, the study contributes not only to advancing curriculum theory but also to offering a scalable and sustainable model for universities seeking to strengthen pedagogical competence in the digital transformation age.

Conclusion and Recommendations

Conclusion

This study developed and validated a curriculum framework designed to advance the pedagogical competence of university teachers in the digital transformation age. Grounded in five pedagogical anchors "data-informed pedagogy, phenomenon-based pedagogy, work-integrated pedagogy, technology-mediated pedagogy, and digital resilience" the framework was constructed and evaluated through a systematic R&D process involving expert interviews, focus group refinement, and empirical testing with 120 university teachers.

The results demonstrated statistically significant improvements ($p < .01$) across all five evaluation dimensions: pedagogical competence growth, curriculum quality outcomes, professional engagement and satisfaction, impact on students and institutions, and sustainability and scalability. Expert validation further confirmed the curriculum's high quality, with IOC scores ranging from 0.86–1.00. These findings underscore the robustness, relevance, and adaptability of the framework for higher education contexts.

Compared with prior research on pre-service teacher education, this study extends discourse by focusing on university educators, who face greater complexity in navigating digital ecosystems and institutional transformation. Importantly, the inclusion of sustainability and scalability as explicit evaluation dimensions highlights a forward-looking contribution, ensuring that the framework not only addresses immediate pedagogical needs but also fosters long-term resilience and institutional innovation.

In sum, the developed framework represents a sustainable, evidence-based, and transformative model that strengthens pedagogical competence while aligning with global imperatives for higher education in the digital transformation age.

Recommendations

1. For Practice

- Integration into Faculty Development: Universities should adopt the curriculum as part of structured faculty development programs to systematically enhance teaching competence in digital and hybrid environments.

- Continuous Reflection and Data Use: Teachers should be encouraged to engage in reflective practice and use learning analytics to continuously refine pedagogy.

- Peer Collaboration: The framework should be implemented within professional learning communities to foster collaborative inquiry and interdisciplinary innovation.

2. For Policy

- Institutional Policy Alignment: Higher education institutions should integrate this curriculum framework into strategic teaching and learning policies, ensuring alignment with digital transformation agendas. Moreover, the executives should launch policy to support university teachers to have opportunity of academic competency development.

- Resource Allocation: Policies should support investment in digital pedagogy labs, infrastructure, and mentoring systems that act as enablers of curriculum effectiveness.

- Scalability Across Institutions: Ministries and accreditation bodies should recognize the framework as a scalable model for improving teaching quality across universities nationally and internationally.

3. For Future Research

- Longitudinal Studies: Future research should investigate the long-term effects of the curriculum on sustained pedagogical competence and student learning outcomes.

- Cross-Context Application: Comparative studies across disciplines, institutional types, and cultural contexts can test the adaptability and universality of the framework.

- Advanced Digital Integration: Further studies should explore the integration of AI, adaptive learning systems, and immersive technologies (e.g., AR/VR) within the curriculum to expand its impact.

Final Reflection

This research contributes a significant step forward in curriculum development for higher education, moving beyond isolated digital skill training to a holistic model of pedagogical competence. By uniting authentic practice, collaborative inquiry, technological adaptability, and resilience, the framework equips university teachers to thrive in an era of continuous change. It is recommended that stakeholders in higher education adopt, adapt, and expand this model to ensure that teaching and learning remain relevant, rigorous, impactful, and sustainable in the digital transformation age.

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