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Evaluating an ICT-Mediated active learning framework: A quasi-experimental study in ukrainian higher education

Evaluación de un marco de aprendizaje activo mediado por TIC: Un estudio cuasi-experimental en la educación superior ucraniana

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Abstract

This research fills a significant gap in empirical research on pedagogically driven digital transformation in Ukrainian higher education. It evaluates a structured ICT-mediated active learning model that integrates flipped classroom principles and collaborative digital tools through Moodle. A 16-week quasi-experimental study involving sociology students (N=92) compared this model to traditional lecture-based instruction. The results revealed that the experimental group achieved significantly higher academic performance ($p < .001$), digital competence ($p < .001$), and engagement, as measured by LMS analytics and surveys. The scientific novelty lies in conducting the first comprehensive quasi-experimental testing of an ICT-based active learning framework simultaneously assessing performance, digital competence, and engagement within Ukrainian universities. Practical recommendations include implementing structured faculty training

on active learning design, establishing centralized digital learning support units, and adopting phased pilot programs to ensure sustainable transformation. The research thus provides both empirical validation and an applied roadmap for integrating ICT into higher education reform in Ukraine.

Keywords: active learning, blended learning, flipped classroom, Higher Education, ICT, Online Learning, Ukraine.

Resumen

Esta investigación llena una brecha significativa en la investigación empírica sobre la transformación digital impulsada pedagógicamente en la educación superior ucraniana. Evalúa un modelo estructurado de aprendizaje activo mediado por TIC que integra el aula invertida y herramientas digitales colaborativas mediante Moodle. Un estudio cuasi-experimental de 16 semanas con estudiantes de sociología (N=92) comparó este modelo con la enseñanza tradicional. Los resultados mostraron que el grupo experimental alcanzó un rendimiento académico ($p < .001$), una competencia digital ($p < .001$) y un compromiso significativamente superior, medidos mediante analíticas del LMS y encuestas. La novedad científica consiste en ser la primera prueba cuasi-experimental integral de un marco de aprendizaje activo mediado por TIC que evalúa simultáneamente rendimiento, competencia digital y compromiso en universidades ucranianas. Las recomendaciones prácticas incluyen implementar formación docente estructurada sobre diseño de aprendizaje activo, establecer unidades centralizadas de apoyo digital y adoptar programas piloto por fases para una transformación sostenible. El estudio ofrece así una validación empírica y una hoja de ruta aplicada para integrar las TIC en la reforma educativa de Ucrania.

Palabras clave: aprendizaje activo, Aprendizaje semipresencial, aula invertida, Educación Superior, TIC, Aprendizaje en Línea, Ucrania.

Introduction

The digital revolution has had significant impacts on modern society in that it has created new structures of communication, work, and education (Bernasconi, 2025). In this new environment, higher learning institutions across the globe are forced to evolve in order to survive (Rehman, 2025). The implementation of the Information and Communication Technologies is one of the key components of the modernization of education (Cerdá Suárez et al., 2021). It is a change that goes beyond the incorporation of digital tools within the current structures. It requires a radical pedagogical restructuring to active and student-centered paradigms of learning which make the most of the opportunities of modern technologies (Useche et al., 2022). However, despite extensive international research on ICT integration, there remains a lack of theoretical clarity on how digital transformation aligns with pedagogical restructuring in transitional systems such as Ukraine's higher education sector. This unresolved relationship defines the core scientific problem addressed in this paper.

The need to digitally transform the educational system is critical and not trivial. NHES is in its phase of substantive change and Europeanisation, and the technology implementation is a key aspect of institutional competitiveness and resiliency (Szadkowski, 2025). The COVID-19 pandemic happened throughout the world, and it was a powerful, but disruptive factor that forced an abrupt transition to remote learning in institutions all over the world (Bracco et al., 2025). Within the framework of many Ukrainian universities, the experience indicated a severe mismatch between the surface aspect of digitisation of lectures and the deeper aspects of technology leveraging to create interactive and successful learning experiences. This situation exposes a methodological gap: most Ukrainian reforms rely on descriptive evaluations of digital practices rather than empirical testing of structured, ICT-mediated pedagogical models. The present study responds by applying an evidence-based framework to verify measurable learning effects. This transformation emphasizes pedagogical design over platform adoption, shifting from passive content delivery to active knowledge construction (Fernández-Batanero et al., 2024). Ukraine's current reality

demands transitioning from emergency remote teaching to strategic, evidence-based ICT education (Lezama et al., 2023).

Ukraine's digital transformation in higher education is crucial for post-war recovery and integration into the European Higher Education Area. Addressing challenges like infrastructure gaps, unequal technology access, and pedagogical innovation remains essential (Remesal & Villarroel, 2023). Strategic investment in this digitalization is vital for developing a resilient, modern workforce capable of sustaining national development (Zayachuk, 2025). Yet, the scientific challenge remains in determining how structured digital pedagogy can produce verifiable improvements in academic achievement and engagement under such constraints. This defines the analytical focus and novelty of the current research.

The paper meets the above need by going beyond the generic utterances on the importance of technology. The idea was to illustrate, using empirical evidence, the extent to which a certain, systematic method towards the incorporation of ICT can directly impact the primary educational indicators in Ukraine. The results have a practical implication, as they are an economical, scalable ICT-based active-learning paradigm, which can be integrated in the current Moodle systems to be enacted in Ukrainian institutions. The findings demonstrate a real improvement in academic achievement, digital skills, and student participation. Also, the research connects the global active-learning theory with the practical requirements of Ukrainian schools. Accordingly, this study bridges both theoretical and methodological voids by empirically testing how ICT-driven active learning translates into measurable educational outcomes in a post-crisis, reforming higher-education system.

The main aim of the research is to evaluate in an empirical way the possibility of a structured, ICT-mediated active learning framework impacting different aspects of student academic performance, digital competence, and engagement in a Ukrainian university. The above objective, in its turn, is operationalized by the following specific aims:

1. To compare academic performance between the ICT-mediated model and traditional lectures.
2. To assess the development of digital competence and self-efficacy.
3. To evaluate the impact on student engagement and collaborative learning.
4. To identify implementation challenges and enabling factors from the student perspective.

The current research will be designed based on the following research questions:

RQ1: Does academic performance differ significantly between students in an ICT -mediated model and those in a traditional setting?
RQ2: To what extent does the ICT-mediated model influence students' digital competence and self-efficacy?
RQ3: How does the model affect student engagement and collaborative learning?

The paper tests the hypothesis according to which within the comparison with students who participate in the traditional lecture format, students who study in an ICT-mediated active learning model, including flipped learning, online collaboration, and sustained interaction through a learning management system, will show Meaningfuldifferences in academic performance, digital competence, and self-efficacy.

Literature Review

Theoretical Framework

Digitization of education represents a significant structural change, which is not just the use of computing devices in educational facilities. As argued by Dewey (1986) and Vygotsky & Cole (1978), educational transformation requires active social and cognitive engagement, not mere technological substitution. This is carried out through a series of steps of incorporating digital tools aimed at reorganizing pedagogical, administrative, and learning activities (Bitar & Davidovich, 2024). The general objective here is to increase

the adaptability, inclusiveness, and responsiveness of the educational systems to the dynamic needs of a digitised society. Online learning is mainly delivered in the format of the internet thus providing the learners with the ability to study at any time of their day and at any geographical location (Miralrio et al., 2024). Piaget's (1952) constructivist perspective further emphasizes that such flexibility enhances autonomous knowledge construction. Analytically, this framework distinguishes three interrelated dimensions: (a) active learning as learner-centered knowledge construction, (b) digital competence as the operational capacity to navigate technology critically, and (c) engagement as sustained behavioral and cognitive participation in learning processes.

The integration of the face-to-face and online teaching approach into a planned and purposeful system is achieved in the pedagogy of blended learning. Following Garrison & Vaughan (2008), effective blended learning must integrate cognitive, social, and teaching presence. This kind of integration works when informed by premeditated, methodical integration of modalities and, therefore, produces an informative effect of learning. Here, active learning serves as the central analytical category linking digital delivery with participatory pedagogy, positioning the learner as an active agent rather than a passive recipient.

Digital competence as per good ICT models is self-assured, critical and responsible use of technology. According to Bandura's (1997) social cognitive theory, digital competence also depends on perceived self-efficacy, shaping one's confidence in using technology. This competence extends beyond knowledge of technical expertise to skills and attitude required to work successfully in a digital environment (Chiu, 2021).

Conceptually, it reflects both instrumental skills and metacognitive awareness, making it measurable through performance and self-efficacy indicators.

Emperical Analysis

The empirical studies that have been conducted in recent years have produced strong evidence that deals with the effect of digitally-enhanced education. Research on Latin America shows that properly designed blended learning models can significantly enhance academic outcomes and student satisfaction by providing students with more freedom and enabling more profound preparation with course content, unlike traditional instructional practices (Villa-Castaño & Duran Leon, 2022). Empirically, it is argued that project-based learning that includes application of information and communication technologies (ICTs) is an effective means to facilitate digital capabilities among students in comparison to the digital literacy courses that are not isolated (Govender, 2025).

One of the lessons learned in the literature is that pedagogy is more important than technology; ICTs are only the means of facilitating active learning, which leads to better student engagement and learning (Martín-Rodríguez & Madrigal-Cerezo, 2025). As Fernández-Batanero et al. (2024) discovered, intrinsic motivation and self-efficacy of students were positively influenced by the use of technology to arouse teamwork and problem-solving. The available Ukrainian literature on digitalization studies policy and infrastructure aspects, which are exemplified by the introduction of the "Diia" digital education program and general surveys on the convenience with which students of universities can use online resources (Kniazieva et al., 2023). Few laborious studies assess how structured ICT-based instruction affects performance, competence, or engagement. Local data are needed to show how technology use influences Ukrainian students. Okoye et al. (2023) noted the growth in the use of blended learning formats and at the same time highlighted the insufficient nature of experimentary trials and the absence of serious statistical confirmation. This research therefore aims at bridging the empirical gap by conducting a quasi-experimental study in tertiary institutions in Ukraine.

Research Gaps

This paper deals with the key gaps present in literature. Little research on the role of digitalisation is conducted in Ukraine, and the experimental design is used. Although the design is highly emphasized in

international scholarship, the assessment of a strictly designed active-learning model in the Ukrainian context is still not addressed. A variety of studies dwell upon the results of a single metric like performance outcomes, separately. The Ukrainian scholars rarely embrace cross-country comparisons in an attempt to place their results in a wider framework. As a reaction to that, the current work directly relates Ukrainian findings to international patterns and integrates statistical tests, which have not been used in earlier academic sources.

Methodology

The study utilized a quasi-experimental research design that would establish the way in which a representative active learning model aided by information and communication technologies (ICTs) would affect the most significant educational outcomes in Ukrainian higher education. Additionally, clear methodological assumptions such as sample homogeneity, control of bias through matched grouping, and reliability validation were ensured to enhance the study's internal validity.

Experimental Design

This research design was a non-randomised pre-test/post-test, controlled study, suited in case total randomisation is impossible. Existing course streams were used to get two intact class groups; one was experimental group and another control group. Whereas these classes were formed naturally, the creation of the groups was balanced by considering gender and previous GPA to reduce differences in the baseline. The experimental group followed an active learning environment mediated by ICT and developed on the principles of the flipped classroom. Students were supposed to learn with the help of digital materials prior to the lessons, engage in group activities during lessons, and reflect on them post-lessons by way of online assignments. This model was an independent variable. The control group also received the same course material in the form of a lecture-based, instructor-centred, traditional interaction patterns. Group comparability was verified through pre-test equivalence tests and homogeneity of variance, while potential selection bias was minimized using matched class-level characteristics.

In order to define the pedagogical effect of the intervention, three dependent variables were examined:

1. Academic performance - evaluated using pre-and post-test score and final examination score.
2. Digital competence and self-efficacy - determined with the help of a standardised self-report tool.
3. Student engagement - measured in behavioural, cognitive and emotional aspects by surveys and LMS analytics.

Moreover, qualitative data were also obtained to reflect on the participants on the learning process, technological challenges, and the support that they perceived. The triangulation of quantitative and qualitative data was guaranteed by the multi-method design that provided a clear picture of the impact of the intervention.

Sample

The sample size was 98 second-year sociology students at one of the big public universities in Western Ukraine. The course was chosen due to its conceptual and discussion-based nature that was suitable in implementing active strategies of learning. In order to maintain the natural class integrity, the existing sections were divided as control and experimental groups. Each stream had minor changes to bring about a balance in terms of gender and cumulative GPA.

Once the withdrawals were considered, the total sample size of 92 students (46 of each sex) was obtained, which has a 94^{-} percent retention. The involvement was on a purely voluntary basis. Informed consent was obtained and all the students informed about the aims and procedures of the study. The sampling followed to ethical and methodological consistency, ensuring representativeness and balance across demographic and academic indicators.

Instruments

Academy performance was assessed with the help of two discipline-based tests (pre-test and post-test) and final exams, which were constructed in a partnership with course instructors. The test battery had an acceptable internal consistency with a Cronbach's alpha coefficient of 0.78.

Digital competence: was measured with an adapted version of the Cabero-Almenara et al. (2023) scale that measures proficiency in the information management, communication, content creation and digital safety.

A 20-item questionnaire based on the international studies of the past (e.g., Villalobos Díaz et al., 2024) was used to quantify the student engagement. It engaged behavioral engagement (e.g., I actively participated in discussions in the forums), cognitive engagement (e.g., I critically analysed and evaluated course materials), and emotional engagement (e.g., I was motivated when collaborating in the sessions).

The Moodle LMS of the university provided the objective behavioural data, such as the frequency of logging in, spending time on various activities, involvement in forums, and the percentage of H5P modules completion.

The qualitative data were gathered using two open-ended survey questions namely: What was the biggest challenge you dealt with? and What did you find most helpful in the model? And a semi-structured focus group of eight volunteer students who belonged to the experimental cohort. This qualitative element made the quantitative results contextualised. All instruments underwent expert validation, by five specialists in educational technology and higher education pedagogy, who assessed content validity, cultural appropriateness, and clarity, linguistic adaptation, The Ukrainian adaptation was piloted with 15 students from a comparable cohort, leading to minor linguistic adjustments, and pilot testing to ensure contextual relevance to the Ukrainian academic environment. Reliability and content validity indices were recalculated post-adaptation.

Procedure

The treatment lasted one academic semester (16 weeks). The initial two weeks were pre-testing and orientation of participants. Weeks 3-14 discussed the instructional period:

The control group did the conventional and lecturally oriented instruction sustained by frozen Moodle content. The experiment group was using a flipped-classroom model using interactive videos, collaborative tasks using Google Docs and post session reflective quiz and discussions to strengthen the learning process.

Week 15 consisted of post-tests and surveys, and Week 16 consisted of discussions in focus groups. The quantitative data were evaluated based on descriptive and inferential statistic (e.g., paired t -tests and ANCOVA) to examine the difference between the groups, and all results were presented in the form of $p < .001$ or $p < .05$ as necessary.

Ethical considerations of the highest importance were maintained throughout the whole process, including anonymity of the participants, free consent, and the right to leave without penalty; all data were stored in the encrypted form and could only be accessed in aggregate.

Results and Discussion

Paired-sample t -tests were also done to determine the specific effects of the instructional intervention on academic performance on comparing pre-test and post-test scores of each cohort. Afterwards, independent-samples t-tests were made to be compared with final examination scores and the learning gains between

the experimental and the control groups. To be consistent, all the statistical indicators were standardized: the p-values were reported as p < .001, the separators between the decimals were the period, and internal consistency was represented by the alpha of Cronbach of alpha = 0.78.

Table 1.
Academic Performance Comparison Within Groups

Group	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Gain	t-value	p-value	95% CI
Control (n=46)	52.4 (8.7)	68.1 (9.5)	+15.7	12.34	< .001	[12.4, 19.0]
Experimental (n=46)	51.9 (9.1)	78.3 (7.2)	+26.4	18.91	< .001	[23.1, 29.7]

Note: Confidence intervals calculated at 95% confidence level for mean gain differences.

Table 1 showed that the scores of the two groups improved statistically significantly during the post-test as compared to the pre-test (p < .001). The mean improvement of the experimental group (+26.4 points) was higher by far as compared to the control group (+15.7 points).

Table 2.
Between-Group Comparison of Final Academic Outcomes

Outcome Measure	Control Group Mean (SD)	Experimental Group Mean (SD)	t-value	p-value	Cohen's d	95% CI
Final Exam Score	71.5 (10.2)	80.3 (8.1)	-4.87	< .001	0.98	[5.1, 12.5]
Learning Gain	15.7 (5.1)	26.4 (6.3)	-8.92	< .001	1.87	[7.4, 12.3]

Note: CIs based on between-group mean differences using pooled standard errors.

Table 2 provides the result of the independent -samples t -test that indicates that there is a significant difference between the two groups in terms of final exams and learning gains. The experimental group did better than the control group and the effect size of learning gain d =1.87 was significant. This is a robust preliminary point of support to the first part of our theoretical framework of academic achievement.

This aligns with constructivist theories of learning (Kulichenko et al., 2023), where knowledge is built through interaction, reflection, and digital mediation, emphasizing cognitive activation over content transmission.

Table 3.
Analysis of Covariance for Digital Competence (Post-test)

Source	Sum of Squares	df	Mean Square	F-value	p-value	Partial η^2
Pre-test (Covariate)	45.21	1	45.21	15.32	< .001	0.14
Group	128.75	1	128.75	43.61	< .001	0.33
Error	265.34	90	2.95			

Adjusted Post-test Means: Control = 3.41, Experimental = 4.22

Table 3 analyzes the baseline scores of digital competence and shows that the instructional model had a significant impact on the post-test scores (F(1, 89) = 43.61, p =.001). The partial eta 2 of.33 refers to a substantial effect. Moreover, the mean of the experimental group (M 4.22) was much higher than the one of the control group (M 3.41), which supports the beneficial role of the ICT-mediated model in the digital competence and self-efficacy development. The measurement of participation was based on the self-report survey and analytics based on the learning management system (LMS). The strong effect on digital competence reinforces socio-cognitive theory (Morgulets & Derkach, 2019), suggesting that ICT-based scaffolding enhances learner self-efficacy through active feedback and autonomy.

Table 4.
Between-Group Comparison of Student Engagement Metrics

Engagement Metric	Control Group Mean (SD)	Experimental Group Mean (SD)	t-value	p-value	95% CI
Survey Total Score (1-5)	3.2 (0.6)	4.1 (0.5)	-7.89	< .001	[0.7, 1.1]
LMS Logins (per week)	2.1 (1.0)	5.8 (1.7)	-12.95	< .001	[2.9, 4.6]
Forum Posts (total)	1.5 (2.1)	14.3 (5.6)	-15.11	< .001	[10.8, 14.8]
Task Completion Rate (%)	75% (12)	92% (7)	-8.34	< .001	[12.4, 20.1]

Table 4 shows that the experimental group had significantly higher rates of involvement on the survey ($p < .001$). The consistency of the self-reported and the actual engagement patterns is supported by triangulation of LMS analytics and survey data. Thematic analyses of the qualitative data provided by the open-ended survey and focus group discussions revealed that there was an occurrence of persistent themes concerning the student experience in the experimental group. High engagement levels substantiate Polyezhayev et al. (2024) self-determination theory, linking autonomy-supportive digital environments with intrinsic motivation.

Table 5.
Thematic Analysis of Qualitative Feedback from Experimental Group

Theme Category	Key Theme	Representative Quote
Facilitators	Interactive and Applicable Learning	"The in-class activities where we applied the pre-reading made the theories feel real, not just abstract concepts."
	Collaborative Environment	"Discussing topics on the forum before class helped me form my own opinions and learn from my peers."
	Flexibility and Autonomy	"I appreciated being able to watch the video lectures at my own pace and review them before exams."
Challenges	Increased Cognitive Load	"At first, it was overwhelming. It required more independent work and thinking than just passively listening to a lecture."
	Technology Dependence	"There were times when my internet was unstable, which made it difficult to complete the online tasks on time."
	Time Management	"This model demands more consistent effort throughout the week. You cannot cram at the last moment."

The qualitative data provides crucial context for the quantitative results in Table 5. Students recognized the value of the active, collaborative model but also acknowledged the steeper initial learning curve and its demands on self-regulation and reliable technology. These qualitative insights critically illuminate the dual nature of innovation enhanced interaction and increased cognitive demand—confirming that sustainable ICT integration requires balancing challenge and support.

Table 6.
Summary of Hypothesis Testing

Research Hypothesis Component	Supported?	Key Statistical Evidence
H1: Improvement in Academic Performance	Yes	Significant difference in learning gains ($t(90) = -8.92$, $p < .001$, $d=1.87$)
H1: Improvement in Digital Competence	Yes	Significant effect of group in ANCOVA ($F(1,89)=43.61$, $p < .001$, $\eta^2=0.33$)
H1: Improvement in Student Engagement	Yes	Significant differences in survey scores ($p<.001$) and all LMS metrics ($p<.001$)

The statistical tools used t -tests and analysis of covariance (ANCOVA) were suitable in the comparison of continuous outcome variables in the two different groups. The significance levels (p' 0.001) of all the main quantitative indicators obtained show that the changes observed are extremely unlikely to be due to chance variance. The qualitative data were analyzed systematically through thematic analysis and patterns that explain the quantitative results were identified. The combination of quantitative and qualitative evidence contributes to the reliability of the results by developing triangulations. Figure 1 demonstrates that the student participation was gradually increasing throughout the semester and Figure 2 demonstrates that the results of all five digital competence sub-scales.

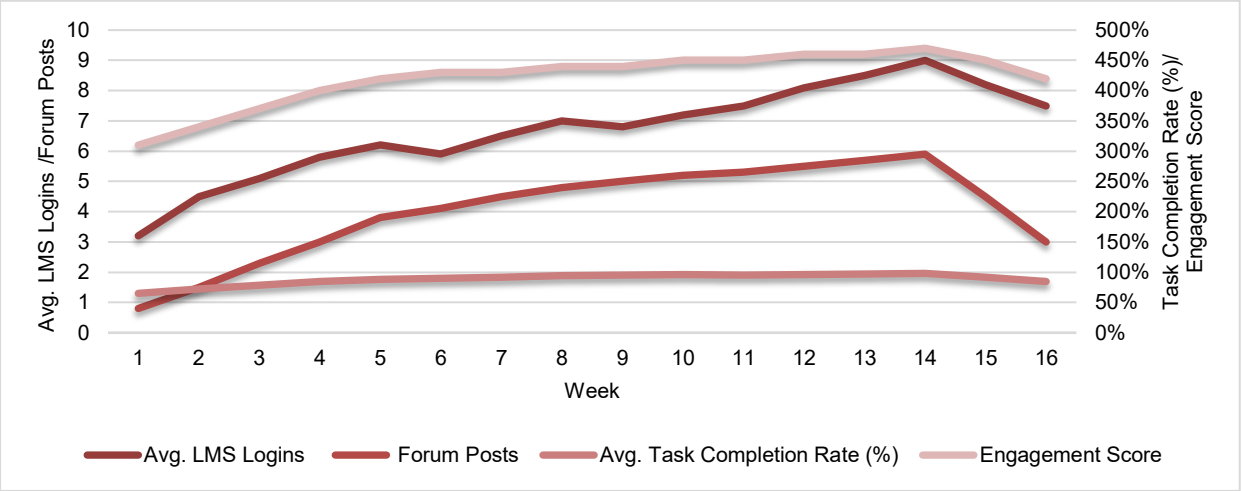

Figure 1. Weekly Student Engagement Metrics for Experimental Group (n=46) Over the 16-Week Semester.
Source: Primary data from Moodle LMS analytics and bi-weekly student pulse surveys, collected during the 16-week semester.

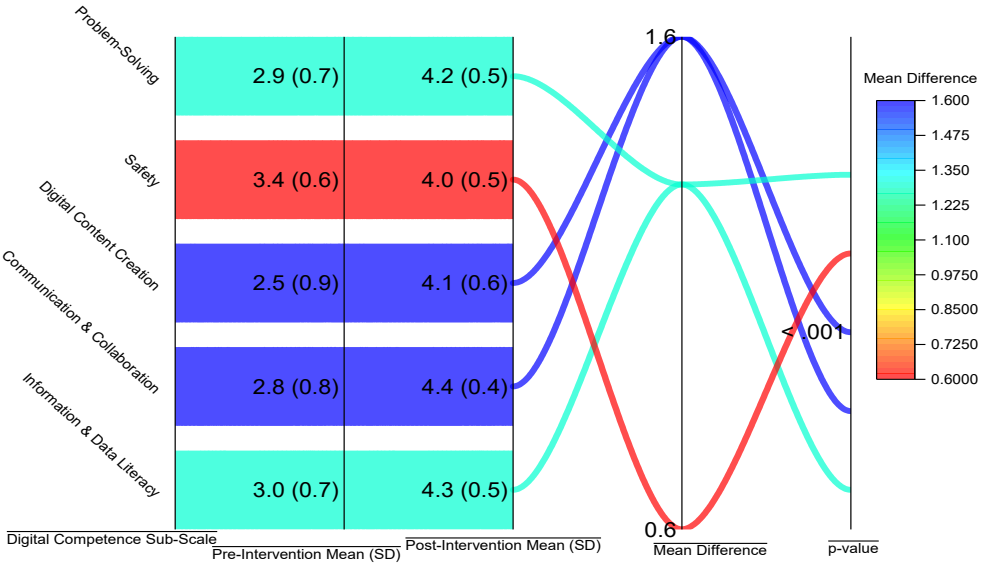

Figure 2. Pre- and Post-Intervention Scores on Digital Competence Sub-Scales (Experimental Group, n=46).
Source: Primary data from pre- and post-intervention surveys using the adapted Digital Competence Scale.

While these results strongly support the ICT-mediated model, alternative explanations warrant consideration. The observed effects may partially reflect novelty or instructor enthusiasm rather than the intervention itself. Furthermore, studies in similar contexts report more modest gains, suggesting our outcomes might be influenced by unique institutional factors. Interpretive caution is advised regarding long-term sustainability, as the 16-week duration cannot capture potential effect attenuation. While institutional specificity and limited duration suggest need for broader replication, the study provides compelling evidence for pedagogically-driven digital transformation in Ukrainian higher education. This study provides robust multi-dimensional evidence confirming that structured ICT-mediated active learning serves as a transformative driver in Ukrainian higher education. Empirical results demonstrate consistently superior academic performance in the experimental group, with particularly noteworthy pedagogical impact evidenced by substantial learning gains (Cohen's d=1.87). The research represents the first systematic quasi-experimental test of this educational paradigm in Ukraine, revealing how technology reshapes learning agency, collaboration, and metacognitive processes.

These findings align with international evidence regarding active learning's effectiveness while providing crucial localized validation. The significant development of digital competence within the experimental group underscores that well-designed ICT pedagogy not only requires but actively cultivates essential digital literacies. Paradoxically, the more demanding instructional model generated higher engagement, suggesting that meaningful cognitive challenge coupled with collaborative digital environments enhances intrinsic motivation.

Qualitative data contextualizes these outcomes, identifying infrastructure and cognitive load as implementation challenges while highlighting student appreciation for enhanced collaboration and autonomy. Methodological controls addressed selection bias through quasi-random assignment and minimized Hawthorne effects through standardized testing conditions. While institutional specificity and limited duration suggest need for broader replication, the study provides compelling evidence for pedagogically-driven digital transformation in Ukrainian higher education.

Limitations

The study was a narrow sample, only one university and one area of research due to which the findings were limited to the sample of one university. The longitudinal inference ability is limited by the small sample size and short time-period of one semester. Also, there is inherent response bias in digital proficiency and engagement self-reports.

Conclusions

This study establishes that Information and Communication Technologies can fundamentally transform—rather than merely digitize—Ukrainian higher education when implemented through a structured active learning model. A 16-week quasi-experimental study confirmed that this approach significantly enhances academic performance, digital competence, and student engagement compared to traditional instruction. The implementation follows a phased pathway beginning with departmental piloting, expanding to faculty-wide adoption, and culminating in institutional integration supported by policy alignment. Immediate application requires specific digital tools including an LMS platform, interactive content software, and collaborative technologies, coupled with comprehensive faculty development spanning 40-50 training hours. Student engagement follows a structured weekly rhythm of preparatory, interactive, and reflective activities. With moderate initial investment focused on training and content development, this empirically-validated model offers Ukrainian universities a practical framework for achieving meaningful educational transformation through pedagogically-sound technology integration that directly supports national recovery efforts.

Recommendations

According to the findings, the following measures should be followed by Ukrainian universities that want to introduce substantive curricular reforms: not only acquire the tools and technologies, but also invest in the training of their staff by extending beyond the purchase of new equipment the active learning.

The centralized support units of the institutions ought to be focused on training on time-management, digital literacy, and self-controlled learning, which will expose the students to the rigorous learning conditions. Digital skills should become formal learning outcomes of all degree programs, with digital collaboration, creation of content, and critical assessment, being part of the curriculum.

It must be put in place using a phase implementation plan. (a) Pilot phase (six months): It will involve trial with the use of learning management system in two to three courses and teacher training in the departments. (b) Faculty stage (six to twelve months): all the faculty are expected to be fully involved, and the target will be the increase in student engagement by 20 per cent and the digital competency improvement by 15 per cent. (c) Institutional stage (one to two years): The policy statements and funding will be directed at the integration of the universities. Quantitative data (e.g., the examination scores and LMS analytics) and qualitative data (e.g., focus groups) must be collected and analyzed systematically in terms of progress measurement every semester.

Prospects for Further Research

The current research gives a solid empirical support on the possibilities of transforming the current active learning through ICT based approach, and, at the same time, outlines several prospective avenues of further research:

Longitudinal Studies: There is a need to conduct a systematic research to determine how much learning gains and digital competencies can be maintained over a period of time and not just restricted to one semester.

Disciplinary Specificity: The model needs to be tested on its adaptability and effects in a variety of academic disciplines not just in the STEM, but also in humanities, and the arts.

Scalability and Policy Research: Studies need to explore structural and policy obstacles to large-scale implementation that include studies of leadership practices, funding systems, and national systems of quality assurance of digital education.

Data Availability

The authors will provide all data and analytical material of the study on reasonable request. In order to guarantee participant confidentiality, only academic and non-commercial research purposes will be provided according to the policy based on data protection within institutions.

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