IMPROVING THE METHODOLOGY FOR PLANNING THE PROFESSIONAL ACTIVITY OF TEACHERS OF TECHNOLOGICAL EDUCATION ON THE BASIS OF ICT: TECHNOLOGY FOR DESIGNING TEACHER ACTIVITIES IN A DIGITAL PEDAGOGICAL ENVIRONMENT

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Annotation: This article examines issues of improving the methodology for planning the professional activity of technological education teachers based on ICT. The technology for designing teacher activities in a digital pedagogical environment is analyzed. Research findings reveal opportunities for the effective use of ICT tools in professional planning.

Keywords: ICT, digital pedagogy, professional activity, teacher, planning, design technology, technological education, digital environment, methodology.

Introduction

The global transformation of education in the twenty-first century has been accelerated by the widespread integration of information and communication technologies (ICT) into instructional practice. Among all subject-area educators, teachers of technological education occupy a distinctively important position: they are expected not only to transmit technical knowledge but also to model the very process of planning, designing, and executing purposeful professional activity. When these competencies are scaffolded within a digital pedagogical environment, the quality and consistency of instructional planning improve measurably, yet the field lacks a consolidated methodological framework that guides this process [1, 4].

The problem addressed by this study is therefore twofold. First, the existing methodology for planning the professional activity of technological education teachers has not been systematically redesigned to exploit the full affordances of contemporary ICT tools — learning management systems, cloud-based collaborative platforms, digital portfolios, and intelligent scheduling applications. Second, while individual innovations have been documented, no coherent technology for designing teacher activity within a digital pedagogical environment has been validated and disseminated at scale [2, 11].

The purpose of the present article is to propose, justify, and empirically evaluate an updated methodology for ICT-based planning of the professional activity of technological education teachers, with special attention to the step-by-step technology for designing that activity in a digital environment. The objectives are: (a) to review theoretical and empirical literature on ICT integration in teacher professional planning; (b) to identify gaps in existing frameworks; (c) to present and validate a five-stage design technology; and (d) to discuss practical recommendations for implementation. The scientific relevance of the study is underscored by national education reform agendas that mandate the digitalization of pedagogical processes and the formation of teachers' digital competence as a priority outcome [3, 7].

Research methodology

The research design integrates theoretical and empirical methods in a sequential, explanatory structure. In the theoretical phase, systematic literature review, comparative analysis, and conceptual modeling were employed to synthesize knowledge about ICT-based planning and digital pedagogical environments. In the empirical phase, a mixed-methods approach combined a structured questionnaire, classroom observation protocols, and expert interview guides to triangulate findings [4, 19].

The study was conducted across three technological education departments in higher pedagogical institutions during the 2023–2024 academic year. The sample comprised 96 full-time technological education teachers selected through purposive sampling, supplemented by 14 subject-matter experts consulted in semi-structured interviews. The questionnaire contained 32 items rated on a five-point Likert scale, measuring current ICT proficiency, frequency of digital planning tool use, and perceived barriers to adoption. Reliability was confirmed by Cronbach's alpha of 0.87.

Three central research questions guided inquiry: (1) What is known about the current state of ICT integration in the professional planning of technological education teachers? (2) What elements of existing practice remain underdeveloped in the digital dimension? (3) What design technology can bridge identified gaps and be practically implemented? Data analysis employed descriptive statistics, thematic coding of qualitative responses, and expert consensus validation of the proposed five-stage model through a two-round Delphi procedure.

LITERATURE REVIEW

The intersection of ICT, professional planning, and technological education is a relatively young but rapidly expanding area of scholarly inquiry. Understanding the theoretical landscape requires tracing three converging lines of research: the evolution of teacher professional planning as a construct, the growing body of work on ICT integration in teacher practice, and the emerging scholarship on digital pedagogical environments as structured spaces for professional activity.

Teacher professional planning was first conceptualized systematically in the second half of the twentieth century. Tyler's rational-linear curriculum model (1949) established the foundational idea that teaching should begin with clearly defined objectives, followed by content selection, methodological decisions, and evaluation procedures [5, 22]. This model, while widely criticized for its rigidity, introduced the principle that planning is a deliberate, structured process subject to iterative refinement. Subsequent theorists, including Yinger (1980) and Clark and Peterson (1986), enriched this view by demonstrating that expert teachers engage in multi-level planning — from year-long unit maps to moment-by-moment lesson decisions — and that these levels are dynamically interconnected rather than hierarchically fixed [6, 34]. The implication for ICT-based planning is significant: digital tools must support not only static document production but also the fluid, recursive nature of professional planning cognition.

The integration of ICT into teaching practice has been studied extensively since the 1990s, initially through theoretical frameworks and later through large-scale empirical investigations. The Technology Acceptance Model (Davis, 1989) identified perceived usefulness and perceived ease of use as the primary determinants of whether educators adopt new technologies [7, 8]. Later, Mishra and Koehler's Technological Pedagogical Content Knowledge (TPACK)

framework (2006) provided a more nuanced account, arguing that effective ICT integration requires the simultaneous command of content knowledge, pedagogical knowledge, and technological knowledge — a tripartite competence that is especially demanding for technological education teachers whose subject matter itself evolves rapidly alongside digital innovation [8, 15]. Research building on the TPACK framework has consistently found that targeted professional development in digital planning tools increases teachers' confidence and frequency of ICT use in classroom preparation [9, 27].

In the specific context of technological education, scholars have highlighted additional considerations. Pavlova (2009) argued that technological education uniquely positions teachers as practitioners of design thinking — an orientation that aligns naturally with the iterative, prototype-based logic of digital pedagogical design [10, 42]. Williams (2011) extended this argument by proposing that technology teachers should experience the design process first-hand, using digital environments to plan, test, and revise their instructional sequences in the same way that engineers use CAD software to prototype artifacts [11, 58]. This analogy between design engineering and instructional design in digital environments has gained traction and provides a powerful conceptual foundation for the present study.

The concept of the digital pedagogical environment (DPE) has been theorized from several directions. Jonassen (2000) described technology-rich learning environments as 'mindtools' — cognitive amplifiers that extend the intellectual reach of both teachers and learners [12, 63]. More recently, Selwyn (2016) cautioned that the mere presence of digital infrastructure does not automatically generate pedagogical improvement; what matters is the purposeful, critically reflective use of digital affordances within a coherent instructional design [13, 19]. Building on both perspectives, Tsybulsky and Muchnik-Rozanov (2019) defined a digital pedagogical environment specifically for teacher professional development as a structured online space in which teachers set learning goals, access curated resources, collaborate with peers, document practice, and receive formative feedback — all mediated by ICT platforms [14, 71].

In Uzbekistan and across Central Asia, national reform documents have positioned ICT integration as a central vector of educational modernization. The Concept for the Development of the Education System of Uzbekistan (2020–2030) explicitly mandates the development of digital competence as a cross-cutting graduate outcome at every level of the education system, and calls for a transition from paper-based instructional documentation to dynamic, platform-hosted lesson design [15, 5]. However, empirical studies conducted in the region — including Muslimov and Tolipov (2021) — reveal a persistent gap between policy aspiration and classroom reality: the majority of technological education teachers continue to plan lessons using paper-based templates or generic word-processing software, with limited uptake of purpose-built pedagogical design platforms [16, 88]. This gap substantiates the need for the methodological development undertaken in the present research.

Research on planning methodology specifically for technological education teachers remains sparse. Most studies address either ICT competence in general or lesson planning in other subject areas, leaving the professional planning needs of technology teachers undertheorized. Notable exceptions include work by Atkinson (2004) on iterative pedagogical design in technology classrooms [17, 33] and De Vries (2016) on the epistemology of technological knowledge and its implications for instructional planning [18, 47]. Both authors

converge on the conclusion that technological education teachers require planning frameworks that foreground procedural, systems-based, and design-oriented thinking — precisely the orientations that structured ICT-based planning environments can cultivate.

A further dimension of the literature concerns the assessment and development of teachers' digital competence as a prerequisite for effective ICT-based planning. The European DigComp 2.2 framework (Vuorikari et al., 2022) identifies five domains of digital competence — information literacy, communication and collaboration, digital content creation, safety, and problem-solving — all of which are activated when a teacher plans instruction in a digital environment [19, 12]. The more recent DigCompEdu framework (Redecker, 2017) applies this logic specifically to educators, identifying the ability to use ICT for professional planning and collaboration as a Level 3 (Integrator) competency — one that requires deliberate skill-building beyond basic tool literacy [20, 36]. These frameworks collectively establish that ICT-based professional planning is not a peripheral add-on to teacher education but a core dimension of contemporary professional competence.

In summary, the literature converges on four key insights that inform the present study. First, professional planning is a complex, multi-level cognitive activity that cannot be reduced to template completion. Second, effective ICT integration in teaching requires domain-specific, pedagogically grounded frameworks — not merely access to digital tools. Third, technological education teachers possess unique design-oriented competencies that are compatible with, and enhanced by, structured digital planning environments. Fourth, significant methodological gaps remain in the literature regarding how these insights can be translated into a coherent, validated planning technology for technological education teachers. The present research addresses this gap directly.

ANALYSIS AND RESULTS

Questionnaire analysis revealed that only 31% of respondents reported using purpose-built digital planning platforms regularly, while 58% relied on generic office productivity software and 11% continued to use paper-based systems exclusively. The most frequently cited barriers to digital planning adoption were: insufficient institutional ICT infrastructure (noted by 64%), lack of targeted professional development in pedagogical design tools (57%), and absence of a clear, institutionally endorsed planning methodology (49%). These findings confirm the existence of the gap identified in the literature review and establish the baseline against which the proposed methodology is assessed.

Expert interviews produced three thematic clusters that shaped the design of the proposed technology. The first cluster concerned goal-setting: experts unanimously stressed that effective ICT-based planning must begin with a rigorous digital formulation of competence-oriented learning outcomes aligned to national curriculum standards, preferably using structured templates embedded in learning management systems (LMS). The second cluster addressed resource curation: experts emphasized the need for teachers to build and maintain personal digital resource libraries — tagged, searchable, and linked to specific lesson objectives — rather than re-curating materials from scratch each planning cycle. The third cluster focused on collaborative design: experts highlighted the underutilization of collegial digital spaces where teachers co-plan, peer-review lesson designs, and accumulate shared professional capital.

Drawing on the questionnaire data, expert insights, and the theoretical synthesis presented in the literature review, a five-stage Technology for Designing Teacher Activity in a Digital Pedagogical Environment (TDTA-DPE) was developed and subsequently validated through a two-round Delphi process. The five stages are as follows. Stage 1 — Digital Competence Audit: the teacher conducts a structured self-assessment of ICT proficiency using the DigCompEdu framework, identifying strengths and priority development areas. Stage 2 — Goal Architecture: using LMS tools, the teacher formulates hierarchically structured learning objectives mapped to curriculum competencies, with each objective linked to assessment indicators and resource tags. Stage 3 — Resource Design and Curation: the teacher builds or sources digital learning objects — interactive presentations, simulation tools, video explanations, assessment rubrics — and organizes them within a tagged personal repository. Stage 4 — Collaborative Peer Review: the draft lesson design is shared within a digital collegial space for structured peer feedback using a standardized review protocol; revisions are made iteratively. Stage 5 — Reflective Documentation: following instruction, the teacher completes a structured digital reflection log capturing what worked, what required adaptation, and what resources should be revised for future cycles, creating a living professional development portfolio.

Validation results from the Delphi process indicated strong expert consensus (content validity ratio > 0.80 for all five stages across both rounds). Pilot implementation with 24 volunteer teachers over one semester showed statistically significant improvements in lesson coherence scores (assessed by independent observers using a validated rubric), digital resource utilization rates, and teacher-reported confidence in professional planning. Specifically, mean lesson coherence scores rose from 3.2 to 4.4 on a five-point scale ($p < 0.01$), digital resource utilization increased from 34% to 71% of lessons observed, and teacher confidence in planning rose by an average of 1.6 scale points. These results provide preliminary empirical evidence for the effectiveness of the TDTA-DPE model.

CONCLUSION AND RECOMMENDATIONS

This study has established that the professional planning methodology currently used by the majority of technological education teachers does not fully exploit the affordances of contemporary ICT tools and digital pedagogical environments. The proposed five-stage TDTA-DPE technology addresses this gap by providing a structured, empirically grounded framework that guides teachers from digital self-assessment through collaborative design and reflective documentation. Pilot results suggest meaningful improvements in lesson quality and teacher digital confidence, though longitudinal studies with larger samples are required to confirm generalizability.

Based on the research, the following recommendations are advanced. For institutional leaders: embed the TDTA-DPE model in institutional professional development programs for technological education faculties, and allocate dedicated ICT infrastructure — including LMS licenses and collaborative platform access — to support its implementation. For teacher educators: incorporate structured ICT-based lesson design as a mandatory component of initial teacher education programs, using the five-stage model as a practicum scaffold. For policymakers: align national digital competence assessment frameworks with the specific planning demands of technological education teachers, ensuring that evaluative instruments capture the design-oriented and iterative dimensions of professional planning activity.

Future research directions include: longitudinal tracking of teacher planning quality following sustained TDTA-DPE implementation; cross-national comparative studies examining how institutional and cultural factors moderate ICT-based planning adoption; and the development of AI-assisted planning support tools that can provide real-time formative feedback within digital pedagogical environments. The broader significance of this research lies in its contribution to a growing evidence base establishing that purposefully designed, methodologically grounded ICT integration in professional planning is not a luxury but a professional necessity for technological education teachers operating in twenty-first-century schools.

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