

AUDIT 2026, 2 (52), səh. 82-95.

AUDIT 2026, 2 (52), pp. 82-95.

АУДИТ 2026, 2 (52), стр. 82-95.



<https://doi.org/10.30546/2707-2037.052.2.2026.1048>

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JEL: L81; M31; M53; O33

UDC: 339.1:004.8

A CONCEPTUAL FRAMEWORK FOR AI-PERSONALIZED E-COMMERCE SKILLS DEVELOPMENT TO STRENGTHEN DIGITAL BUSINESS RELATIONS

A B S T R A C T

The purpose of the research – this article develops a conceptual framework explaining how AI-personalized learning can build relationship-critical e-commerce competencies and thereby strengthen digital business relations. It addresses the gap in the literature, where AI-enabled adaptive learning systems, e-commerce competency taxonomies, and relationship digital trust constructs are usually examined separately rather than within one integrated causal model.

The methodology of the research – the study is based on a conceptual and theoretical synthesis of adaptive learning theory, capability-based reasoning, and relationship marketing. On this basis, three core constructs are defined as AI-personalized learning, relational e-commerce skills, and digital business relationship quality. In addition to that the mechanisms connecting them are specified. The model also incorporates contextual factors such as digital literacy, experience, and interaction context, and proposes an operationalization roadmap for later empirical validation through objective competency tests, scenario-based performance rubrics, and learning analytics.

The practical importance of the research – the framework provides value for researchers, educators, and e-commerce practitioners by offering a basis for designing adaptive learning interventions that explicitly develop trust-building, communication quality, and

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service recovery capabilities in digital commerce. It is especially relevant for future multi-site validation and application in contexts such as Azerbaijan and Uzbekistan.

The results of the research – the study proposes that AI-personalized learning improves digital business relationship quality indirectly through the development of relational e-commerce skills. In this framework, relational e-commerce skills function as a full mediator, while contextual factors influence the strength of these relationships. Four propositions are formulated and made ready for empirical testing in future studies.

The originality and scientific novelty of the research – the paper makes an original contribution by integrating adaptive learning, e-commerce competency development, and relationship marketing into a single conceptual model. It advances the literature by clarifying the mediating role of relational e-commerce skills and by presenting a structured roadmap for empirical testing of the framework in different national settings.

Keywords: AI-personalized learning, adaptive LMS, e-commerce skills, relationship capability, digital trust, communication quality, service recovery.

INTRODUCTION

Electronic commerce has become a structural element of the global digital economy. Over the past two decades, digital platforms, marketplaces, and online services have fundamentally transformed interactions among companies, suppliers, and consumers, eliminating geographical barriers and reshaping traditional value chains. At the same time, the expanding scale of digital trade has exposed a deep-seated contradiction. “The pace of technological platform development significantly outstrips the rate at which professionals develop the competencies required for effective participation in digital business interactions.”

Literature review. Relationship marketing theory demonstrates that the sustainability of business interactions is determined not so much by the technological parameters of transactions as by the quality of interpersonal and interorganizational connections. It has been argued that trust and commitment serve as central mediators between the perceived benefits of relationships and their long-term behavioral outcomes [9, s.20-38]. A meta-analysis of 38 studies confirmed that the relational competencies of interaction participants are more reliable predictors of partner satisfaction than the technical characteristics of a product or service [12, s.136-153].

In the digital environment, the importance of relational factors increases. In online interactions, the absence of direct personal contact makes trust a critical condition for successful transactions [7, s.51-90]. A study based on a sample of 321 companies established that the quality of AI-powered services on e-commerce platforms significantly affects partner loyalty and engagement, with trust acting as a moderator of this relationship [13, s.1483-1522].

Despite growing recognition of the role of relational factors, educational programs in e-commerce continue to focus predominantly on technical competencies. As a result, professionals frequently possess strong technical knowledge yet experience persistent difficulties in building trustworthy and long-term partnerships online. This gap is particularly acute in light of World Economic Forum data indicating that six in 10 workers will require training before 2027 [22].

One promising avenue for modernizing professional educational programs is the application of artificial intelligence to personalize learning. A systematic review of 78 articles documented a rapid transition to sophisticated models integrating machine learning, natural

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language processing, and intelligent tutoring systems [3, s.355-367]. That same review noted, however, that the application of AI personalization in professional workplace contexts remains considerably less researched.

Problem statement. A systematic analysis of the literature across three relevant research streams like AI-personalized learning, e-commerce competencies, and digital business relations reveals a structural theoretical gap. “Despite the active and independent development of each stream, the existing academic literature contains virtually no conceptual models integrating all three constructs within a unified causal framework”.

In support of this claim we operated a targeted search of academic databases using the keywords "AI-personalized learning" AND "e-commerce skills" AND "digital business relations", and did not identify studies that simultaneously operationalize all three constructs within a single unified theoretical model, within the defined search scope.

This gap has both theoretical and practical dimensions. Theoretically, the mechanism through which educational interventions translate into the quality of business relations remains unconceptualized. Practically, it deprives organizations of a theoretical foundation for designing AI-supported professional development programs explicitly oriented toward relational outcomes.

Adjacent studies approach this gap without filling it. AI algorithms can identify individual competency gaps, yet relational skills are not treated as a distinct category [6, s.199-229]. A study of 367 companies links organizational AI competencies to business relationship outcomes but does not examine the mechanism of educational interventions [2, s.39-47]. Another study examines AI applications in customer relationship management but remains confined to CRM discourse [11, s.195-210]. Accordingly, the present study occupies a distinct position at the intersection of these three streams.

Theoretical foundations. To provide a theoretical foundation for the problem under investigation, this study integrates three established research domains through a capability-based lens that treats professional skills as strategic, relationship-enabling capabilities.

The capability-based view argues that firms achieve sustained advantage by developing valuable, rare, inimitable, and well-organized resources and capabilities [1, s.99-120]. In digital commerce, many critical resources are intangible and skill-based. The ability to communicate credibly online, manage interdependence with partners, and recover service failures becomes a relationship capability that supports long-term cooperation. Dynamic capability theory further emphasizes that such capabilities must be continuously renewed to match fast-changing digital platforms and customer expectations [17, s.509-533; 5, s.1105-1121]. In our framework, relational e-commerce skills represent the microfoundations of relationship capability. These observable behaviors can be developed and strengthened through targeted, adaptive training.

Adaptive learning theory and AI in education provide the conceptual toolkit for explaining how educational pathways can be personalized in a scalable manner. AI-personalized learning relies on personalization inputs like diagnostics, learner profiles, and behavioral traces, and personalization outputs like content sequencing, adaptive task difficulty, and feedback tailored to an individual’s learning gaps and professional context [4, s.3-48; 18, s.118-130]. For e-commerce skills, scenario-based tasks and adaptive feedback are especially relevant because they support transfer from classroom knowledge to relationship-critical behavior in real digital interactions [10, s.146-154].

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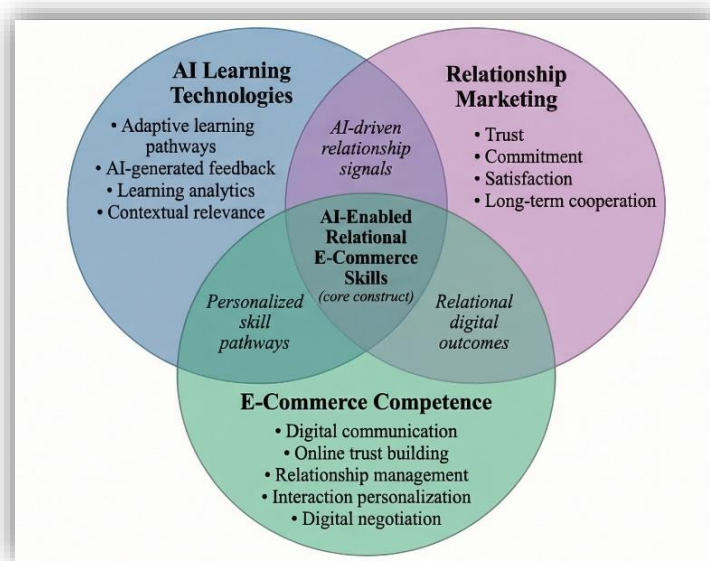
E-commerce competence theory provides the classificatory basis for systematizing professional skills in digital commerce. Beyond instrumental platform skills, relationship-critical competencies include digital communication, trust-building, negotiation, and service recovery in online environments where uncertainty and information asymmetry are high [15, s.726-743]. For baseline digital competence, we align with DigComp 2.2 [19], while extending it by emphasizing how competencies translate into relationship capability through repeated, context-specific practice and feedback.

Relationship marketing theory provides constructs for explaining why digital business relations endure. Trust and commitment are central determinants of relationship quality and long-term cooperation [9, s.20-38; 12, s.136-153]. However, digital relationships are also shaped by communication quality and how partners handle service failures and complaints. Service recovery and perceived fairness after failures can either restore or damage trust, making recovery capability a key relational competence in e-commerce [16, s.60-76; 14, s.356-372].

The intersection of these domains is summarized in Figure 1.

Figure 1.

Interdisciplinary Framework for Relational E-Commerce Skills Development



As shown in Figure 1, each of the three directions constitutes a well-established and independently developed field of knowledge. At the same time, their intersection represents an underexplored yet promising area of scholarly synthesis. The interdisciplinary framework performs a dual function. It substantiates the relevance of the research and defines the structure of the conceptual model.

Research questions. The aim of the present study is to develop and theoretically substantiate a conceptual model describing the mechanisms through which AI-personalized learning influences the development of relational e-commerce skills and the subsequent improvement of digital business relationship quality.

In accordance with this aim and the identified theoretical gap, the following research questions are formulated below:

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RQ1: Which e-commerce skills are most critically important for the formation and maintenance of digital business relations, and through what mechanism do they influence the quality of business interactions?

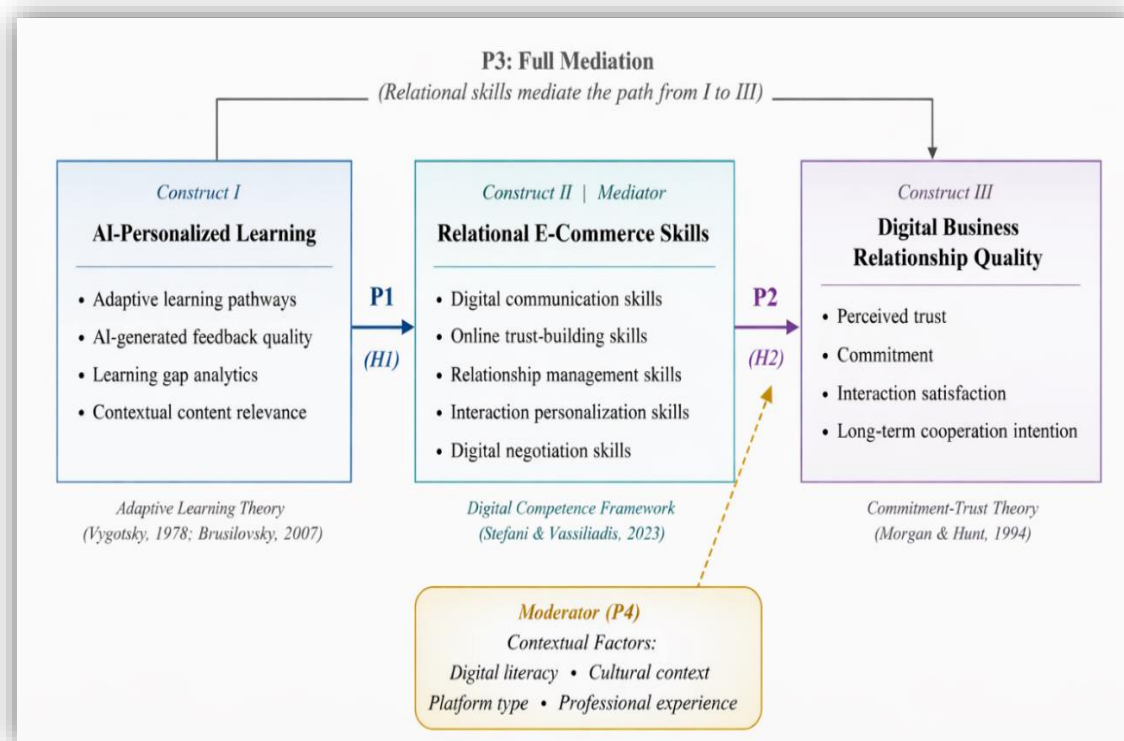
RQ2: In what ways does AI-personalized learning contribute to the development of relational skills among e-commerce professionals?

RQ3: Through what mechanisms does the development of relational professional competencies translate into measurable improvements in digital business relationship quality?

Answers to these questions constitute the system of formal propositions presented in “Conceptual model”.

Conceptual model. The conceptual model is developed on the basis of the interdisciplinary framework presented in “**Theoretical foundations**” and specifies the causal mechanisms within the convergence area of the three scholarly directions. The model is constructed along the logic of mediation analysis and comprises three primary constructs linked by two causal paths. The input construct - AI-personalized learning influences the outcome construct - digital business relationship quality exclusively through relational e-commerce skills which is the mediator. The conceptual model is presented in Figure 2.

Figure 2.
Conceptual Model of AI-Personalized E-Commerce Skills Development and Digital Business Relationship Quality



Note. P1-P4 = Propositions 1-4. Solid arrows indicate hypothesized causal paths. The dashed arrow indicates the moderating effect (P4) on path P2. The arc above indicates full mediation (P3). Theoretical anchors are shown in italics below each construct block.

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Construct I: AI-Personalized Learning. AI-personalized learning is an educational system that employs machine learning and data analytics algorithms to dynamically adapt educational trajectories, content, complexity, and feedback mechanisms to the individual characteristics, needs, and professional context of each learner, with the aim of maximizing competency outcomes.

This construct is operationalized through four interrelated dimensions. The first one is so called “adaptivity of educational trajectories” and draws on the concept of the Zone of Proximal Development [20, s.84-91; 4, s.3-48]. The second is so called “quality of AI-generated feedback” [18, s.118-130]. The third is so called “learning gap analytics”, enabling proactive identification of competency deficits [6, s.199-229]. The fourth is so called “contextual relevance of content”, ensuring correspondence to the learner's professional context [10, s.146-154].

Construct II: Relational E-Commerce Skills. Relational e-commerce skills are the set of professional competencies enabling an e-commerce specialist to effectively initiate, develop, and sustain trustworthy, mutually beneficial, and long-term business relations with partners and clients in the digital environment in the absence of direct personal contact.

This construct performs the function of mediator and constitutes a new theoretical contribution of the present study. Its composition was determined on the basis of a synthesis of the e-commerce competence classification [15, s.726-743], research on digital trust [7, s.51-90], empirical work on B2B interactions [13, s.1483-1522], and AI in CRM research [11, s.195-210]. Five skill groups are identified:

- digital communication;
- online trust-building;
- relationship management;
- interaction personalization;
- digital negotiation.

Construct III: Digital Business Relationship Quality. Digital business relationship quality is a multidimensional construct reflecting the perceived value, sustainability, and mutual orientation toward long-term collaboration among participants in interactions conducted predominantly in the digital environment, operationalized through four dimensions:

- perceived trust;
- commitment;
- interaction satisfaction;
- long-term cooperation intention.

This definition synthesizes classical relationship marketing theory [9, s.20-38; 12, s.136-153] with the findings of contemporary empirical research in the B2B e-commerce context [13, s.1483-1522]. Perceived trust reflects a participant's conviction regarding the competence and goodwill of the partner under conditions of digital uncertainty [7, s.51-90].

Causal Paths of the Model. The model specifies two causal paths. The first path proposes that AI-personalized learning positively influences relational skills development through three mechanisms as adaptive scenario-based learning facilitates context-specific skill

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transfer to real professional settings [6, s.199-229], personalized feedback enables targeted correction of competency deficits, consistent with the Zone of Proximal Development principle [20, s.84-91], and learning gap analytics support proactive identification of relational competency deficits. Empirical evidence confirms that AI-personalized platforms significantly outperform traditional training formats on skill acquisition outcomes. However, poorly designed AI learning may stimulate cognitive offloading at the expense of genuine skill acquisition [8, s.67-78].

The second path proposes that relational skills positively influence digital business relationship quality through a competence signaling mechanism. In digital environments where partners lack the opportunity to directly observe one another, a specialist's professional behavior serves as an observable signal of reliability. Digital communication and trust-building skills reduce perceived interaction risk. Relationship management and personalization skills foster a sense of relational value. Digital negotiation competence produces mutually beneficial transaction outcomes [9, s.20-38; 7, s.51-90].

Formal Propositions. On the basis of the theoretical analysis, four propositions are formulated for empirical testing in future research.

Table 1.

Formal Proposotions for future research

P1	<i>AI-personalized learning is positively associated with the level of relational e-commerce skills development. The higher the adaptivity of educational trajectories, the quality of feedback, the accuracy of gap analytics, and the contextual relevance of content, the higher the level of relational competencies developed by the specialist.</i>
P2	<i>Relational e-commerce skills are positively associated with digital business relationship quality. Higher levels of digital communication skills, online trust-building, relationship management, interaction personalization, and digital negotiation predict higher scores on trust, commitment, satisfaction, and long-term cooperation intention.</i>
P3	<i>Relational e-commerce skills fully mediate the relationship between AI-personalized learning and digital business relationship quality. The influence of the educational system on relational outcomes is realized through the development of professional competencies, rather than directly through the technology.</i>
P4	<i>The relationship between relational skills and digital business relationship quality is moderated by contextual factors. Specifically, the specialist's level of digital literacy, the cultural context of interaction, platform type, and professional experience such that higher values of the moderator strengthen this relationship.</i>

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Alternative Explanations. To make the model more understandable, we propose alternative explanations below.

Alternative 1. Is it sufficient to develop only technical skills? Technical competencies do not directly produce trust and commitment between business partners [12, s.136-153]. The present model focuses on the relational dimension, which is systematically undervalued in existing educational programs.

Alternative 2. Why AI personalization rather than standard training? Empirical research with 300 students demonstrates that AI-personalized platforms significantly outperform traditional training formats on academic performance, engagement, and satisfaction. Nevertheless, poorly designed AI learning may stimulate cognitive offloading [8, s.67-78].

Alternative 3. Are organizational factors not more important than individual competencies? The present model does not compete with organizational-level analysis but complements it by focusing on the individual level. The specific specialist's competence is treated as the mechanism through which organizational potential is realized [2, 2.167-175].

Theoretical Contributions. First, the model introduces a new construct as “relational e-commerce skills” - a distinct category of professional competencies. This construct bridges the conceptual gap between digital competence research [15, s.726-743] and relationship marketing theory [9, s.20-38].

Second, the model establishes a mediation mechanism linking educational technologies to business relationship outcomes through the development of professional competencies, thereby extending adaptive learning theory [18, s.118-130; 4, s.3-48].

Third, the model integrates relationship marketing theory with research in educational technology, opening a new direction for empirical investigation and providing a theoretical foundation for the development of AI-supported educational programs explicitly oriented toward relational outcomes.

C O N C L U S I O N

This article developed an integrated conceptual framework explaining how AI-personalized learning can strengthen digital business relations by building relationship-critical e-commerce competencies. Drawing on the capability-based view and dynamic capabilities, we position relational e-commerce skills as microfoundations of relationship capability in digital markets, where information asymmetry and limited face-to-face contact make trust formation, communication quality, negotiation behavior, and service recovery decisive for relationship continuity. We further specify how AI-personalized learning through adaptive learning trajectories, targeted feedback, and learning-gap analytics can accelerate the acquisition of these competencies at scale.

The model makes three main contributions. First, it synthesizes adaptive learning theory, e-commerce competency development, and relationship marketing into a single causal

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mechanism in which relational e-commerce skills fully mediate the effect of AI-personalized learning on digital business relationship quality. Second, it provides four formal propositions that are ready for empirical testing and offers alternative explanations that clarify why personalization and relational competencies matter beyond purely technical training. Third, the article provides an operationalization roadmap for future validation using objective competency tests, scenario-based performance rubrics, and learning analytics extracted from an adaptive LMS.

Future research should implement the proposed framework in multi-site settings and compare adaptive versus non-adaptive learning pathways across learner profiles and interaction contexts. Such studies can refine the measurement of relational skills, test boundary conditions, and quantify how improvements in service recovery and communication translate into durable trust and cooperation intention. Overall, the framework offers a theoretically grounded basis for designing AI-supported professional development that targets relationship outcomes as a core performance dimension in e-commerce.

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RƏQƏMSAL BİZNES MÜNASİBƏTLƏRİNİN GÜCLƏNDİRİLMƏSİ ÜÇÜN SÜNİ İNTELLEKTƏ ƏSASLANAN FƏRDİLƏŞDİRİLMİŞ ÖYRƏNMƏ VASİTƏSİLƏ ELEKTRON TİCARƏT BACARIQLARININ İNKİŞAFININ KONSEPTUAL ÇƏRÇİVƏSİ

X Ü L A S Ə

Tədqiqatın məqsədi – məqalədə süni intellektə əsaslanan fərdiləşdirilmiş öyrənmənin münasibətlərin qurulması baxımından mühüm elektron ticarət kompetensiyalarını necə formalaşdırdığını və bununla da rəqəmsal biznes münasibətlərini necə gücləndirdiyini izah edən konseptual çərçivə hazırlanmışdır. Tədqiqat ədəbiyyatda mövcud olan boşluğu aradan qaldırmağa yönəlmişdir. Belə ki, süni intellektlə dəstəklənən adaptiv öyrənmə sistemləri, elektron ticarət kompetensiyalarının təsnifatları və münasibətlərdə rəqəmsal etimad konstruktları, bir qayda olaraq, vahid integrasiya olunmuş səbəb-nəticə modeli çərçivəsində deyil, ayrı-ayrılıqda tədqiq edilir.

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Tədqiqatın metodologiyası – tədqiqat adaptiv öyrənmə nəzəriyyəsi, kompetensiyalara əsaslanan yanaşma və münasibətlər marketinqinin konseptual və nəzəri sintezinə əsaslanır. Bu əsasda üç əsas konstrukt – süni intellektə əsaslanan fərdiləşdirilmiş öyrənmə, münasibətlərin qurulmasına yönəlmiş elektron ticarət bacarıqları və rəqəmsal biznes münasibətlərinin keyfiyyəti müəyyən edilmişdir. Bundan əlavə, bu konstruktlar arasında əlaqəni təmin edən mexanizmlər konkretləşdirilmişdir. Modeldə, həmçinin rəqəmsal savadlılıq, təcrübə və qarşılıqlı əlaqə konteksti kimi kontekstual amillər nəzərə alınmış, gələcək empirik yoxlama üçün obyektiv kompetensiya testləri, ssenari əsaslı fəaliyyət qiymətləndirmə meyarları və öyrənmə analitikası vasitəsilə əməliyyatlaşdırma yol xəritəsi təklif edilmişdir.

Tədqiqatın tətbiqi əhəmiyyəti – təklif olunan konseptual çərçivə tədqiqatçılar, təhsil işçiləri və elektron ticarət sahəsində fəaliyyət göstərən praktiklər üçün əhəmiyyət kəsb edir. Çərçivə rəqəmsal ticarət mühitində etimadın formalaşdırılması, kommunikasiya keyfiyyətinin yüksəldilməsi və xidmətin bərpası üzrə bacarıqların məqsədyönlü şəkildə inkişaf etdirilməsini təmin edən adaptiv öyrənmə müdaxilələrinin hazırlanması üçün əsas yaradır. Bu yanaşma, xüsusilə Azərbaycan və Özbəkistan kimi müxtəlif məkanlarda gələcəkdə çoxsaylı tədqiqat məntəqələrini əhatə edən empirik yoxlama və tətbiq baxımından aktualdır.

Tədqiqatın nəticələri – tədqiqatda irəli sürülür ki, süni intellektə əsaslanan fərdiləşdirilmiş öyrənmə münasibətlərin qurulmasına yönəlmiş elektron ticarət bacarıqlarının inkişafı vasitəsilə rəqəmsal biznes münasibətlərinin keyfiyyətini dolayısı yolla yüksəldir. Təklif olunan çərçivədə münasibətlərin qurulmasına yönəlmiş elektron ticarət bacarıqları tam vasitəçi rolunu oynayır, kontekstual amillər isə bu əlaqələrin gücünə təsir göstərir. Gələcək tədqiqatlarda empirik yoxlama üçün dörd müddəə irəli sürülmüşdür.

Tədqiqatın orijinallığı və elmi yeniliyi – məqalə adaptiv öyrənmə, elektron ticarət kompetensiyalarının inkişafı və münasibətlər marketinqini vahid konseptual modeldə inteqrasiya etməklə orijinal elmi töhfə verir. Tədqiqat münasibətlərin qurulmasına yönəlmiş elektron ticarət bacarıqlarının vasitəçi rolunu aydınlaşdırmaqla mövcud elmi ədəbiyyatı inkişaf etdirir və konseptual çərçivənin müxtəlif milli kontekstlərdə empirik yoxlanılması üçün strukturlaşdırılmış yol xəritəsi təqdim edir.

Açar sözlər: süni intellektə əsaslanan fərdiləşdirilmiş öyrənmə, adaptiv LMS, elektron ticarət bacarıqları, münasibətlərin qurulması üzrə kompetensiya, rəqəmsal etimad, kommunikasiya keyfiyyəti, xidmətin bərpası.

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АУДИТ 2026, 2 (52), стр. 82-95.

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КОНЦЕПТУАЛЬНАЯ ОСНОВА РАЗВИТИЯ НАВЫКОВ ЭЛЕКТРОННОЙ КОММЕРЦИИ НА ОСНОВЕ ПЕРСОНАЛИЗИРОВАННОГО ОБУЧЕНИЯ С ИСПОЛЬЗОВАНИЕМ ИИ ДЛЯ УКРЕПЛЕНИЯ ЦИФРОВЫХ БИЗНЕС- ОТНОШЕНИЙ

Р Е З Ю М Е

Цель исследования – данная статья разрабатывает концептуальную основу, объясняющую, каким образом персонализированное обучение с использованием искусственного интеллекта может формировать критически важные для отношений компетенции в сфере электронной коммерции и тем самым укреплять цифровые бизнес-отношения. Исследование восполняет пробел в литературе, где адаптивные обучающие системы на основе ИИ, таксономии компетенций электронной коммерции и конструкты цифрового доверия в отношениях, как правило, рассматриваются отдельно, а не в рамках единой интегрированной причинно-следственной модели.

Методология исследования – исследование основано на концептуальном и теоретическом синтезе теории адаптивного обучения, подхода, основанного на способностях,

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АУДИТ 2026, 2 (52), стр. 82-95.

и маркетинга отношений. На этой основе определены три ключевые конструкта: персонализированное обучение с использованием ИИ, реляционные навыки электронной коммерции и качество цифровых бизнес-отношений. Кроме того, конкретизированы механизмы, связывающие их между собой. Модель также учитывает контекстуальные факторы, такие как цифровая грамотность, опыт и контекст взаимодействия, и предлагает дорожную карту операционализации для последующей эмпирической проверки с использованием объективных тестов компетенций, сценарных рубрик оценки результатов деятельности и аналитики обучения.

Практическая значимость исследования – предложенная основа представляет ценность для исследователей, преподавателей и практиков электронной коммерции, поскольку дает базу для проектирования адаптивных обучающих интервенций, целенаправленно развивающих навыки формирования доверия, качества коммуникации и восстановления сервиса в цифровой коммерции. Она особенно актуальна для будущей многосторонней валидации и применения в таких контекстах, как Азербайджан и Узбекистан.

Результаты исследования – в исследовании выдвигается положение о том, что персонализированное обучение с использованием ИИ косвенно повышает качество цифровых бизнес-отношений через развитие реляционных навыков электронной коммерции. В данной модели реляционные навыки электронной коммерции выступают в роли полного медиатора, тогда как контекстуальные факторы влияют на силу этих взаимосвязей. Сформулированы четыре положения, подготовленные для эмпирической проверки в будущих исследованиях.

Оригинальность и научная новизна исследования – статья вносит оригинальный вклад, объединяя адаптивное обучение, развитие компетенций электронной коммерции и маркетинг отношений в единую концептуальную модель. Она развивает существующую литературу, уточняя медирующую роль реляционных навыков электронной коммерции и предлагая структурированную дорожную карту для эмпирической проверки данной модели в различных национальных условиях.

Ключевые слова: персонализированное обучение с использованием ИИ, адаптивная LMS, навыки электронной коммерции, способность к выстраиванию отношений, цифровое доверие, качество коммуникации, восстановление сервиса.

Məqalə redaksiyaya daxil olmuşdur:
03.03.2026
Təkrar işlənməyə göndərilmişdir:
17.04.2026
Çapa qəbul olunmuşdur: 20.05.2026

Дата поступления статьи в редакцию: 03.03.2026
Отправлено на повторную обработку: 17.04.2026
Принято к печати: 20.05.2026

The date of the admission of the article to the editorial office: 03.03.2026
Send for reprocessing: 17.04.2026
Accepted for publication: 20.05.2026