The Effectiveness of Using Digital Technologies to Optimize the Study of Law for Students of Technical Specialties

Botagoz Bermukhambetova[1,*], Kristina Vozniakovska[2], Maral Yessekeshova[3], Nursaule Tastanbekova[3], and Aliya Kosshygulova[4]

[1]Department of Economics, Management and Marketing, Faculty of Business and Digital Technologies, NCJSC "S. Seifullin Kazakh Agro Technical Research University", Astana, Kazakhstan
[2]Department of Civil, Commercial Law and Other Private Law Disciplines, Chernivtsi Educational and Scientific Law Institute of the National University Odesa Law Academy, Odesa, Ukraine
[3]Department of Vocational Education, Faculty of Computer Systems and Vocational Trai, NCJSC "S. Seifullin Kazakh Agro Technical Research University", Astana, Kazakhstan
[4]Department of Pedagogy, Faculty of Pedagogy and Psychology, Abai Kazakh National Pedagogical University, Almaty, Kazakhstan
Email: bbermukhambetova@gmail.ru (B.B.); christjachristja@gmail.com (K.V.); maral-astana@mail.ru (M.Y.); nursaule.84@mail.ru (N.T.); alenti85@mail.ru (A.K.)
*Corresponding author

Manuscript received May 30, 2025; revised June 25, 2025; accepted September 28, 2025; published March 17, 2026

***Abstract*—In the context of a digitally evolving society, the integration of legal awareness into technical education is critical for the development of comprehensive professional competence. This study examines the potential of digital technologies to enhance the acquisition of legal knowledge among students in technical disciplines. Employing an interdisciplinary pedagogical framework, the research evaluates the effectiveness of three digital platforms—Knewton, Casetext, and LexisNexis—implemented in higher education institutions in Kazakhstan. 126 students (26 girls and 100 boys) participated in a survey on the effectiveness of digital applications. A quantitative design was applied, including content analysis, surveys, and statistical tools such as Analysis of Variance (ANOVA) and Tukey HSD. The results show that students highly rated the applications Casetext and LexisNexis, but the application Knewton received lower ratings. This can be explained by the use of this application for studying theoretical knowledge, which is a passive method, and the focus of the assessment was more on the performance of practical tasks. Implications of these results suggest the importance of taking into account the aspects of the purpose of using certain applications in the learning process, as other aspects of the use of digital technologies in the learning process.**

***Keywords*—higher technical education, digital technologies, digital educational applications, integration of law and technology, legal competence**

I. Introduction

Although the development of legal competence among technical students is widely recognized as a critical component of professional education, empirical research on the role of specific digital applications in supporting this process remains scarce. Previous studies have emphasized the general advantages of digital tools in legal education but have not adequately examined their applicability to students in technical disciplines. This lack of evidence creates a significant gap in understanding how modern technologies can be integrated into curricula to strengthen both legal and digital literacy among future technical specialists.

Earlier research has documented the motivational, cognitive, and performance-related benefits of digital tools in legal and higher education more broadly, including enhanced engagement, critical thinking, and academic performance [1–8]. However, most of these findings remain descriptive and rarely distinguish discipline-specific outcomes for technical majors. Evidence regarding whether particular applications yield distinct benefits for technical students—whose coursework prioritizes applied problem-solving and regulatory compliance—remains limited. This study addresses this gap by analyzing the use of three platforms in teaching legal disciplines to students of technical specialties.

In the context of rapid societal and technological change, legal competence functions as both a core dimension of professionalism and a critical instrument of risk management for contemporary practitioners across domains. Legal norms provide the framework that aligns transformation and innovation-driven development with applicable requirements and constraints [9]. Students' knowledge of legal aspects is an important part of their understanding of the principles of civil society [10]. Modern engineering practice goes far beyond designing technical systems: it inherently involves working with intellectual property, data protection, occupational safety, environmental regulations and contractual obligations in project work. Developing multifaceted competences and adaptability to the demands of a constantly transforming society is the primary educational objective of contemporary universities [11]. There is a growing tendency to strengthen interdisciplinary connections, characterized by increased interaction between technical, managerial, and legal fields. As a result, curricula have shifted from focusing solely on narrow technical skills toward training well-rounded professionals, capable of operating effectively in complex, regulated environments [11]. The ability to navigate legal norms – including conflict resolution, intellectual property protection, and data security – has become a fundamental aspect of professionalism for technical specialists. For example, informational technology companies face the challenge of balancing strict data protection with the pursuit of innovation [12]. The symbiosis of legal and digital competence reflects the demands of today's technological world, where artificial intelligence and digital tools already influence teaching, learning and the university management processes [13]. Higher education reform aims to improve the effectiveness of the learning process, promote personalized

learning [14], and promote the comprehensive development of students as responsible citizens who are aware of the legal and ethical aspects of their work [15]. Digital literacy and the ability to manage diverse information are quite important for students' future careers [16].

For engineering students, legal competence directly supports core professional tasks: protecting intellectual property arising from design projects; ensuring compliance with data protection and cybersecurity requirements in software and systems; adhering to occupational safety and environmental regulations in laboratory and field work; and negotiating contractual obligations in technical projects. These legal dimensions are pervasive in contemporary engineering practice and, accordingly, integral to program outcomes and risk management.

However, there remains a challenge of identifying and integrating the most effective digital solutions, tailored to the specific professional profiles of technical students [17]. The choice of digital technologies for teaching law to students in technical specialties requires systematic research into their practical application. Finding effective digital platforms and applications is necessary for improving the teaching of legal disciplines, fostering legal competence, and developing awareness of the professional responsibilities of future specialists. Despite the availability of research on the effectiveness of digital technologies for studying legal disciplines [1, 18], there is still a lack of data on the effectiveness of specific examples of applications for teaching law to students of technical specialties. The purpose of this article is to study the effectiveness of digital applications used for studying law by students of technical specialties at universities in the Republic of Kazakhstan. To achieve this goal, the following research tasks were formulated and implemented:

1) To identify applications recommended for studying law by technical students;
2) To design and implement a plan for legal studies using three digital applications - Knewton, Casetext, LexisNexis for students of technical specialities;
3) To evaluate students' opinions of these applications (Knewton, Casetext, LexisNexis) through experimental research, including statistical analysis of responses and assessment of their impact on the learning process and pedagogical methods in legal education.

II. Literature Review

A. Legal Competence Needs in Technical Education

The necessity of forming legal competence and improving the study of law among future specialists stems from significant changes in society and the labor market [19]. Modern engineering practice increasingly intersects with legal fields, including intellectual property protection, data security, and contract management. As Zubaedah *et al.* [12] argue, rational legal skills of technical professionals are fundamental on the way to balancing strict data protection with the need for innovation. The priority of modern society is to train versatile and comprehensively developed specialists [11]. Studying social sciences and humanities helps students of technical specialities 'broaden their horizons, analyse problems from different points of view and boldly express their opinions' [20]. In view of this aspect, technical education can be interpreted as 'a path that combines the study of science, technology, engineering and mathematics with an interest in and concern for society, its well-being, values and culture' [21]. Students need knowledge of basic legal concepts and an understanding of the fundamentals of law for their future work. The use of digital technologies can contribute to the formation of basic knowledge of the fundamentals of law, enable students to apply this knowledge, and free up more time for practical training in core disciplines [16]. According to Nilupu-Moreno *et al.* [22] the use of LegalTech can significantly improve students' preparation for the modern labour market when used in a balanced and ethical manner.

B. Digital Transformation and Discipline-Specific Effects

The digitalization of education and legal practice has changed both professional requirements and educational approaches [2]. Digital environment can form a system of electronic, distance and blended environment to optimize a process of education on the whole. Digital technologies are successfully used in the study of various subjects and can significantly improve the process of learning the basics of law for students of technical specialties. According to empirical studies, the use of effective digital tools in the learning process helps to improve perception and cognitive skills [23, 24], critical thinking skills [3, 4], problem solving, motivation and interest in learning [5]. The use of appropriately selected digital technologies for teaching the basics of law contributes to the qualitative assimilation and assimilation of the necessary material [6]. The use of technology makes it possible to create an individualized, flexible and accessible learning environment, allowing students to test their knowledge in practical tasks using virtual reality tools or chatbots [7, 25]. As previous studies show, students are quite interested in using new opportunities for learning [19, 26]. At the same time, there are certain problems associated with the use of digital applications in education, in particular, rejection of technology, unequal access, or the unsuitability of certain technologies for teaching certain subjects [23, 27]. As discussed by [28], the dominance of legal services based on innovative technologies over traditional ones highlights the need to prepare students to work with digital legal tools and the need to adapt the curriculum to the use of digital tools [8]. Integrating effective digital technologies into the educational process helps students understand trends in the legal services market, and find innovative solutions to solve legal cases [28].

While these studies confirm the general advantages of digitalization for education, most of them remain descriptive and focus on broad pedagogical benefits. They rarely explore how digital tools function in teaching specific disciplines such as law for technical students, leaving open questions about their practical effectiveness in this context.

C. Application-Level Evidence and Affordances (Knewton, Casetext, LexisNexis)

According to a study by Hongsuchon *et al.* [29], the rational use of digital technologies was the main determining factor in improving the overall effectiveness of the educational process. Numerous studies show the positive impact of technology on student motivation as an indicator of

educational effectiveness, self-efficacy, and engagement [2, 7]. Digital platforms are an effective environment for collaboration between students and student-teachers [30, 31], which ultimately improves their academic performance [32].

At the same time, there is insufficient research in the literature on the specifics of using specific digital applications in the process of teaching students. The assessment of the usefulness of digital technologies in pedagogical practice varies significantly depending on the specifics of the students' fields of study. The idea that traditional methods are more effective for the humanities than for the applied and natural sciences is described by Dona *et al.* [33]. At the same time, however, the global integration of technology into pedagogical practice, including research, teaching, and administration [32], contributes to the transformation of learning. The integration of digital applications into the education of technical students contributes to the formation of not only knowledge but also skills for high-quality work [4, 24]. One way or another, technology will be used in education, and the task of modern educators and administrators is to select high-quality digital applications for studying specific disciplines and to rationally combine them with offline learning, supplementing education and expanding learning opportunities.

Despite robust evidence for the motivational and cognitive benefits of digital platforms, findings on their adaptation across fields remain inconsistent. What proves effective in the humanities may not translate directly to technical contexts, underscoring the need for more field-specific evaluation.

According to Annuš [26], the Knewton platform ([Knewton])is used effectively in schools and, since 2017, in higher education institutions, and is rated pretty positively by students as an effective learning tool. A major advantage of the platform is its ability to analyse and manipulate large amounts of information and use artificial intelligence algorithms to build personalised learning experiences [27]. It provides adaptive delivery content and low-stakes practice, aligning ith foundational legal knowledge acquision.

Studies on the effectiveness of using Casetext [Casetext Inc.] in legal education show that its use improves students' understanding of legal research tools [17]. Using Casetext allows for active teaching methods in the fundamentals of law and the practical application of specific knowledge of legal materials. The case method can also be used for teaching, which significantly improves critical thinking and decision-making skills in legal matters.Casetext offers case-law search and analysis with artificial intelligence assistants, which enables authentic case-based learning, argument construction, and exposure to legal reasoning.

As for the LexisNexis application ([LexisNexis (Reed Elsevier Props.)]), studies show that it can be used to obtain well-structured information, high-quality data visualisation, and the ability to quickly search for the necessary information to learn the basics of law [34]. LegalNexis provides document templates, regulatory databases, and analytical tools, which map onto engineering workflows (e.g. scanning safety and environmental regulations). For technical students, using Knewton reduces time spent on theoretical study and supports mastery of key definitions (e.g., liability, data protection) prior to applied tasks. Using Casetext enables authentic work with case materials, strengthening evidence-based argumentation and decision-making under regulatory constraints. Using LexisNexis facilitates template-driven drafting, rapid regulatory scans, and risk identification in project documentation. Although these platforms have been positively evaluated in various contexts, their application in technical higher education remains underexplored. The existing literature lacks systematic evidence on how these tools contribute to the development of legal competence among technical students, thereby delineating the research gap addressed in this article.

D. Summary and Identified Gap

Prior research underscores the importance of developing legal competence in technical education and acknowledges the growing role of digital technologies in this process. While existing studies indicate general benefits of digital platforms for legal learning, there is little evidence on the effectiveness of specific applications such as Knewton, Casetext, or LexisNexis when used by technical students. This lack of empirical data defines the research gap addressed in this study by examining how these tools support the formation of legal competence in technical specialties.

III. Methodology

A. Methods

To obtain the goal, the methodology of combining general scientific methods (content analysis of literary sources, generalization, synthesis), a survey of the students, and a method of mathematical statistics (one-factor repeated-measures Analysis of Variance (ANOVA)). Sphericity was tested with Mauchly's test; when violated, Greenhouse-Geisser corrections were applied. Post-hoc pairwise comparisons used (Tukey-Kramer for repeated measures / Holm Bonferroni-adjusted paired t-tests). Effect sizes are reported as partial $\eta 2$ for omnibus tests and Cohen's for pairwise contrasts. For ANOVA we used the analysis ToolPak add-in, and for Tukey HSD we used Real Statistics Resource Pack. For verification, the Real Statistics add-in was used.

B. Design

1) Study design

Stage I—a content analysis of scholarly sources to identify key trends and contemporary pedagogical methods in the study of law by technical students. The authors selected three of the popular applications—Knewton [35], Casetext [36], LexisNexis [37]. The Knewton application is designed to integrate core elements of the learning process—adaptive mastery of theoretical legal concepts, completion of practical tasks, and interactive collaboration for team-based resolution of legal cases. The main advantages include individualization, visualization of complex legal concepts, and optimization of study time. Casetext and LexisNexis enable interaction with real legal cases, which is particularly effective for developing students' practical legal reasoning. These applications foster interdisciplinary, including legal, competence and promote analytical and critical thinking among technical students, whose training is otherwise more narrowly oriented toward technical skills. These applications serve as sources for individual or group analyses of court cases, the formulation

of legal conclusions, and the resolution of situational tasks. This substantially develops technical students' ability to apply legal knowledge in practice without direct engagement in the legal profession. Accordingly, students were offered a three-application study plan in which Knewton supported the study of theoretical legal concepts, while Casetext and LexisNexis supported work with legal information and the practical application of basic legal concepts.

Stage II—development of a law-teaching plan for technical students using Knewton, Casetext, and LexisNexis by synthesizing and generalizing information about the applications and the specifics of their practical use. It also includes implementation and adaptation of the plan to the learning context of technical students, analysis of the law study process over one academic term, and subsequent revision of the plan and practice of using the proposed digital applications.

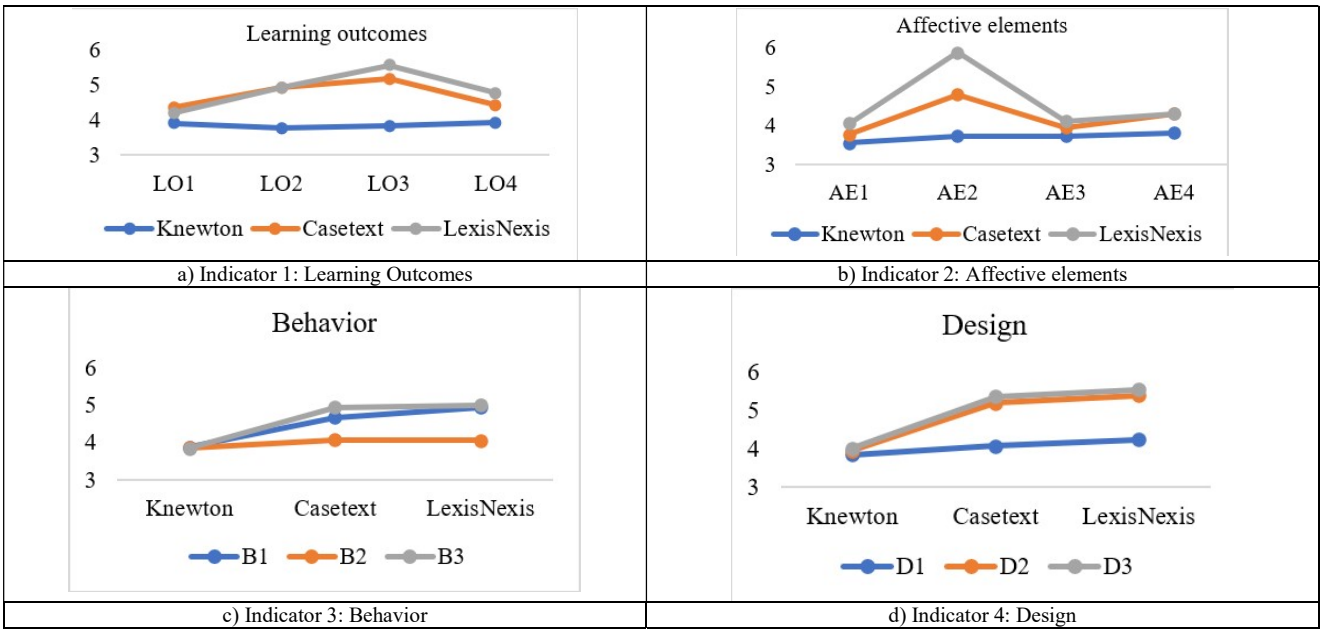
Stage III—evaluation of the effectiveness of Knewton, Casetext and LexisNexis applications by conducting a survey and statistical analysis of the experimental participants' responses, interpretation of the results, analyzing the practical value of using the applications in the study of law. The study used an intra-subject design – all students used applications (Knewton, Casetext, LexisNexis) which they then evaluated. This approach was dictated by the specifics of the curriculum and allowed for the evaluation of these platforms and comparison of students' opinions about them. At the same time, this design is prone to the effects of assessment sequence or transfer (possibly transfer of knowledge between classes, fatigue, novelty). In developing the curriculum using applications, we mitigated these risks as much as possible by using different applications for different learning tasks. The type and procedure of assessment were the same for each application. However, this does not eliminate the potential effects of order inherent in repeated measurements. Therefore, the results should be interpreted with due caution and taking into account this aspect of the study design.

C. Sample and Data Collection

We employed non-probability convenience sampling with year-level quotas. Invitations were emailed to all 1-st to 4-th-year students of one of the universities of the Republic of Kazakhstan specialties – electrical engineering, mechanical engineering, industrial engineering. The students were surveyed in the form of an online questionnaire. Google Forms, which contained the questionnaire, was sent to the students' email. Participation was voluntary. A total of 150 questionnaires were sent out and 126 responses were received. For the study, a learning process using digital applications (Knewton, Casetext and LexisNexis) was developed for first- to fourth-year students. The features of using applications in the learning process are presented in Table A1 in Appendix. The study presents the results of a survey of students who responded to the questionnaire.

The questionnaire consisted of two parts - a section with socio-demographic questions and a specific section aimed at assessing the effectiveness of Knewton, Casetext and LexisNexis applications (Appendix). The specific section involved the use of the validated by Lai *et al.* [38] questionnaire 'Comprehensive Assessment of Technology Use in Education'. Participants were asked to rate their level of agreement with 28 statements on a 7-point Likert scale (where, 0—strongly disagree, 6—strongly agree). The proposed statements in total represent students' evaluation of eight elements of the educational process, namely student's personal opinion on learning outcomes, affective elements, behavior, design, technology, teaching/pedagogy, presence/community and institutional environment (Fig. 1). Prior to administration, three experts of linguistic translation reviewed the items for content relevance and clarity; no changes to content were required.

24 students were suspended at certain stages of the study. The final number of respondents was 126 students ($N = 126$). The survey was conducted in the second semester of the 2023/2024 academic year. Its duration was 4 months. The student survey was conducted at the end of the experiment, with each application being evaluated separately using the questionnaire provided in the Appendix. For example, after the final lesson using the Knewton application, as per the curriculum, students were asked to evaluate it by responding to a Google form by the end of the following day.

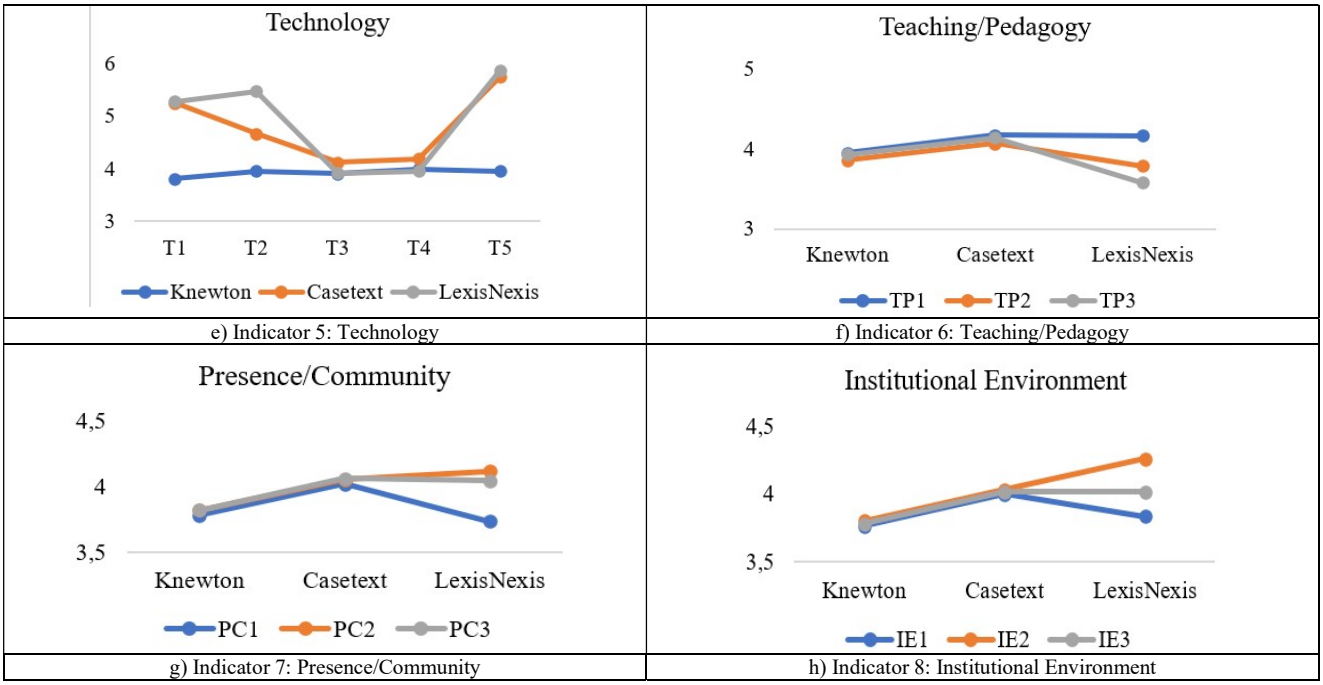


a) Indicator 1: Learning Outcomes

b) Indicator 2: Affective elements

c) Indicator 3: Behavior

d) Indicator 4: Design



e) Indicator 5: Technology | f) Indicator 6: Teaching/Pedagogy

g) Indicator 7: Presence/Community | h) Indicator 8: Institutional Environment

Fig. 1. Visual representation of the data obtained from student evaluation of applications: (a) Indicator 1: Learning Outcomes; (b) Indicator 2: Affective elements; (c) Indicator 3: Behavior; (d) Indicator 4: Design; (e) Indicator 5: Technology; (f) Indicator 6: Teaching/Pedagogy; (g) Indicator 7: Presence/Community; (h) Indicator 8: Institutional Environment.

The details of the respondents' sample are presented in Table 1.

Table 1. Detailed description of respondents

No	Characteristics	Frequency	Percentage
1.	Country		
	Republic of Kazakhstan	126	100%
2.	Course		
	First	29	23.0%
	Second	32	25.4%
	Third	44	34.9%
	Fourth	21	16.7%
3.	Gender		
	Female	26	20.6%
	Male	100	79.4%

D. Data Analysis

Statistical data analysis was performed using MS Excel. The normality of residuals, was tested using the Shapiro-Wilk test for each indicator; all p-values exceeded 0.05, suggesting no significant deviations from normality. Homogeneity of variances was assessed using Levene's test, and again all p-values were above 0.05, suggesting that the assumption of equal variances was met. Given that the same participants rated all three platforms, a one-factor repeated-measures ANOVA was used (three applications: Knewton, Casetext, LexisNexis). Sphericity was tested with Mauchly's test; when violated, Greenhouse-Geisser corrections were applied. Post-hoc pairwise comparisons used (Tukey-Kramer for repeated measures / Holm Bonferroni-adjusted paired t-tests). Effect sizes are reported as partial $\eta 2$ for omnibus tests and Cohen's for pairwise contrasts.

The statistical analysis examined the mean (Mean) and standard deviation (Standard Deviation) of the questionnaire results, p-value, F criterion and confidence intervals.

E. Research Ethics

Research with the participation of students was reviewed and approved by the methodological council (approval No.17 \ 2023, dated March 20) of the educational institution on the basis of which the experiment was implemented. Participation in the survey took place on the condition of anonymity. Adult students took part in the survey, which did not require written consent to collect information from parents/guardians. Also, the ethical principles of the study required that a student could refuse to participate in the survey at any stage of the study.

IV. Results

The first stage involved developing the curriculum, implementing it, and using it as the basis for organizing students' learning over one semester. Details of the plan are provided in Table A1 in Appendix. The following factors were considered in developing and implementing the curriculum:

- The phased introduction and use of digital applications in the educational process;
- Implementation of student use in a manner that ensures the comprehensive development of professional and general competences, balancing professionalism and awareness in the future specialist;
- The characteristics of higher technical education, including students' learning approaches and their predominantly logical, algorithmic, and constructivist thinking;
- The need to use digital applications both for organizing instruction and for monitoring acquired theoretical and practical knowledge.

Students who consented to participate studied legal disciplines according to the proposed curriculum for four months. In the second phase, the results of using digital technologies in learning law by technical students were evaluated via a participant survey and statistical analysis of responses, enabling assessment of student attitudes toward

digital platforms and a generalized understanding of their effectiveness and prospects in higher technical education for studying legal disciplines (Fig. 1).

The data in Fig. 1 indicate meaningful differences in application ratings, suggesting varying levels of effectiveness for developing legal competence among technical students. Knewton, used for studying theoretical legal concepts, received the lowest rating (3.852), whereas LexisNexis, used to develop practical skills, received the highest (4.540).

The results indirectly suggest that applications fostering practical skills are perceived as more effective and convenient for developing legal competence. To test this hypothesis, the statistical significance of differences in responses was examined to confirm or refute variation in students' perceptions of digital applications. Accordingly, a one-factor repeated-measures ANOVA was conducted, and the results are reported in Table 2.

Table 2. Results of one-factor repeated-measures ANOVA

TOTAL						
Groups	***Score***	***Sum***	***Average***	***Dispersion***		
Knewton	28	107.849	3.852	0.009		
Casetext	28	124.690	4.453	0.277		
LexisNexis	28	127.111	4.540	0.500		
Variance analysis						
Source of variation	***SS***	***df***	***MS***	***F***	***P-Value***	***Partial η2***
Platform (Knewton, Casetext, LexisNexis	7.0863	2.000	3.932	15.002	<0.001	0.27
Error	21.228	250	0.085			
Total	29.091	252				

Table 3. Pairwise post-hoc comparisons of students' ratings for applications

Groups	**Mean difference (MD)**	**t (df=125)**	**p_adj**	**Cohen's dz**	**Statistical significance of differences (at $\alpha = 0.05$)**
Knewton vs Casetext	0.6015	−0.520	<0.001	(0.2749; 0.9282)	Yes
Knewton vs LexisNexis	0.6880	−6.14	<0.001	(0.3613; 1.0146)	Yes
Casetext vs LexisNexis	0.0864	−1.45	0.31	(−0.2402; 0.4131)	No

Note: pairwise comparisons following repeated-measures ANOVA with Holm-Bonferroni correction. Effect sizes are reported as Cohen's dz. Significant results at $\alpha = 0.05$ are shown in bold.

A repeated-measures ANOVA shoved a significant effect of evaluating different platforms on student' evaluations, $F(2.250) = 15.00$, $p < 0.001$, partial $\eta 2 = 0.27$. Post-hoc tests with Holm-Bonferoni correction indicated that Knewton was rated significantly lower than Casetext ($M = -0.60$, $p\_adj < 0.001$, dz = 0.46) and LexisNexis (M = -0.90, $p\_adj < 0.31$, $dz = 0.13$).

Pairwise comparisons with Holm-Bafferoni correction (Table 3) revealed that Knewton received significantly lower raitings than both Casetext and LexisNexis, while no significant difference was observed between Casetext and LexisNexis.

As shown in Table 3, post-hoc pairwise comparisons revealed that Knewton was rated significantly lower than Casetext ($MD = -0.69$, $p\_adj < 0.001$, $dz = 0.55$). In contrast, no significant difference was observed between Casetext and LexisNexis ($MD = -0.09$, $p\_adj = 0.31$, $dz = 0.13$). These findings indicate that, although Casetext and LexisNexis performed similarly, both were consistently evaluated more positively. However, this does not imply that Knewton is less effective for studying law in technical programs, as Knewton was used to learn theoretical foundations, which likely influenced satisfaction ratings. At the same time, Knewton remains effective for studying theoretical foundations.

V. Discussion

The conducted study indicates that, according to students' opinions, the use of the LexisNexis app is more effective for learning law. The differences in the ratings of the Casetext and LexisNexis applications are smaller than between these applications and Knewton, indicating that both applications are effective and provide approximately the same level of performance (above average −4.453 and 4.540 respectively) in developing legal competence. This can be explained by the fact that the Knewton application is aimed at familiarizing students with the theoretical side of legal disciplines and forming a basic, generalized understanding of legal concepts and norms. Although the difference between the ratings of the applications was small but statistically significant, it may not have a significant effect on the practical use of the applications.

Evaluating the applications in the context of their use for learning law as a discipline, the following conclusions were drawn. Casetext and LexisNexis assessed by students as significantly higher in learning the subject (4.937 and 4.939 respectively), developing professional skills (5.198 and 5.563 respectively), and enhancing existing knowledge and forming new knowledge (4.437 and 4.770 respectively) compared to Knewton (3.778; 3.825 and 3.913 respectively). Evaluating the applications based on their impact on the attitudes of students in technical fields towards studying legal disciplines, the following conclusion was reached. Casetext and LexisNexis rated by students as more motivating them to study (3.960 and 4.119 respectively) and contribute to creating comfortable conditions for studying the discipline (4.312 and 4.310 respectively). The use of Knewton resulted in slightly lower motivation scores among technical students studying law (3.746). The data obtained should still be considered in light of the purpose of using the application Knewton in this experiment. Theoretical study can somewhat reduce motivation, as it involves 'passive learning methods.' At the same time, practical performance of certain tasks is an active method that increases students' motivation to learn [29]. However, various methods, both theoretical and practical, are necessary in the learning process. It can be argued that students are less motivated to study theory, but this does not diminish the need to study it and the important functionality of the application itself. It is also worth noting

that a difference of less than 1 point on a 7-point scale does not mean lower effectiveness of using this application in the learning process.

The behavior indicator, particularly the overall engagement of students in studying law, ranges from 3.857 (Knewton) to 5.016 (LexisNexis). Such ratings can be explained by the fact that students, using the LexisNexis application, are fully immersed in the specifics of the legal case and work with real legal documents. Respondents reported a significant improvement in the course content when using the Casetext and LexisNexis applications (5.198 and 5.397 respectively), indicating that technical specialty students prefer studying real legal situations they may encounter in their professional activities rather than the theoretical legal concepts offered by Knewton. The indicators of student interaction with teachers and the availability of institutional support are assessed at almost the same level for each of the applications. The digital educational space, in general, allows students, teachers, and educational institutions to interact virtually without hindrance [30]. It is also worth considering the specific role of teachers in the learning process using digital applications, as this can also have a significant impact on their effectiveness [33, 39]. Also, for effective study of various disciplines it is important to use appropriate methods, approaches, and digital applications as also stated by Starkey *et al.* [32]. Considering the obtained results, it is worth discussing the lack of universality of all digital applications. In this context, teacher feedback and the frequency of instructional guidance operate as important moderating factors: the same platform may receive different evaluations depending on whether students receive regular, constructive feedback or are left to navigate the tool independently. Accordingly, ratings of Knewton, Casetext, or LexisNexis may reflect not only the inherent qualities of the applications but also the extent to which instructors provide direction and contextualize digital resources within the learning process. Interpreting the results and conclusions of our study, it is worth considering the moderate role of pedagogy in the process of teaching students with the use of technology. The usefulness of digital applications depends to a certain extent on how teachers integrate them into a constructive framework, structure tasks, and provide formative feedback to students. Effective feedback and timely assistance with specific questions about using the application or the learning material using the application contribute to the positive engagement of students in the learning process and the effective use of applications. On the other hand, insufficient use of applications in teaching can reduce their impact on the learning process and outcomes, even if the application itself is effective and powerful. It is also important how teachers model expertise and link the results of using certain applications to the criteria for assessing students' knowledge. This interpretation is consistent with the results of previous studies, which emphasise the importance of teacher digital competence and the quality of feedback for the effective use of technology in student learning [32, 39–41]. Conceptually, these results are consistent on the combination of capabilities of the applications and the pedagogical implementation of platform's capabilities, all of which influence the success of its use in the learning process.

The formation of the curriculum should include three components: the selection of effective applications, the exclusion of ineffective ones, and the adaptation of promising digital applications to the needs and capabilities of students in technical fields. The essence of technical and legal disciplines differs due to their discipline-specific culture, as described in the work of Pumptow and Brahm [42], Dutta *et al.* [43] using the example of differences between the humanities and the exact sciences. Accordingly, the success of integrating new curricula and models largely depends on the practice of adapting and balancing tasks and student capabilities [34].

The evaluation of the Casetext and LexisNexis applications indicates that for the modern student, the development of practical skills, particularly through access to global databases, plays a priority role over the theoretical component of the educational process. This continues Aguirre *et al.* [44] and Egelandsdal and Færstad [45] research on the importance of active methods in teaching the fundamentals of law using digital technologies. In the work of Bygstad *et al.* [46], it is stated that "digital technologies most effectively eliminate the boundaries of physical and institutional limits, allowing interaction with a broader society and its experiences." Rational use of digital applications in the learning process contributes to the qualitative assimilation of the basics of law by students of technical specialities and allows them to independently study the necessary information, which is particularly important in modern learning conditions [39]. As evidenced by previous studies comparing digital technologies for learning [43], ineffective organization of learning or irrational use of digital technologies can have negative consequences for learning, such as cognitive overload, reluctance to learn and failure to assimilate information. The data obtained continues to support research on the need to develop digital competence in students, taking into account their course of study and perception of digital competence [1, 47]. It is also worth considering the competence of educational staff in using specific applications for specific learning purposes, as this significantly affects the quality and results of learning using applications, as noted by Lin *et al.* [40] and Leeuw *et al.* [41]. The development of the practice of using digital tools in the study of law by students of technical specialities lies in the opportunities for high-quality assimilation of the necessary legal knowledge, which is relevant for students of all specialities. In future research, it is worth optimising the theoretical component of the use of digital tools during the educational process, specifying the time and purpose of using applications for students of certain specialities.

VI. Conclusion

The study shows a fairly positive assessment of the use of digital applications in the study of law by students of technical specialities. The Knewton application, which was more focused on studying the theoretical aspects of law, was rated lower by students than Casetext and LexisNexis, whose functionality is aimed at practical educational activities and the actual development of legal competence. Although students rated the app Knewton lower, in this study it was

used for theoretical study of the basics of law, while the other two apps had a more practical focus. Therefore, it is important to consider the purpose of using apps in the learning process. In addition, the actual learning outcomes, in particular the completion of test tasks or the assessment of students' theoretical knowledge, which could demonstrate the effectiveness of the Knewton application, were not investigated. These aspects require further research.

A. Practical Recommendations

There are many aspects to consider when using digital applications in the study of law by students enrolled in Technical specialties. These include the purpose of each digital application, the role of the teacher in the interaction between digital applications and students, and the interaction of different applications for different learning tasks.

Map course outcomes to platform affordances: use Knewton for pre-class theoretical micro-modules; Casetext for case analysis seminars; LexisNexis for document drafting labs.

Assessment alignment: theory quizzes in Knewton; rubric -based briefs in Casetext; contract-clause critique and compliance checklists in NexusLexis.

Faculty enablement: short workshops for instructors on search strategies (Casetext / LexusNexis) and adaptive assignment authoring (Knewton).

Equity and access: provide on-campus points and short "getting started" guides to mitigate technology refusal//unequal access.

Program-level integration: embed a capstone mini-project combining all three tools (see Module IV in Table A1 in Appendix).

B. Practical Significance of the Results

The possibility of using the results for further modernization of the educational process and harmonization of the technical and legal competencies of students in technical specialties. For the effective use of digital applications, it is important not only to choose a specific digital tool, but also to determine its purpose in the learning process (theoretical knowledge acquisition or practical task completion), cooperation between teachers and students (feedback from teachers on questions from students) regarding the use of this application, frequency of use, and individual preferences of students.

C. Limitations

The limitations of the study were, first, the educational characteristics of the Republic of Kazakhstan. Each country's higher education system has unique characteristics and may differ significantly from those of other countries. Similarly, the results and conclusions may not be fully applicable to universities in other countries. Second, the sample size of respondents. 126 students agreed to participate in the experiment, which is sufficient for a basic analysis but may not reflect the full range of opinions of a wider audience. The gender imbalance reflects enrollment patterns in the participating technical programs; generalizability to more gender-balanced cohorts may be limited. Thirdly, the selection of digital applications. The use of other tools during the experiment could have provided additional information about the effectiveness of technologies in the study of law by students of technical specialties. Ways of using the Knewton application could have had a direct impact on the results obtained, which should be taken into account when planning future studies. The data presented does not contain a qualitative analysis of the reasons for the lower ratings of the Knewton app by students. The student survey did not include open-ended questions that would help to understand the reasons for such ratings of the Knewton app. Hypothetically, the reason for the lower ratings of the Knewton platform could be a greater focus on studying theoretical tasks using it than the other two platforms (LexisNexis, Casetext) that we used in this study. The evaluation of the application may be influenced by excessive cognitive load, weaker consistency with the results of learning using the application, feedback, or the frequency of use of this application by teachers. This aspect is planned to be investigated in future studies, in particular to understand how students' perceptions and the characteristics of the application's design or its use affect the assessment of its usefulness in the learning process.

This study relies solely on self-report measures, which may be subject to social desirability or response biases. Future research should therefore incorporate more objective indicators, such as pre/posttests, case analysis scores or performance based assessments, to verify actual learning gains and strengthen the validity of the findings.

D. Suggestions for Further Research

In the long term, it is important to focus on improving the proposed curriculum, particularly the use of the Knewton app. It is necessary to conduct a survey among students, examine which aspects caused negative evaluations, assess the recommendations and expectations of students regarding the use of this application, and modernize the curriculum. It is also necessary to consider the possibility of scaling and specifying the proposed training plan for students of different specialties, not just technical ones.

Future studies could use more reliable research designs, such as balanced app usage sequences, cross-over experiments, and groups of students taught by different teachers. In addition, it is necessary to record the influence of the teacher on the use of certain applications, attitudes towards the use of these applications, and the timeliness of providing feedback on the specifics of using the applications (frequency and clarity of feedback), which will allow us to verify how teaching style affects the results of assessing the quality of application use. Such approaches will help to understand which platform students prefer and the conditions for using applications that will contribute to improving learning. It is also important to conduct other studies on students' individual preferences regarding the use of digital applications.

APPENDIX

Questionnaire for assessing the use of digital platforms for studying law by students of technical specialties

A. Section 1: Social and demographic questions

1) Your sex:

- male;
- female;

2) Which course are you studying

- 1st course;
- 2nd course;
- 3rd course;
- 4th course.

B. Section 2: Specific section

(rate the statements on a scale from 0 – completely disagree to 6 – completely agree)

Indicator 1: Learning Outcomes

LO1: The use of [the digital application] in the law course helped me get to know the subject well.

LO2: Using the [digital application] helped me to learn the subject of "law" (or "fundamentals of law").

LO3: The use of [the digital application] has improved my knowledge of the subject "law."

LO4: The use of [the digital application] has increased my level of knowledge in studying the subject of "law."

Indicator 2: Affective elements

AE1: The use of [the digital app] improved my attitude towards the subject.

AE2: Using the [digital application] helped me boost my confidence in legal knowledge.

AE3: The use of [the digital application] has increased my motivation to study the subject of "law."

AE4: The use of the [digital application] made learning the subject of "law" more enjoyable.

Indicator 3: Behavior

B1: The use of [the digital app] has increased my engagement/participation in studying law.

B2: The use of [the digital application] has enhanced my ability to reflect on my learning of the fundamentals of law.

B3: The use of [the digital application] has increased my overall engagement in the processes of learning the fundamentals of law.

Indicator 4: Design

D1: The use of [the digital application] improved the overall design of the learning process the subject "law."

D2: The use of [the digital application] has improved the content of my study of the subject "law."

D3: The use of [the digital application] improved the structure of the law course.

Indicator 5: Technology

T1: The use of the [digital application] was at a high technical level (effective management, the ability to study the material and to complete tasks).

T2: The functionality of the [digital application] helped me study the subject of "law."

T3: Using the [digital app] was easy for me.

T4: The use of the [digital application] was reliable (tasks can be completed in online and offline modes, clear tasks and mechanisms for their completion).

T5: Using the [digital application] was helpful for supporting my studies in law.

Indicator 6: Teaching/Pedagogy

TP1: The use of [the digital application] has improved my overall perception of the quality of law teaching.

TP2: The use of [the digital application] has improved the quality of teaching.

TP3: The use of [the digital application] improved the feedback process with the law teacher (checking completed tasks, communication, discussions, online recommendations, links).

Indicator 7: Presence/Community

PC1: The use of [the digital application] has strengthened my sense of connection with the teacher (the ability to complete and attach tasks at any time – receiving feedback, understanding assignment deadlines, creating and following a study plan, understanding knowledge requirements).

PC2: The use of [the digital app] enhanced my sense of presence in the learning process.

PC3: The use of [the digital app] increased the sense of connection with other students.

Indicator 8: Institutional Environment

IE1: During the use of [the digital application], there was good technical support.

IE2: The institutional support provided during the use of the [digital application] in the "Introduction to Law" course positively impacted my learning experience.

IE3: The educational institution supports the use of [digital application] for studying the subject "Introduction to Law" (optional, this question can be omitted).

Table A1. Curriculum for technical specialty students for one semester to study legal disciplines (using digital applications)

Tools	Goal	Educational tasks	Content of the educational module	Expected results
Module I: Introduction to the Law Study for Students of Technical Specialties *The Knewton application is used for testing students, determining their level of understanding of basic legal concepts and theories, and for interactive study of theoretical legal concepts.*				
Knewton	Familiarizing students with the basics of law and the importance of their understanding in technical activities.	1. Testing with using an application to determine the student's level of proficiency in basic legal categories; 2. Interactive introduction to basic theoretical concepts and principles of law.	1. The concept of law and legislative regulation of processes in technical fields of activity, the essence and role of legal responsibility; 2. Basics of labor and copyright law; 3. Basics of cybersecurity, information, and data protection.	Formation of basic legal competence, interpretation of key legal concepts in the context of the specifics of technical activities.
Module II: Practical Work – Analysis of Legal Situations in the Technical Field *The Casetext application is used to access real legal cases and conduct practical analysis of the legal position of each party.*				
Casetext	Skills development in applying theoretical legal knowledge in practical activities.	1. Analysis of court cases and decisions opened in the field of technical activities; 2. Modeling the process of reviewing a court case, designing legal conclusions (taking into account the specifics of proceedings related to technical activities).	1. Working with legal cases in the field of technical activities; 2. Analysis of legal documents in the field of contract regulation, intellectual property, copyright, liability for damages, non-fulfillment of obligations, etc.	Formation of legal competence in the use of legal norms in practical technical activities.
Module III: Practical Work – In-depth Professional Orientation Research on Legal Situations *The LexisNexis application is used for searching templates of legal documents (standard contracts in the IT field), analyzing legal risks described in contracts,*				

researching international regulations (in particular, the General Data Protection Regulation (GDPR), principles of fair use of copyrighted materials, etc.).				
LexisNexis	Development of skills for independent search and use of legal norms (other legal information), drafting legal documents.	1. In-depth practical work with regulatory documents; 2. Practical preparation for the formation of accompanying legal documents for technical projects; 3. Familiarization with the features of technical activities in the international market.	1. In-depth analysis of legal norms and concepts used to regulate processes in the field of technical activities; 2. Practical work with legal documents (drafting contracts); 3. Study of international standards, norms, and legal aspects, comparison with national ones, familiarization with the peculiarities of legal regulation of labor activities in international companies.	Develop legal competence and skill in integrating legal aspects into professional technical activities.
Module IV: Project Work – Integration of Legal Knowledge in the Implementation of Technical Projects, Analysis of Real Cases in the Field of Technology and Law The Casetext application is used to access real court cases for the purpose of modeling court processes by analogy and finding precedents. The LexisNexis application is used to search for regulations, court decisions, and documents related to corporate ethics in IT companies.				
Casetext, LexisNexis	Using the acquired knowledge to assess real legal situations and resolve conflicts in the field of technical activities	1. Study of a real legal case, group work (analyzing the essence of the conflict, the rights and obligations of the conflicting parties, forming arguments to defend the positions of the parties, preparing a report with an analysis of the potential court decision in the real case); 2. Modeling the judicial process; 3. Writing legal recommendations for IT companies	1. Analysis of court cases related to copyright violations of intellectual work results, information data, cybersecurity, non-compliance with good faith principles, and others; 2. Analysis of legal disputes involving large IT companies; 3. Ethical Aspects of Technical Work in IT Companies	Development of the skill of legal analysis, reasoned defense of one's position in a contentious situation, protection of the results of one's own intellectual activity.
Module V: Test *The Knewton application is used to assess the level of mastery of theoretical legal concepts and norms in technical work. The Casetext application is used to assess practical skills (knowledge control through the implementation of practical analysis of a real legal case). The LexisNexis application is used to assess practical skills in working with legal documents and analytical reports.*				
Knewton, Casetext, LexisNexis	Control and assessment of acquired knowledge	1. Theoretical and practical assignments using each of the digital applications in the context of comprehensive work on a legal case; 2. Preparation of legal documents; 3. Defense of the legal case based on the formed legal conclusion/analytical report on the work done.	1. Assessment of theoretical legal knowledge; 2. Implementation of practical work and assessment of practical skills; 3. Assessment of the legal competence of a future specialist in a technical field.	The ability to integrate legal knowledge into technical work, the development of analytical and critical thinking skills, legal competence in matters of organizing technical activities and protecting the results of intellectual activities.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

B.B. conceptualized the study and supervised the research process. K.V. collected and systematized the data. M.Y. performed the data analysis. N.T. contributed to the interpretation of the results and literature review. A.K. drafted the manuscript and coordinated revisions. All authors reviewed and approved the final version of the manuscript.

REFERENCES

[1] S. Zhao and J. Chen, "The influence of e-book teaching on the motivation and effectiveness of learning law by using data mining analysis," *J. Organ. End User Comput.*, vol. 34, no. 3, pp. 1–17, 2022. https://doi.org/10.4018/joeuc.295092

[2] X. Kang and W. Zhang, "An experimental case study on forum-based online teaching to improve student's engagement and motivation in higher education," *Interact. Learn. Environ*., vol. 31, no. 2, pp. 1029–1040, 2023. https://doi.org/10.1080/10494820.2020.1817758

[3] I. Kopotun, M. Durdynets, N. Teremtsova, L. Markina and L. Prisnyakova, "The use of smart technologies in the professional training of students of the law departments for the development of their critical thinking," *Int. J. Learn. Teach. Educ. Res.*, vol. 19, no. 3, pp. 174–187, 2020. https://doi.org/10.26803/ijlter.19.3.10

[4] A. Jeyaraj, Y. K. Dwivedi, and V. Venkatesh, "Intention in information systems adoption and use: Current state and research directions," *Int. J. Inf. Manage.*, vol. 73, 102680, 2023. https://doi.org/10.1016/j.ijinfomgt.2023.102680

[5] S. Harrington, "The ultimate study partner: Using a custom chatbot to optimize student studying during law school," *SSRN*, 2023. https://doi.org/10.2139/ssrn.4457287

[6] K. Martzoukou, P. Kostagiolas, C. Lavranos, T. Lauterbach, and C. Fulton, "A study of university law students' self-perceived digital competences," *J. Librariansh. Inf. Sci.*, vol. 54, no. 4, pp. 751–769, 2021. https://doi.org/10.1177/09610006211048004

[7] C. H. Liu *et al*., "How big data applications and digital learning change students' sustainable behaviours—the moderating roles of hard and soft skills," *Interact. Learn. Environ*., vol. 32, no. 10, pp. 6751–6773, 2023. https://doi.org/10.1080/10494820.2023.2282104

[8] A. R. VargasMurillo, R. F. Supo Hallasi, C. A. C. Quispe, and E. I. H. Perez, "The integration of digital technologies in legal education: A systematic review of trends and challenges," in *Proc. 4th IEEE Int. Conf. Adv. Learn. Technol. Educ. Res. (ICALTER)*, IEEE, 2024. https://doi.org/10.1109/ICALTER65499.2024.10819212

[9] B. Khamzina, N. Roza, G. Zhussupbekova, K. Shaizhanova, A. Aten and B. A. Meirkhanovna, "Determination of cyber security issues and awareness training for university students," *Int. J. Emerg. Technol. Learn.*, vol. 17, no. 18, pp. 177–190, 2022. https://doi.org/10.3991/ijet.v17i18.32193

[10] D. Sharma and S. Kumari, "Role of legal education in advancement of access to justice: A panormic insight," *Asian J. Legal Educ*., vol. 11, no. 2, pp. 141–149, 2024. https://doi.org/10.1177/23220058241253403

[11] S. Shen, H. Yang, and Q. Zhou, "Development of academic programs in the digital age: Practice from China," in *Handbook of Educational Reform Through Blended Learning*, M. Li, X. Han, and J. Cheng, Eds., Singapore: Springer, 2024. https://doi.org/10.1007/978-981-99-6269-3_3

[12] P. Zubaedah, R. Harliyanto, S. Situmeang, D. Siagian, and E. Septaria, "The legal implications of data privacy laws, cybersecurity regulations, and AI ethics in a digital society," *J. Acad. Sci*., vol. 1, no. 2, pp. 103–110, 2024.

[13] B. Williamson, "The social life of AI in education," *Int. J. Artif. Intell. Educ*., vol. 34, no. 1, pp. 97–104, 2024. https://doi.org/10.1007/s40593-023-00342-5

[14] J. Komljenovic *et al*., "Digitalised higher education: Key developments, questions, and concerns," *Discourse: Stud. Cult. Polit. Educ*., vol. 46, no. 2, pp. 276–292, 2024. https://doi.org/10.1080/01596306.2024.2408397

[15] L. Hakimi, R. Eynon and V. A. Murphy, "The ethics of using digital trace data in education: A thematic review of the research landscape," *Rev. Educ. Res.*, vol. 91, no. 5, pp. 671–717, 2021. https://doi.org/10.3102/00346543211020116

[16] M. Akour and M. Alenezi, "Higher education future in the era of digital transformation," *Educ. Sci.*, vol. 12, no. 11, 784, 2022.

https://doi.org/10.3390/educsci12110784
[17] J. Han, "Construction of practical teaching mode of law course based on multi-mode and low-resource language learning," *ACM Trans. Asian Low-Resour. Lang. Inf. Process.*, vol. 23, no. 6, p. 93, 2023. https://doi.org/10.1145/3622938
[18] T. Heart, E. Finklestein, and M. Cohen, "Insights from pre Covid-19 perceptions of law students on four learning methods: Implications for future design of blended learning," *Qual. Assur. Educ.*, vol. 30, no. 1, pp. 32–50, 2021. https://doi.org/10.1108/qae-12-2020-0169
[19] N. Koleini, T. Boroughani, Z. Eslami, and I. Xodabande, "Exploring the impacts of mobile-assisted learning on university students' technical vocabulary knowledge," *Int. J. Educ. Res. Open*, vol. 7, 100344, 2024. https://doi.org/10.1016/j.ijedro.2024.100344
[20] M. Li and X. Liu, "Enhancing humanities and social sciences curriculum in engineering institutions by using interdisciplinary approaches," *Cogent Educ*., vol. 12, no. 1, 2433831, 2025. https://doi.org/10.1080/2331186X.2024.2433831
[21] E. K. Faulconer, B. Wood, and J. C. Griffith, "Infusing humanities in STEM education: Student opinions of disciplinary connections in an introductory chemistry course," *J. Sci. Educ. Technol*., vol. 29, no. 3, pp. 340–345, 2020. https://doi.org/10.1007/s10956-020-09819-7
[22] K. Nilupu-Moreno, Y. Riega-Virú, E. Puga-Ayala, J. Salas-Riega, and Y. Lázaro-Ortiz, "Legaltech in legal education: A systematic review of the training of technological competencies," in *Proc. 4th IEEE Int. Conf. Adv. Learn. Technol. Educ. Res. (ICALTER)*, IEEE, 2024. https://doi.org/10.1109/ICALTER65499.2024.10819225
[23] T. Gkrimpizi, V. Peristeras and I. Magnisalis, "Classification of barriers to digital transformation in higher education institutions: Systematic literature review," *Educ. Sci.*, vol. 13, no. 7, 746, 2023. https://doi.org/10.3390/educsci13070746
[24] X. Hao, Z. Xu, M. Guo, Y. Hu, and F. Geng, "The effect of embedded structures on cognitive load for novice learners during block-based code comprehension," *Int. J. STEM Educ*., vol. 10, 2023. https://doi.org/10.1186/s40594-023-00432-9
[25] A. Nath, G. Chakravarty, and S. Barman, "Transforming legal education through experiential learning: Integrating intellectual property simulations and digital copyright case studies into the law school curriculum," *Asian J. Legal Educ.*, vol. 12, no. 2, pp. 198–215, 2025. https://doi.org/10.1177/23220058251334749
[26] N. Annuš, "Educational software and artificial intelligence: Students' experiences and innovative solutions," *Inf. Technol. Learn. Tools*, vol. 101, no. 3, pp. 200–226, 2024. https://doi.org/10.33407/itlt.v101i3.5479
[27] C.-M. Mirea, R. Bologa, A. Toma, A. Clim, D.-D. Plăcintă, and A. Bobocea, "Transforming learning with generative AI: From student perceptions to the design of an educational solution," *Appl. Sci.*, vol. 15, no. 10, 5785, 2025. https://doi.org/10.3390/app15105785
[28] Q. Hongdao, S. Bibi, A. Khan, L. Ardito, and M. B. Khaskheli, "Legal technologies in action: The future of the legal market in light of disruptive innovations," *Sustainability*, vol. 11, no. 4, 1015, 2019. https://doi.org/10.3390/su11041015
[29] T. Hongsuchon, I. M. M. E. Emary, T. Hariguna, and E. M. A. Qhal, "Assessing the impact of online-learning effectiveness and benefits in knowledge management, the antecedent of online-learning strategies and motivations: An empirical study," *Sustainability*, vol. 14, no. 5, 2570, 2022. https://doi.org/10.3390/su14052570
[30] H. Guo, F. Ma, and Z. Zhou, "Validation of technology acceptance model for virtual reality usage in collaborative learning to enhance learner performance," *Innov. Educ. Teach. Int.,* vol. 62, no. 2, pp. 429–443, 2025. https://doi.org/10.1080/14703297.2024.2307994
[31] M. A. Qureshi, A. Khaskheli, J. A. Qureshi, S. A. Raza, and S. Q. Yousufi, "Factors affecting students' learning performance through collaborative learning and engagement," *Interact. Learn. Environ*., vol. 31, no. 4, pp. 2371–2391, 2021. https://doi.org/10.1080/10494820.2021.1884886
[32] L. Starkey *et al.*, "Each discipline is different: Teacher capabilities for future-focussed digitally infused undergraduate programmes," *Educ. Technol. Res. Dev*., vol. 71, no. 1, pp. 117–136, 2023. https://doi.org/10.1007/s11423-023-10196-2
[33] K. L. Dona, J. Gregory, and E. Pechenkina, "Lecture-recording technology in higher education: Exploring lecturer and student views across the disciplines," *Australas. J. Educ. Technol*., vol. 33, no. 4, pp. 122–133, 2017. https://doi.org/10.14742/ajet.3068
[34] A. Hridoy, T. Rahman, A. I. Rashique, and M. M. Khan, "First enriched legal database in Bangladesh with efficient search optimization and data visualization for law students and lawyers," in *Proc. IEEE World AI IoT Congr. (AIIoT)*. IEEE, 2021, pp. 468–473. https://doi.org/10.1109/AIIoT52608.2021.9454220
[35] Knewton (Wiley). Knewton adaptive learning platform. *Computer Software*. [Online]. Available: https://www.knewton.com
[36] Casetext (Casetext Inc.). Casetext legal research platform. *Computer Software*. [Online]. Available: https://www.casetext.com
[37] LexisNexis (Reed Elsevier Properties Inc.). LexisNexis legal research platform. *Computer Software.* [Online]. Available: https://www.lexisnexis.com
[38] J. W. M. Lai, J. De Nobile, M. Bower, and Y. Breyer, "Comprehensive evaluation of the use of technology in education—validation with a cohort of global open online learners," *Educ. Inf. Technol*., vol. 27, no. 7, pp. 9877–9911, 2022. https://doi.org/10.1007/s10639-022-10986-w
[39] I. Diachenko, O. Kuznetsova, I. Ivanenko, B. Khamzina, and G. Kaltayeva, "Effective practices for increasing student's learning efficiency during the pandemic," *Int. J. Educ. Pract.*, vol. 12, no. 1, pp. 26–37, 2024. https://doi.org/10.18488/61.v12i1.3554
[40] R. Lin, J. Yang, F. Jiang, and J. Li, "Does teacher's data literacy and digital teaching competence influence empowering students in the classroom? Evidence from China," *Educ. Inf. Technol.*, vol. 28, no. 3, pp. 2845–2867, 2023. https://doi.org/10.1007/s10639-022-11274-3
[41] R. A. de Leeuw *et al.*, "Influencing factors in the implementation of postgraduate medical e-learning: A thematic analysis," *BMC Med. Educ*., vol. 19, 300, 2019. https://doi.org/10.1186/s12909-019-1720-x
[42] M. Pumptow and T. Brahm, "Higher education students differ in their technology use," *Comput. Educ. Open*, vol. 5, 100149, 2023. https://doi.org/10.1016/j.caeo.2023.100149
[43] R. Dutta, A. Mantri, and G. Singh, "Evaluating system usability of mobile augmented reality application for teaching Karnaugh-maps," *Smart Learn. Environ.*, vol. 9, p. 6, 2022. https://doi.org/10.1186/s40561-022-00189-8
[44] S. Aguirre, E. Iguasnia, H. Córdova, and G. Vera, "Problem-based learning in the area of law: Systematic review," *Migr. Lett.*, vol. 20, no. S5, pp. 1241–1248, 2023. https://doi.org/10.59670/ml.v20is5.4728
[45] K. Egelandsdal and J. Færstad, "Student-active lectures in legal education," *Law Teach.*, vol. 58, no. 2, pp. 217–233, 2024. https://doi.org/10.1080/03069400.2024.2335033
[46] B. Bygstad, E. Øvrelid, S. Ludvigsen, and M. Dæhlen, "From dual digitalization to digital learning space: Exploring the digital transformation of higher education," *Comput. Educ*., vol. 182, 104463, 2022. https://doi.org/10.1016/j.compedu.2022.104463
[47] Y. Zhao, M. C. Sánchez Gómez, A. M. Pinto Llorente, and L. Zhao, "Digital competence in higher education: Students' perception and personal factors," *Sustainability*, vol. 13, no. 21, 12184, 2021. https://doi.org/10.3390/su132112184