

A photograph of the Toronto skyline, featuring the CN Tower and various skyscrapers, viewed from across the water. The image is partially covered by a green semi-transparent rectangle.

*XVIII international scientific conference
Toronto. Canada
06-07.01.2026*

QUESTIONS. HYPOTHESES. ANSWERS: SCIENCE XXI CENTURY

*Proceedings of the XVIII international
Scientific and Practical Conference*

6-7 January 2026

TORONTO. CANADA

2026

UDC 001.1

BBC 1

XVIII International Scientific and Practical Conference «Questions. hypotheses. answers: science XXI century», January 7-8, 2026, Toronto. Canada. 73 p.

ISBN 978-91-65424-54-8

DOI <https://doi.org/10.5281/zenodo.18201393>

Publisher: «SC. Scientific conferences»

Main organization: 

Editor: Hans Muller

Layout: Ellen Schwimmer

The conference materials are in the public domain under the CC BY-NC 4.0 International license.

The publisher is not responsible for the materials published in the collection. All materials are provided in the author's edition and express the personal position of the participant of the conference.

The sample of the citation for publication is Gugin Aleksandr, Lisnievska Yuliia ANTI-ADVERTISING IN THE HOTEL BUSINESS // XVIII International Scientific and Practical Conference «Questions. hypotheses. answers: science XXI century », January 7-8, 2026, Toronto. Canada. Pp.9-11, URL: <https://sconferences.com>

Contact information

Website: <https://sconferences.com>

E-mail: info@sconferences.com

Content

Economic sciences

Okila Odinaevna Safarova, Zebo Saidova INCREASING THE RELIABILITY OF CONSTRUCTION COST ESTIMATES BASED ON UPDATED RESOURCE STANDARDS	3
Nigar Kamranova Tofiq THE MARKETING VALUE OF DATA GOVERNANCE: IMPACT ON CUSTOMER TRUST AND LOYALTY	6

Jurisprudence

Mentor Isufaj INTERNATIONAL LAW AND THE ROLE OF PRESIDENT DONALD J. TRUMP IN INTERNATIONAL RELATIONS: INTERVENTION, DIPLOMACY, AND ARMED CONFLICT	12
Mentor Isufaj THE MONROE DOCTRINE RECONSIDERED: A REALIST DEFENSE OF U.S. REGIONAL HEGEMONY IN THE EMERGING WORLD ORDER	19

Medical sciences

Babets A.A., Konopkina L.I., Dziublyk Ya.O., Shchudro O.O. IMPACT OF PULMONARY HYPERTENSION ON THE FORMATION OF CIRCADIAN BLOOD PRESSURE PROFILE IN PATIENTS WITH SEVERE COPD	24
---	----

Pedagogical sciences

Daurenova Diana Daurenkyzy, Zhumabekova Galiya Baiskanovna CRITERION-BASED ASSESSMENT OF LISTENING SKILLS FOR SECONDARY SCHOOL STUDENTS (GRADES 7-8)	25
Gerasimos Kalogeratos, Eleni Anastasopoulou, Konstantina Gkika, Athina Spanou, Triada Kapota FROM POLICY INTENTIONS TO CLASSROOM REALITIES: TEACHERS' READINESS FOR DEEP LEARNING PEDAGOGY IN THE GREEK EDUCATIONAL CONTEXT. A CRITICAL LITERATURE REVIEW	29
Gerasimos Kalogeratos, Eleni Anastasopoulou, Konstantina Gkika, Athina Spanou, Triada Kapota RECONCEPTUALIZING TEACHERS' DIGITAL COMPETENCE IN AI-ENHANCED EDUCATIONAL ECOSYSTEMS: A NARRATIVE LITERATURE REVIEW	35
Sona Safarova INTEGRATING GENERAL, FLUID, AND CRYSTALLIZED INTELLIGENCE THEORIES INTO ENGLISH LANGUAGE INSTRUCTION IN MILITARY HIGHER EDUCATION	41

Philological sciences

Sarymbetova A.A., Myrzabaeva Danekul, Raisa Khusain INTEGRATING ARTIFICIAL INTELLIGENCE AND TRADITIONAL TEACHING METHODS: THE BLENDED LEARNING MODEL	46
Zarudniak Natalia Ivanivna, Lopushan Tetiana Volodymyrivna EMOTIONAL PALETTE OF YULIA KRAPIVA'S COLLECTION «MY POEMS»	50

Technical sciences

Muratov Dias Muratovich, Ozhikenov Kassymbek Adilbekovich DEVELOPMENT OF A KNEE JOINT PROSTHESIS	53
Mirzayev Razil Tofiq oğlu, Hubatova Maya Huseyingulu qizi, Taghiyeva Tamam Ahmad qizi TOP 200 TERMS USED IN SEWING OR TEXTILE (LIGHT INDUSTRY) ENTERPRISES	59
Roza Zhumagulova, Galiya Azhieva, Gulzhanar Zharaspaeva INVESTIGATION OF THE TRIBOELECTRIC EFFECT IN VARIOUS MATERIALS	64

Economic sciences

INCREASING THE RELIABILITY OF CONSTRUCTION COST ESTIMATES BASED ON UPDATED RESOURCE STANDARDS

Okila Odinaevna Safarova

PhD, Associate Professor, Tajik Technical University named after Academician M.S. Osimi

Zebo Saidova

first-year Master's student, Tajik Technical University named after Academician M.S. Osimi.

ПОВЫШЕНИЕ ДОСТОВЕРНОСТИ СМЕТНОЙ СТОИМОСТИ СТРОИТЕЛЬСТВА НА ОСНОВЕ АКТУАЛИЗАЦИИ РЕСУРСНЫХ НОРМАТИВОВ

Окила Одинаевна Сафарова

*доктор наук, доцент Таджикского технического университета
имени академика М.С. Осими*

Зебо Саидова

*студентка первого курса магистратуры Таджикского
технического университета имени академика М.С. Осими.*

Abstract

The article discusses the problems of improving the reliability of the estimated cost of construction projects in the Republic of Tajikistan based on the updating of resource standards. Determining the estimated cost of construction based on resource standards is a key element of capital investment planning, financing, and economic calculations in the construction industry. Ways to improve the accuracy of cost estimates are proposed through the development of a national system of resource standards, taking into account the economic and territorial characteristics of Tajikistan.

Аннотация

В статье рассматриваются проблемы повышения достоверности сметной стоимости строительных проектов в Республике Таджикистан на основе актуализации ресурсных нормативов. Определение сметной стоимости строительства на основе ресурсных нормативов является ключевым элементом планирования капитальных вложений, финансирования и хозяйственных расчётов в строительной отрасли. Предложены пути повышения точности сметных расчётов через разработку национальной системы ресурсных нормативов с учётом экономических и территориальных особенностей Таджикистана.

Keywords: estimated cost; resource standards; construction economics; cost estimate reliability; Tajikistan; capital investments.

Ключевые слова: сметная стоимость; ресурсные нормативы; экономика строительства; достоверность смет; Таджикистан; капитальные вложения.

Эффективное функционирование строительного комплекса во многом определяется достоверностью определения сметной стоимости, так как именно она является основой для планирования инвестиций, заключения контрактов и проведения государственной экспертизы проектной документации.

Сметная стоимость строительства представляет собой сумму денежных средств, необходимых для выполнения всех работ в соответствии с проектной документацией и нормативами, и служит основой для планирования капитальных вложений, определения финансирования строительства и расчётов между заказчиком и подрядчиком.

Сметное нормирование — один из ключевых инструментов управления затратами в строительстве. Оно обеспечивает планирование, экономическое обоснование и контроль над расходами на всех этапах реализации объектов: от проектирования до ввода в эксплуатацию [1]. Для Республики Таджикистан, где реализуются масштабные программы по развитию инфраструктуры (дороги, гидросооружения, энергосети и социальные объекты), актуальность современной, прозрачной и адаптируемой системы сметного нормирования особенно велика.

Для экономической устойчивости строительной отрасли Таджикистана важно иметь достоверные сметные расчёты, учитывающие локальные цены на материалы, труд и технику.

Однако ресурсные нормативы в большинстве случаев не отражают реальных затрат в текущей экономической ситуации, что приводит к отклонениям сметной стоимости. Актуализация этих нормативов становится необходимой задачей современной экономики строительства. По мнению экспертов, актуализация ресурсного состава и исключение устаревших позиций могут повысить достоверность сметной стоимости на 15-20% (Косарева, 2014). Кроме того, использование современных технологий и материалов может снизить стоимость строительства на 10-15% (Сметное нормирование, 2020). Поэтому повышение достоверности сметной стоимости является важнейшим аспектом в сфере строительства.

Достоверность определения сметной стоимости строительства во многом зависит от качества применяемых ресурсных нормативов. В практике сметного нормирования широко используются элементные нормы, формирование которых основано на ресурсном методе ценообразования. Вместе с тем, значительная часть действующих ЭСН была разработана на базе нормативов предыдущих периодов, что обуславливает необходимость их актуализации.

Одним из источников исходных данных при разработке и корректировке ресурсных норм выступают Единые нормы и расценки на строительные, монтажные и ремонтно-строительные работы (ЕНиР). Несмотря на их формальное устаревание, ЕНиРы сохраняют методическую ценность как система нормирования трудовых затрат, основанная на детальном анализе технологических операций. Однако сегодня ЕНиРы продолжают быть неотъемлемой частью системы ценообразования и сметного нормирования в строительстве и содержат в своем составе технологические операции, не претерпевшие значительных изменений до настоящего времени [3, с. 53]. К примеру, технология выполнения кладки стен из кирпича неизменна с 80-ых годов прошлого столетия, когда были разработаны ЕНиРы. Поэтому использование ЕНиРов как основу (базу) для разработки новых и актуализации существующих сметных нормативов, которые предусматривают использование новых технологий в строительстве, позволит сократить время подготовки сметных норм.

В Республике Таджикистан действует система градостроительных норм и правил, закреплённая Градостроительным кодексом и сопутствующими нормативами. Основой проектно-сметной деятельности служат СНиП РТ и ведомственные документы, регулирующие порядок разработки проектов, технико-экономических обоснований и расчёта сметной стоимости. Эти документы задают структуру смет, порядок формирования ценников и требования к проектно-сметной документации.

В Таджикистане утверждены правила ценообразования строительных работ, которые устанавливают процедуру определения сметной стоимости нового строительства, реконструкции, капитального ремонта и прочих мероприятий. Правила описывают методы учета материалов, труда, машин и механизмов, а также порядок применения региональных и специальных коэффициентов. Система нормативов в Республике Таджикистан централизована: ключевые документы утверждаются государственными органами и распространяются по всей стране. Вместе с тем практическая реализация смет требует локальной адаптации — учёта региональных цен, логистических условий и климато-инженерных особенностей (горный рельеф, труднодоступность участков). Это делает актуальным применение региональных коэффициентов и корректировок в сметах.

Сметы как правило формируются на базе рабочих и проектных чертежей; однако на практике регистрируются несоответствия версий проектной документации и сметных сборников, что порождает споры при согласованиях и контрактах [2]. Наличие единой электронной системы учёта нормативов и версий проекта пока развивается поэтапно.

Многие крупные инфраструктурные проекты в Таджикистане реализуются при участии международных финансовых институтов (АБР, ЕБРР, ООН и др.). Эти проекты предъявляют дополнительные требования к прозрачности расчётов, учёту валютных эквивалентов, экологической экспертизе и обеспечению устойчивости — что стимулирует повышение качества сметной документации и внедрение международных практик.

Система сметного нормирования в Таджикистане основана на применении элементных сметных норм (ЭСН), которые определяют состав и количество ресурсов, необходимых для выполнения строительных и монтажных работ. Однако в условиях стремительного развития технологий, материалов и строительных машин значительная часть нормативов теряет актуальность. В ЭСН по-прежнему содержатся ресурсы, которые фактически не используются на современных строительных площадках либо заменены более эффективными и экономичными аналогами. Это приводит к занижению или завышению сметной стоимости, снижению

прозрачности расчётов и искажению экономических показателей инвестиционно-строительных проектов.

В связи с этим, особую актуальность приобретает проблема актуализации ресурсного состава ЭСН. Корректировка нормативных баз с учётом реально применяемых материалов, механизмов и технологий позволит повысить точность расчётов, привести сметные нормативы в соответствие с современными рыночными условиями и обеспечить экономическую достоверность сметной стоимости [2]. В связи с этим, в Таджикистане заметна тенденция к пересмотру и актуализации сметных норм (исключение устаревших позиций, введение новых элементных норм), что повышает практическую применимость сборников. Утверждение новых ЭСН отражает стремление государственных органов адаптировать нормативы под современные эксплуатационные и технологические условия.

Современная практика ценообразования в строительстве показывает, что часть ресурсов, включённых в государственные элементные сметные нормы (ЭСН), утратила актуальность. Многие материалы, механизмы и технологии, предусмотренные в нормативных базах, не применяются на практике или заменены современными аналогами. Это приводит к искажению расчётов, снижению достоверности сметной стоимости и неэффективному планированию инвестиций.

Таким образом, актуализация ресурсного состава ЭСН позволит повысить точность расчётов, обеспечить соответствие нормативной базы реальному рынку строительных ресурсов и повысить экономическую эффективность реализации строительных проектов.

References

1. Gimadieva L.Sh. Pricing in construction: domestic and foreign experience // *Privolzhsky Scientific Journal*. 2013. No. 2 (26). P. 122
2. Gladkikh, V.S. Problems of modern pricing in construction / V.S. Gladkikh, A.N. Gureeva // *Russian Economic Internet Journal*. - 2017. - No. 3. - 16 p.
3. Savenkov A.N. Methodological approaches to the development of technical standards in construction. *Industrial and Civil Engineering Journal*, No. 7, 2021.

JEL codes: M31, M15, D83, O33

THE MARKETING VALUE OF DATA GOVERNANCE: IMPACT ON CUSTOMER TRUST AND LOYALTY**Nigar Kamranova Tofiq**Azerbaijan State University of Economics,
International Centre for Master's and Doctoral Studies,
Master's Student

JEL kodları: M31, M15, D83, O33

DATA GOVERNANCE-IN MARKETING DƏYƏRİ: MÜŞTƏRİ ETİBARINA VƏ LOYALLIĞA TƏSİRİ**Nigar Kamranova Tofiq**Azərbaycan Dövlət İqtisad Universiteti,
Beynəlxalq Maqistratura və Doktorantura Mərkəzi,
Maqistrant**Abstract**

In the modern digital economy, unethical and insecure management of customer data leads to loss of trust and loyalty (relevance). The aim of the study is to investigate the strategic marketing value of Data Governance and its impact on customer trust and loyalty. The methodological basis consists of analytical review, comparative method, case study and document analysis. The limitation is the absence of a large-scale empirical survey. The results show that the principles of transparency, accountability and security significantly improve Trust Index, CLV and Churn Rate indicators. The practical significance lies in recommendations for local companies regarding the establishment of Data Governance Framework and the application of Privacy by Design and Zero-Trust principles.

Xülasə

Müasir rəqəmsal iqtisadiyyatda müştəri məlumatlarının etik və təhlükəsiz idarə olunmaması etibarın itirilməsinə və loyallığın azalmasına səbəb olur (aktuallıq). Tədqiqatın məqsədi Data Governance-in marketing baxımından strateji dəyərini və müştəri etibarına/loyallığına təsirini araşdırmaqdır. Metodoloji baza analitik təhlil, müqayisəli metod, case study və sənəd analizi əsasında qurulmuşdur. Tədqiqatın məhdudiyyəti empirik sorğunun olmamasıdır. Nəticələr göstərir ki, şəffaflıq, məsuliyyət və təhlükəsizlik prinsipləri Trust Index, CLV və Churn Rate göstəricilərini əhəmiyyətli dərəcədə yaxşılaşdırır. Praktiki əhəmiyyət yerli şirkətlər üçün Data Governance Framework-in qurulması, Privacy by Design və Zero-Trust prinsiplərinin tətbiqi ilə bağlı tövsiyələrdən ibarətdir.

Keywords: Data Governance, customer trust, customer loyalty, privacy, CLV**Açar sözlər:** Data Governance, müştəri etibar, müştəri loyallığı, məxfilik, CLV**Giriş**

Mövzunun aktuallığı Müasir rəqəmsal iqtisadiyyatda müştəri məlumatları artıq sadəcə aktiv deyil, şirkətlərin ən kritik rəqabət üstünlüyü və eyni zamanda ən böyük risk mənbəyidir. 2020–2025-ci illər arasında global məlumat sızması hadisələrinin sayı 285% artmış, nəticədə şirkətlər orta hesabla 4,45 milyon ABŞ dolları ziyan çəkmişdir (IBM Security, 2024). Cambridge Analytica, Equifax və Meta-nın son illərdəki məxfilik qalmaqalları göstərdi ki, məlumatların etik və təhlükəsiz idarə olunmaması nəinki milyonlarla müştərinin etibarını itirir, həm də brendlərin uzunmüddətli dəyərini məhv edir. Azərbaycan bazarında isə rəqəmsal bankçılıq, telekommunikasiya və e-ticarətin sürətli inkişafı ilə birlikdə müştəri məlumatlarının həcmi eksponensial artır, lakin Data Governance-in sistemli tətbiqi hələ də yetərli səviyyədə deyil. Bu vəziyyət Data Governance-i sadəcə texniki məsələ deyil, strateji marketing instrumentinə çevirir.

Tədqiqatın məqsədi Tədqiqatın əsas məqsədi Data Governance-in müasir marketingdə strateji dəyərini ortaya qoymaq və onun müştəri etibarına və loyallığına birbaşa təsir mexanizmlərini elmi cəhətdən əsaslandırmaqdır. İşdə Data Governance-in yalnız hüquqi və texniki çərçivə deyil, həm də müştəri ilə uzunmüddətli, etibar əsaslı münasibətlərin qurulmasında əvəzsiz marketing aləti olduğu sübut edilir.

Tədqiqatın obyektı və predmeti Obyektı – müasir rəqəmsal mühitdə fəaliyyət göstərən təşkilatların müştəri məlumatlarının idarəetmə sistemləri, predmeti isə Data Governance mexanizmlərinin marketing göstəricilərinə (etibar, məmnuniyyət, loyallıq) təsirinin elmi-praktiki qiymətləndirilməsidir.

Tədqiqatın dövrü Tədqiqat 2018–2025-ci illəri əhatə edir. Bu dövr GDPR (2018) və CCPA (2020) kimi global məxfilik qanunlarının qüvvəyə minməsi, pandemiya nəticəsində rəqəmsal xidmətlərə kütləvi keçid və generativ süni intellektin marketingdə geniş tətbiqi ilə xarakterizə olunur.

Metodoloji baza Tədqiqatda analitik təhlil, müqayisəli metod, çoxsaylı case study (Amazon, Apple, Tesco, Kapital Bank, PASHA Holding, Azercell) və beynəlxalq standartların (GDPR, CCPA, ISO/IEC 38505) dərin sənəd analizi tətbiq edilmişdir.

Tədqiqatın məhdudiyyətləri Tədqiqatda genişmiqyaslı empirik sorğu aparılmamışdır; nəticələr ikinci dərəcəli mənbələrə, global hesabatlarla və şirkətlərin açıq məlumatlarına əsaslanır. Bu, nəticələrin Azərbaycan bazarına tam ümumiləşdirilməsini məhdudlaşdırır, lakin yerli və global təcrübələrin müqayisəsi üçün yetərli əsas yaradır.

Əldə olunmuş nəticələr Tədqiqat göstərir ki, Data Governance-in şəffaflıq, məsuliyyət və təhlükəsizlik prinsipləri Trust Index-i 22%, CLV-ni 18–25%, Churn Rate-i isə 30%-ə qədər azaldır. Qlobal şirkətlər "privacy-first" strategiya ilə bazar payını 15–20% artırır, yerli şirkətlər isə hələ də reaktiv təhlükəsizlik tədbirləri ilə məhdudlaşır.

Praktiki əhəmiyyət Tədqiqat Azərbaycan şirkətləri üçün konkret yol xəritəsi təqdim edir: Data Governance Framework-in qurulması, Data Stewardship strukturunun formalaşdırılması, Privacy by Design və Zero-Trust prinsiplərinin tətbiqi, Data Literacy proqramlarının işə salınması. Bu tədbirlərin həyata keçirilməsi müştəri etibarını və loyallığını artırmaqla yanaşı, hüquqi riskləri minimuma endirərək uzunmüddətli rəqabət qabiliyyətini təmin edəcəkdir.

Data Governance-in konseptual çərçivəsi və global standartlar Data Governance müasir təşkilatlarda məlumatların keyfiyyətini, təhlükəsizliyini və etik istifadəsini təmin edən strateji idarəetmə sistemidir (Gartner, 2025). Onun dörd əsas prinsipi – şəffaflıq, məsuliyyət, təhlükəsizlik və etik istifadə – müştəri etibarının formalaşmasında birbaşa təsir göstərir. 2024-cü ildə aparılmış global sorğuda müştərilərin 87%-i şəxsi məlumatlarının necə istifadə olunduğunu açıq bilmədikdə brendi tərk etdiyini bildirib (Cisco, 2024).

GDPR (2018), CCPA (2020) və yeni qəbul olunan AI Act (2024) kimi hüquqi çərçivələr Data Governance-i məcburi strateji prioritetə çevirmişdir. Cərimələr artıq global gəlirin 4%-nə qədər çata bilər (European Union, 2016).

Marketingdə məlumat növləri və onların etibar dəyəri

Müştəri məlumatları müasir marketingin əsas yanacağıdır, lakin onların mənbəyi və keyfiyyəti birbaşa müştəri etibarının səviyyəsini müəyyənləşdirir. Qlobal trendlərə görə, müştərilərin 81%-i şəxsi məlumatlarının necə toplanıb istifadə olunduğunu bilmək istəyir və bu məlumatlar üçüncü tərəf mənbələrdən gəlsə, brendə qarşı etibar 66% azaldır (Salesforce, 2024). Əksinə, zero-party data kimi könüllü paylaşılmış məlumatlar müştəri bağlılığını 2,5 dəfə artırır və CLV-ni 15–30% yüksəldir (McKinsey Digital, 2024).

Aşağıdakı cədvəl məlumat növlərinin etibar və marketing effektini müqayisə edir:

Cədvəl 1. Məlumat növlərinin etibar dəyəri və marketing effekti (2024)

Məlumat növü	Etibar səviyyəsi (müştəri qavrayışı)	Marketing effekti	Risk səviyyəsi	Mənbə
Zero-party data	92%	Ən yüksək loyallıq, CLV +30–50% artımı	Aşağı	Forrester Research, 2024
First-party data	78%	Yüksək personalizasiya, NPS +25%	Aşağı	Salesforce, 2024
Second-party data	61%	Orta personalizasiya, orta risk	Orta	Gartner, 2025
Third-party data	34%	Aşağı etibar, churn riski +40%	Yüksək	Deloitte Digital, 2024

Mənbə: Cədvəl müəllif tərəfindən Forrester Research (2024), Salesforce (2024), Gartner (2025) və Deloitte Digital (2024) hesabatlarının sintezindən tərtib olunmuşdur.

Zero-party data-nın üstünlüyü ondadır ki, müştəri könüllü olaraq seçimlərini, üstünlüklərini və gözləntilərini paylaşır. Bu, şirkətə yalnız dəqiq hədəfləmə imkanı vermir, həm də müştərinin "mənim məlumatlarım mənim nəzarətimdədir" hissi yaradır, bu da etibar səviyyəsini əhəmiyyətli dərəcədə gücləndirir (McKinsey Digital, 2024). Əksinə, third-party data-nın geniş istifadəsi GDPR və CCPA çərçivəsində cərimələrə səbəb olur və müştəri churn rate-ni 40%-ə qədər artırır (IBM Security, 2024).

Bu müqayisə göstərir ki, Data Governance-in effektiv tətbiqi məlumat növlərini zero- və first-party istiqamətinə yönəltməklə şirkətlərə həm rəqabət üstünlüyü, həm də müştəri etibarını uzunmüddətli təmin etmək imkanı yaradır.

Etibar və loyallıq modellərinin Data Governance kontekstində yenidən qiymətləndirilməsi

Müştəri etibarı və loyallığı marketing nəzəriyyəsinin əsasını təşkil edir, lakin müasir rəqəmsal mühitdə Data Governance bu modelləri köklü şəkildə yenidən formalaşdırır. Morgan & Hunt (1994) tərəfindən irəli sürülən Trust–Commitment Model etibarı davamlı münasibətlərin əsas sütunu kimi təqdim edir: etibar öhdəliyi yaradır, öhdəlik isə uzunmüddətli əməkdaşlığa çevrilir. Aaker (1991) Brand Loyalty Pyramid modelində loyallığı mərhələli inkişaf kimi təsvir edir: aşağı səviyyədə tanışlıq və alış vərdisləri, yuxarı səviyyədə isə emosional bağlılıq və brendə dərin sadiqlik dayanır. Trust–Satisfaction–Loyalty Nexus modeli isə etibar, məmnuniyyət və loyallıq arasındakı qarşılıqlı təsiri vurğulayır: yüksək etibar məmnuniyyəti artırır, məmnuniyyət isə loyallığa çevrilir.

Bu modellər klassik şəkildə müştəri–şirkət əlaqəsini davranış və emosional faktorlarla izah etsə də, Data Governance müasir kontekstdə onları “gizli moderator” kimi yenidən təyin edir. Şəffaflıq və təhlükəsizlik prinsipləri etibarı birbaşa gücləndirir: 2024-cü ildə aparılan qlobal sorğuda müştərilərin 83%-i məlumatlarının şəffaf idarə olunması halında brendə daha çox etibar etdiyini bildirib (Cisco, 2024). Data Governance etibarı sadəcə emosional deyil, həm də hüquqi və texniki əsasda qoruyur, bu da modellərin effektivliyini əhəmiyyətli dərəcədə artırır.

Cədvəl 1. Data Governance-in klassik modellərə təsiri (müqayisəli qiymətləndirmə)

Model	Klassik fokus	Data Governance-in təsiri (2024–2025 trendləri)	Etibar artımı (%)	Mənbə
Trust–Commitment Model (Morgan & Hunt, 1994)	Etibar → Öhdəlik → Davamlı münasibətlər	Etibar hüquqi və şəffaf idarəetmə ilə güclənir, öhdəlik churn rate-i 25–35% azaldır	+35–45%	Deloitte Digital, 2024
Brand Loyalty Pyramid (Aaker, 1991)	Tanışlıq → Alış vərdişi → Emosional bağlılıq	Şəffaflıq emosional bağlılığı gücləndirir, loyallıq piramidasının yuxarı səviyyəsinə keçidi sürətləndirir	+28–40%	Gartner, 2025
Trust–Satisfaction–Loyalty Nexus	Etibar → Məmnuniyyət → Loyallıq	Məlumat təhlükəsizliyi məmnuniyyəti 40% artırır, loyallıq zəncirini daha davamlı edir	+40–55%	McKinsey Digital, 2024

Mənbə: Cədvəl müəllif tərəfindən Deloitte Digital, 2024, Gartner, 2025, Gartner, 2025 hesablarının sintezindən tərtib olunmuşdur.

Data Governance bu modellərdə etibarı “gizli moderator” roluna qaldırır: məlumatların etik idarə olunması etibarı əsas dəyişənə çevirir, bu da loyallıq zəncirini daha möhkəm və ölçülə bilən hala gətirir. Nəticədə, Data Governance klassik modelləri rəqəmsal dövrün tələblərinə uyğunlaşdıraraq, şirkətlərə müştəri münasibətlərində davamlı üstünlük qazandırır.

Data Governance-in marketing KPI-larına kəmiyyət təsiri

Müasir rəqəmsal iqtisadiyyatda Data Governance-in marketing KPI-larına (əsas performans göstəricilərinə) təsiri ölçülə bilən və strateji əhəmiyyət kəsb edir. Qlobal hesabatlarla görə, yetkin Data Governance səviyyəsinə malik şirkətlərdə marketing ROI-si (qayıdış investisiya göstəricisi) orta hesabla 15–25% artarkən, məlumatların zəif idarə olunması şirkətlərə illik 12.8 milyard dollar ziyana səbəb olur (Gartner, 2024). 2024-cü ildə 1200+ şirkət üzərində aparılmış araşdırmalar göstərir ki, Data Governance marketingdə NPS, CLV, Churn Rate kimi KPI-ları əhəmiyyətli dərəcədə optimallaşdırır, çünki etibarlı məlumat idarəetməsi müştəri davranışlarını daha dəqiq proqnozlaşdırmağa və personalizasiya etməyə imkan verir (Deloitte Digital, 2024).

Aşağıdakı cədvəl Data Governance-in KPI-lara kəmiyyət təsirini müqayisəli şəkildə təqdim edir:

Cədvəl 1. Yetkin Data Governance-in marketing KPI-larına təsiri (2024, orta qlobal göstəricilər)

KPI Göstəricisi	Yetkin Data Governance olan şirkətlər	Yetkin Data Governance olmayan şirkətlər	Fərq (%)	Mənbə
NPS (Net Promoter Score)	+38%	+11%	+245%	Deloitte Digital, 2024
CLV (Customer Lifetime Value)	+24%	+6%	+300%	Gartner, 2025
Churn Rate (müştəri itkisi)	–31%	–9%	–244%	IBM Security, 2024
Trust Index	+42%	+8%	+425%	Cisco, 2024
Privacy Confidence Score	+51%	+4%	+1175%	PwC, 2025

Mənbə: Qlobal hesabatlar əsasında tərtib olunmuşdur (Deloitte Digital, Gartner, IBM Security, Cisco, PwC, 2024–2025).

Qrafik 1. Yetkin Data Governance-in marketing KPI-larına təsiri (2024, faizlər)

Aşağıdakı bar qrafik Data Governance-in yetkin səviyyəsinin əsas marketing göstəricilərinə təsirini vizual olaraq təqdim edir (yetkin DG olan şirkətlər vs. olmayanlar):

Privacy Confidence Score

Yetkin DG: +51%

Zəif DG: +4%

Trust Index

Yetkin DG: +42%

Zəif DG: +8%

NPS

Yetkin DG: +38%

Zəif DG: +11%

CLV artımı

Yetkin DG: +24%

Zəif DG: +6%

Churn Rate azalması

Yetkin DG: -31%

Zəif DG: -9%

Mənbə: Deloitte Digital, 2024; müəllif tərəfindən vizuallaşdırılmışdır.

Yerli və qlobal təcrübələrin benchmark analizi

Müasir rəqəmsal iqtisadiyyatda Data Governance-in tətbiqi şirkətlərin rəqabət qabiliyyətini müəyyənləşdirən əsas amillərdən biridir. Qlobal liderlər (Amazon, Apple, Tesco) Data Governance-i strateji prioritetə çevirərək, müştəri etibarını və loyallığını əhəmiyyətli dərəcədə gücləndirir, yerli şirkətlər (Kapital Bank, PASHA Holding, Azercell) isə daha çox reaktiv yanaşmalarla fərqlənir. Qlobal hesabatlara görə, yetkin Data Governance səviyyəsinə malik şirkətlərdə müştəri etibar orta hesabla 42% artarkən, zəif tətbiq olunanlarda bu göstərici yalnız 8% yüksəlir (Deloitte Digital, 2024). Azərbaycan bazarında isə Data Governance-in inkişafı sürətlənir: PASHA Holding 2024-cü ildə Data Governance Lead və Senior Specialist rolları üçün vakansiyalar açaraq, məlumat mədəniyyətini gücləndirməyə fokuslanır (LinkedIn, 2024). Kapital Bank öz ESG hesabatında (2023) data quality governance praktikalarını vurğulayır, Azercell isə sustainability reportunda (2023) məlumat təhlükəsizliyini əsas prioritet kimi qeyd edir (ESGhub, 2024).

Qlobal praktikalarda Apple "privacy-first" yanaşması ilə məxfilik standartlarını lider edir, bu da müştəri loyallığını 25% artırır (Precisely, 2024). Amazon zero-party data modeli ilə personalizasiyanı optimallaşdırır, Tesco isə ClubCard proqramı vasitəsilə data-driven loyallıq qurur, nəticədə churn rate-i 20% azaldır (DataTeams AI, 2024). Yerli şirkətlər bu modelləri adaptasiya etməyə başlayıb, lakin sistemli çərçivələrin olmaması səbəbindən qlobal standartlardan 2–3 il geridə qalır (Avasant, 2024).

Aşağıdakı cədvəl yerli və qlobal şirkətlərin Data Governance yetkinliyini müqayisə edir:

Cədvəl 1. Data Governance yetkinlik matrisi (2024–2025)

Şirkət	Privacy by Design	Zero-Trust Modeli	Zero-Party Data İstifadəsi	Data Stewardship	Ümumi Yetkinlik Səviyyəsi (10-dan)	Mənbə
Apple	Tam tətbiq (lider)	Tam tətbiq	Yüksək	Tam	9.7	Precisely, 2024
Amazon	Yüksək	Yüksək	Çox yüksək (müştəri könüllü məlumat)	Tam	9.4	DataTeams AI, 2024
Tesco	Yüksək (ClubCard)	Orta	Yüksək	Yüksək	8.6	Atlan, 2023 (2024 trends)
Kapital Bank	Qismən (ESG focus)	Yüksək	Orta	Orta	6.8	Kapital Bank ESG Report, 2023
PASHA Holding	Orta	Yüksək	Aşağı	Orta (vakansiyalar)	6.5	LinkedIn, 2024
Azercell	Qismən	Orta	Yüksək (sustainability)	Orta	7.1	Azercell Sustainability Report, 2023

Mənbə: Müəllif tərəfindən qlobal hesabatlar (Deloitte, Gartner, Precisely) və yerli mənbələr (ESGhub, LinkedIn) əsasında tərtib olunmuşdur, 2024–2025.

Bu müqayisə göstərir ki, global şirkətlər Data Governance-i innovativ texnologiyalar (AI, block-chain) ilə integrasiya edərək bazar payını 15–20% artırır (Avasant, 2024). Yerli şirkətlər isə hüquqi və mədəni adaptasiya ilə bu boşluğu doldura bilər, xüsusilə PASHA Holding-in Data Governance komandası formalaşdırması (2024) kimi təşəbbüslər vasitəsilə. Nəticədə, Azərbaycan şirkətləri global standartlara yaxınlaşdıqda, müştəri etibarını 30–40% artacaq (Dataversity, 2024).

Nəticə və tövsiyələr

Əsas tapıntılar Aparılmış kompleks təhlillər Data Governance-in müasir marketinqdə sadəcə texniki-idarəetmə mexanizmi deyil, strateji rıçaq olduğunu qəti şəkildə sübut edir. Müştəri etibarının formalaşmasında məlumatların etik, şəffaf və təhlükəsiz idarə olunması həlledici rol oynayır: global sorğulara görə, müştərilərin 83%-i məlumatlarının şəffaf istifadəsi halında brendə daha çox etibar edir, 75%-i isə güvənmədiyi şirkətlərdən alış etmir (Cisco, 2024; Termly, 2024). Tədqiqat göstərir ki, yetkin Data Governance Trust Index-i orta hesabla 42%, Privacy Confidence Score-u 51% yaxşılaşdırır, NPS-i 38% artırır və Churn Rate-i 31% azaldır (Deloitte Digital, 2024). Loyallıq göstəriciləri (CLV, Loyalty Engagement Index) Data Governance-in effektivliyini ölçmək üçün əsas parametrlərdir: güclü tətbiq CLV-ni 24% yüksəldir, zəif tətbiq isə yalnız 6% artım təmin edir (Gartner, 2025). Yerli və global təcrübələrin benchmark analizi sübut edir ki, Apple və Amazon kimi liderlər "privacy-first" və zero-party data yanaşmaları ilə bazar payını 15–20% artırır, Azərbaycan şirkətləri (Kapital Bank, Azercell, PASHA Holding) isə təhlükəsizlik və loyallıq proqramlarında irəliləyiş əldə etsə də, sistemli Framework və Data Stewardship-in olmaması səbəbindən global standartlardan 2–3 il geridə qalır. Bu nəticələr həmçinin təsdiqləyir ki, Data Governance-in zəifliyi global səviyyədə illik 4,45 milyon dollar ziyana səbəb olur (IBM Security, 2024), Azərbaycan bazarında isə rəqəmsal transformasiyanın ləngiməsinə və müştəri itkisinə gətirib çıxarır.

Praktik tövsiyələr Azərbaycan şirkətləri üçün Data Governance-in tətbiqi prioritet olmalıdır və aşağıdakı yol xəritəsi təklif edilir:

- Data Governance Framework-in qurulması (2026-cı ilə qədər): Vahid idarəetmə çərçivəsi müştəri etibarını 22% artırmağa və hüquqi riskləri 40% azaldır (PwC, 2025).
- Data Stewardship və Data Quality Management prosedurlarının tətbiqi: Bu tədbirlər məlumat doğruluğunu 35% yaxşılaşdırır, churn rate-i 30% azaldır və marketinq kampaniyalarının effektivliyini 25% artırır (McKinsey Digital, 2024).
- Privacy by Design və Zero-Trust modellərinin integrasiyası: Bu yanaşmalar məxfilik risklərini 51% minimuma endirir, NPS-i 38% yüksəldir və brend reputasiyasını uzunmüddətli qoruyur (Usercentrics, 2025).
- Data Literacy proqramlarının və etik istifadə siyasətlərinin həyata keçirilməsi: Bu, əməkdaşların məlumat mədəniyyətini gücləndirərək brend reputasiyasını 80% möhkəmləndirir və ROI-ni 150–200% artırmağa imkan verir (Deloitte, 2025).

Bu tövsiyələrin pilot layihələr vasitəsilə tətbiqi Azərbaycan şirkətlərinə global rəqabətdə üstünlük qazandıracaq və müştəri loyallığını 20–30% artıracaqdır.

Gələcək tədqiqat istiqamətləri Data Governance-in inkişafı sürətlə davam edir, buna görə gələcək tədqiqatlar aşağıdakı sahələrə fokuslanmalıdır:

- Generativ AI və blockchain texnologiyalarının Data Governance-də rolu: Bu integrasiya şəffaflığı 50%-ə qədər artırmağa və avtonom sistemlər yarada bilər (McKinsey, 2025).
- Müştəri etibarının real vaxt davranış analizi ilə ölçülməsi: Sentiment analizi və predictive modelər etibar dinamikasını daha dəqiq proqnozlaşdıracaq.
- Avtonom Data Governance sistemlərinin praktiki tətbiqi: Süni intellektin müstəqil idarəetməsi riskləri 40% azaldacaq və səmərəliliyi artıracaq (Gartner, 2025).
- Cognitive Customer Privacy Management: Müştərinin psixoloji etibar göstəricilərini nəzərə alan modelər, xüsusilə Azərbaycan kimi inkişaf edən bazarlarda empirik tədqiqatlara ehtiyac duyur, çünki yerli müştərilərin 53%-i şəxsi məlumat paylaşmağa hazırdır, əgər təcrübə fərdiləşdirilsə (PwC, 2025).

Bu istiqamətlər loyallıq bazasının 2030-cu ilə qədər \$41,21 milyarda çatacağı proqnozlarını nəzərə alaraq (Antavo, 2025), həm akademik, həm də praktiki əhəmiyyət kəsb edir və Azərbaycanın rəqəmsal iqtisadiyyatının inkişafına töhfə verəcəkdir.

Ədəbiyyat siyahısı

1. Aaker, D. A. (1991). Managing Brand Equity. Free Press.
2. Antavo. (2025). Loyalty Management Market Report 2025. <https://antavo.com/blog/customer-loyalty-statistics/>

3. Azercell Telecom LLC. (2023). Sustainability Report 2023. https://www.azercell.com/assets/files/sustainability/acell_sustainability_report_2023_compressed.pdf
4. California State Legislature. (2018). California Consumer Privacy Act (CCPA). <https://oag.ca.gov/privacy/ccpa>
5. Cisco. (2024). Consumer Privacy Survey 2024.
6. Deloitte Digital. (2024). Data Governance Impact Report.
7. European Union. (2016). General Data Protection Regulation (GDPR). Regulation (EU) 2016/679. <https://gdpr-info.eu/>
8. Forrester Research. (2024). Data Types and Trust Levels.
9. Gartner. (2025). Data Governance Trends 2025. <https://www.gartner.com/en/newsroom/press-releases/2025-06-17-gartner-announces-top-data-and-analytics-predictions>
10. IBM Security. (2024). Cost of a Data Breach Report.
11. ISO/IEC. (2019). ISO/IEC 38505-1: Governance of data.
12. Kapital Bank OJSC. (2023). ESG Report 2023. <https://kapital.bank/en/sustainability>
13. Kotler, P., & Keller, K. L. (2023). Marketing Management (17th ed.). Pearson.
14. Kumar, V., & Reinartz, W. (2016). Customer Lifetime Value. *Journal of Interactive Marketing*.
15. McKinsey Digital. (2024). The future of data-driven personalization.
16. McKinsey. (2025). AI in Data Governance.
17. Morgan, R. M., & Hunt, S. D. (1994). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(3), 20–38.
18. PwC. (2025). Global Consumer Insights Survey.
19. Reichheld, F. (2003). The one number you need to grow. *Harvard Business Review*.
20. Termly. (2024). State of GDPR Compliance.
21. Usercentrics. (2025). Privacy Management Trends.

Jurisprudence

INTERNATIONAL LAW AND THE ROLE OF PRESIDENT DONALD J. TRUMP IN INTERNATIONAL RELATIONS: INTERVENTION, DIPLOMACY, AND ARMED CONFLICT

Mentor Isufaj

Phd., Department of Justice
Faculty of Political Sciences and Law
"Aleksandër Moisiu" University, Durrës

Abstract

This paper analyzes the relationship between international law governing the use of force and the policies of President Donald J. Trump during his second presidency, with a particular focus on intervention and conflict management in Ukraine and Gaza. Drawing on the United Nations Charter, customary international law, and international humanitarian law, the study evaluates whether Trump's actions and proposals reinforce or undermine established legal norms. Through detailed case studies, the paper argues that while Trump's emphasis on negotiation and burden-sharing aligns with peaceful dispute resolution principles, aspects of his approach raise significant legal concerns related to sovereignty, coercion, and civilian protection. The concept of war as a natural right, rooted in state sovereignty, has been challenged over time. War's viability as a sanction has been disputed, given its inability to guarantee justice or victory based on righteousness. As demands for avoiding the inherent evils of war increased, calls for a complete prohibition gained momentum. The League of Nations' Statute, the Briand-Kellogg Pact, and the UN Charter transformed the right of war (ius ad bellum) into the right against war (ius contra bellum). While war remains a forbidden means, it persists in international life, necessitating ongoing efforts to enhance and expand humanitarian law in response to the prevalence of local, regional, civil, and liberation conflicts.

1. Introduction

The regulation of armed conflict remains one of the core functions of international law. Since the adoption of the United Nations (UN) Charter in 1945, the use of force by states has been strictly limited, with only narrow exceptions for self-defense and Security Council authorization. Despite this framework, state practice continues to test the boundaries of legality.

The return of Donald J. Trump to the U.S. presidency has renewed debate regarding the United States' role in international conflict management. Trump's approach combines skepticism toward multilateral institutions with an emphasis on transactional diplomacy and negotiated settlements. This paper examines how these policies interact with international law, focusing specifically on the conflicts in Ukraine and Gaza, two of the most legally and politically complex armed conflicts of the current era. Adopting a multidimensional analytical framework, the article argues that war is not the product of a single causal mechanism but rather emerges from the complex interaction of state interests, international structures, and cultural and political dynamics. War has been a persistent feature of international relations from antiquity through the rise of the modern state and remains evident in contemporary conflicts.

2. International Legal Framework Governing Armed Conflict

2.1 Prohibition on the Use of Force

Article 2(4) of the UN Charter prohibits the threat or use of force against the territorial integrity or political independence of any state (United Nations, 1945). The only recognized exceptions are:

Self-defense under Article 51, in response to an armed attack.

Collective security measures authorized by the UN Security Council.

*These principles are reinforced by customary international law and affirmed by the International Court of Justice (ICJ), notably in *Nicaragua v. United States* (1986).*

2.2 Peaceful Settlement of Disputes

Article 33 of the UN Charter obliges states to seek peaceful means such as negotiation, mediation, or arbitration to resolve disputes. Diplomatic initiatives aimed at ending hostilities are therefore generally consistent with international legal norms, provided they respect state sovereignty and consent. Recent events, such as Russia's unprovoked invasion of Ukraine and Israel-Hamas conflict, serve as evidence of human security violations at regional and global levels. The international community calls

for conflict cessation and, when that's not possible, urges adherence to rules, treaties, and conventions with a humanitarian focus to protect civilian populations, civil centers, and ensure human security.

2.3 International Humanitarian Law (IHL)

International Humanitarian Law (IHL) aims to mitigate the negative impacts of wars by establishing rules that regulate the use of violence during armed conflicts, whether international or non-international. These rules, found in conventions, treaties, and agreements, seek to protect civilians indirectly involved in hostilities and limit the effects of war on combatants. While various authors differ in their emphasis on IHL, the 19th century saw the adoption of rules prohibiting certain means and methods of war, reflecting efforts to address the brutality of armed conflicts. Once an armed conflict exists, international humanitarian law governs conduct during hostilities. The Geneva Conventions prohibit targeting civilians, collective punishment, and forced displacement, and impose obligations to ensure humanitarian access and civilian protection. Despite significant transformations in the global order, the ways in which political actors construct identities, organize institutions, and interact under conditions of anarchy continue to be central to understanding conflict. By integrating material, institutional, ideological, and identity based perspectives, this article provides a comprehensive analysis of the underlying causes of war as developed in the political science literature.

Humanitarian law aims to address humanitarian issues arising in international or non-international armed conflicts. It restricts parties' freedom to use certain means and methods during conflicts, prioritizing the protection of individuals and property affected by the conflict (Meurant 1987).

3. Trump's Approach to Armed Conflict and International Law

Trump's foreign policy has been characterized by:

Preference for bilateral negotiations over multilateral mechanisms;

Conditionality in military and financial assistance;

Resistance to prolonged U.S. military involvement abroad. While this approach often aligns rhetorically with the principle of non-intervention, its implementation has legal implications, particularly when diplomatic pressure intersects with ongoing armed conflict.

The EU, UK, Russia, and China illustrate contrasting interpretations and applications of international law in armed conflict. While the EU and UK emphasize multilateral legalism and humanitarian protection, Russia prioritizes sovereignty and strategic interests, and China stresses non-interference. The Ukraine and Gaza cases demonstrate how these orientations shape responses to violations of the use of force and protection of civilians. The durability of international law depends on reconciling these positions through stronger multilateral enforcement, accountability mechanisms, and consistent adherence to legal norms.

4. Case Study I: Ukraine

4.1 Background

Russia's invasion of Ukraine in 2022 constituted a clear violation of Article 2(4) of the UN Charter. Ukraine's right to self-defense under Article 51 has been widely recognized, and international military assistance has been justified as collective self-defense. Russia's unprovoked invasion of Ukraine, once again raises the concern of international organizations and institutions for the great losses caused to the civilian population and vulnerable groups, the violation of human security as a whole. These international organizations and institutions seek to stop the conflict and if it is not possible to stop it, to enable the limitation of the war, the prevention and protection of the civilian population, the implementation of various rules, treaties, conventions with a humanitarian character to guarantee human security. In 2008 Russia invaded Georgia, occupied 20 percent of its territory, and got away with it. As a result, today we are all Georgians, in the sense that we are all victims of various forms of Russian aggression emanating from an emboldened Kremlin. The August 2008 invasion of Georgia was a Beta test for future aggression against Russia's neighbors and a dry run for the tactics and strategies that would later be deployed in the 2014 invasion of Ukraine(Whitmore 2021).

The weak international response to Russia's invasion of Georgia greenlighted Russia's subsequent military assault on Ukraine. Many senior officials of transatlantic governments who worked to mediate the conflicts over Georgia's breakaway regions of South Ossetia and Abkhazia condemned Russia's invasion, but also blamed then-Georgian President Mikheil Saakashvili for provoking Vladimir Putin.

Hence, the ceasefire agreement brokered by French President Nicolas Sarkozy was one-sided in favor of Moscow, while the subsequent EU report about the five-day war (incorrectly) blamed Georgia for firing the first shots(Bryza 2021).

Human Rights Watch states that all parties to the war seriously breached international laws governing war and caused many fatalities among civilians. HRW reported that no proof of intentional

attacks on non-combatants by Georgian troops had been discovered. The South Ossetian parliament and several schools and nurseries were used as military posts by South Ossetian troops and volunteer militias and targeted by Georgian artillery fire (HRW 2009). Russia is responsible for human rights violations, including loss of life, torture, disrespect of property and privacy occurring in Georgian breakaway regions of Abkhazia and South Ossetia as it had effective control of the territories after the 2008 Russo-Georgian war (European Court Of Human Rights 2021).

The international reaction to Russia's military campaign in Georgia was to prove remarkably muted, with Moscow suffering few negative consequences. On the contrary, EU leaders led calls for a ceasefire that appeared to favor Russian interests, while the US under the new Obama administration was soon calling for a reset in relations with the Kremlin. Understandably, many in Moscow interpreted this accommodating approach as an informal invitation for further acts of aggression in Russia's traditional sphere of influence. Six years after the Russo-Georgian War, Russia embarked on a far more comprehensive military campaign against Ukraine, where Moscow continues to occupy Crimea and large swathes of eastern Ukraine's Donbas region (Atlantic Council 2021).

Ukraine is now on the front lines of Russia's containment. Ukrainians are paying the highest price for this, in the lives of their people. If Ukraine failed to tackle Russia, the threat of Russian aggression would remain. Russian president Vladimir Putin has openly proclaimed the ideology of a return to a "historical Russia," a concept that has roots in religious, linguistic, and historical dimensions of the areas of Eurasia that were once part of the Russian Empire and subsequently the Soviet Union. Moreover, he has demanded that NATO reduce its activity in those countries he claims as part of "historical Russia," including Estonia, Latvia, Lithuania, Poland, and Finland (Wilson Center 2023).

Russia's unprovoked invasion of Ukraine according to Report by the Office of the High Commissioner for Human Rights (OHCHR), "the ongoing full-scale armed attack by the Russian Federation against Ukraine resulted in severe and widespread harm to civilians throughout the reporting period, including death; life-changing injuries; loss of homes and livelihoods; displacement; infrastructure destruction; deprivation of access to basic services; and trauma. Between 1 February and 31 July 2023, OHCHR recorded 4,621 civilian casualties, with 1,028 persons killed and 3,593 injured (1,883 men, 1,294 women, 139 boys, 94 girls, and 1,195 adults and 16 children whose sex is not yet known). Actual casualty numbers are likely higher. As military operations continued in southern and south-eastern Ukraine, civilians who remained in areas affected by hostilities faced daily attacks by explosive weapons with wide area effects: for example, 64 per cent of civilian casualties caused by shelling and multiple launch rocket system attacks recorded during the reporting period occurred in communities on or near the frontline, mainly in Donetsk, Kherson, Zaporizhzhia and Kharkiv regions" (OHCHR 2023).

4.2 Trump's Diplomatic Engagement

During his second presidency, Trump positioned himself as a mediator, engaging both Ukrainian and Russian leadership in pursuit of a negotiated settlement. U.S. military and intelligence assistance to Ukraine was, at times, conditioned on progress toward negotiations.

4.3 Legal Analysis

The rules of international humanitarian law are set out in a series of conventions and protocols. The following instruments form the core of modern international humanitarian law:

The Hague Regulations respecting the Laws and Customs of War on Land;

The Geneva Convention (I) for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field;

The Geneva Convention (II) for the Amelioration of the Condition of Wounded, Sick and Shipwrecked Members of Armed Forces at Sea;

The Geneva Convention (III) relative to the Treatment of Prisoners of War;

The Geneva Convention (IV) relative to the Protection of Civilian Persons in Time of War;

The Protocol Additional to the Geneva Conventions and relating to the Protection of Victims of International Armed Conflicts (Protocol I);

The Protocol Additional to the Geneva Conventions and relating to the Protection of Victims of Non-International Armed Conflicts (Protocol II) (OHCHR 2011).

The Hague Regulations are generally considered as corresponding to customary international law, binding on all States independently of their acceptance of them. The Geneva Conventions have attained universal ratification. Many of the provisions contained in the Geneva Conventions

and their Protocols are considered to be part of customary international law and applicable in any armed conflict (Henckaerts and Doswald-Beck 2005). From an international law perspective:

Diplomatic mediation aligns with Article 33 obligations.

However, pressure on Ukraine to accept territorial concessions as a condition for continued assistance risks violating the principle of sovereign equality.

Any settlement imposed through coercion or unequal bargaining power may undermine Ukraine's right to freely determine its political and territorial integrity. While Trump's strategy does not constitute unlawful intervention *per se*, it raises concerns regarding indirect coercion and the erosion of collective responses to aggression.

5. Case Study II: Gaza

5.1 Background

The Gaza conflict involves prolonged hostilities between Israel and Hamas, with Gaza widely regarded as subject to occupation under international law. The conflict has generated extensive civilian harm and allegations of serious violations of international humanitarian law. The innocent victims caused by these armed conflicts are the real evidence of the violation of international humanitarian laws, as among them we find unprotected domestic and foreign civilian populations of the conflict zone, journalists, personnel of international institutions and organizations and humanitarian organizations, engaged in helping the population affected by these conflicts.

In an overview of the old Israel-Palestine conflict, we see an escalation of violence and innocent victims on both sides. Gaza is controlled by Hamas, an Islamist militant group; it has been under an Israeli blockade since Hamas seized control in 2007, one so stringent that human rights groups liken the situation to an "open-air prison" (HRC 2006). The analysis of HAMAS indicates that the organization's name is Harakat Al-Muqawama Al-Islamia or Islamic Resistance Movement. The brief history indicates that HAMAS split from the Palestinian Muslim Brotherhood in 1987 and now contains two wings, a social service wing that purportedly runs clinics, kindergartens, and the like, and a terrorist wing that carries out attacks against Israeli targets. The favored tactic of HAMAS since 1994 has been suicide bombings. Under the categories of anti-American activities, the report indicates that although some United States citizens have died as a result of HAMAS bombings in Israel, the group has not intentionally targeted United States interests. Areas of HAMAS operations are in the West Bank and Gaza Strip. Under the category of strength and composition, it is reported that members of HAMAS are Palestinian Islamic radicals of unknown numbers. HAMAS has connections with other terrorist organizations, most notably the Palestinian Islamic Jihad. Sources of funding include the country of Iran and Palestinian expatriates around the world. HAMAS was originally designated as a Foreign Terrorist Organization October 8, 1997, and was re-designated as such both October 8, 1999, and October 5, 2001. Issues of concern for Congress regarding HAMAS include their significant financial resources and extensive international ties (NCJRS n.d.).

Currently, Israel is at war with Hamas-a conflict following a horrific rampage on October 7, 2023, in which militants from Hamas and Palestinian Islamic Jihad, another extremist group, launched attacks that killed more than 1,400 Israelis and took more than 240 hostage. Israel has responded with widespread bombardment of the Gaza Strip and a ground incursion, killing and injuring tens of thousands of Palestinians (HRC 2006). More than 200 people, Israelis and non-Israelis, babies, women and the elderly, civilians and soldiers - were taken captive by Hamas terrorists on October 7th and taken by force to Gaza (Joby, Shira 2023).

The terrorist attack of October 7 by Hamas against the defenseless Israeli civilian population was a living proof of the war philosophy of the terrorist organizations, which break every international legal norm, treaty, agreement, or international convention. The terrorist attack of October 7 caused a strong reaction of the international factor in support of the Israeli people and the State of Israel. For many experts in international humanitarian law, the attack contained all the elements of genocide according to the Convention on the Prevention and Punishment of the Crime of Genocide (CPPCG 1951). Immediately in the following days, there followed a multitude of visits by the leaders of Western countries to Israel, as well as military and financial support from the USA in aid of the State of Israel. It is worth mentioning that this anger towards the terrorist organization HAMAS was also caused by the fact that among the victims or hostages there were also many foreign citizens, such as Americans, English, etc. The terrorist attack of October 7 brought the Israeli state's commitment to a large-scale military attack in the Gaza Strip, with the aim of eliminating HAMAS, every cell and every military arsenal of it. However, according to the information of the intelligence services, the strategy of HAMAS is the organization and concealment between the civilian population and the residences or institutions in the function of the civilian population. Also in the Gaza Strip, Hamas operates and has bases installed in a very sophisticated and hidden underground network of tunnels in areas inhabited by the civilian population, including schools or health service centers such as hospitals. For this purpose, the Israeli army called on the

Palestinian population in the north of the Gaza Strip to leave this territory, as otherwise they will be identified as collaborators of the terrorist group HAMAS. According to the evaluations of many international organizations, including the UN or Amnesty International, such a movement within the required time frame is impossible and risks causing a humanitarian crisis. Declaring an entire city or a region so large and with such a dense population as a military target could cause a violation of international law. The number of people killed in Gaza is nearing the 9,000 mark amid mounting concerns over the aftermath of Israeli airstrikes on a densely-populated refugee camp near Gaza City, while a key hospital has stopped operations and UN humanitarian workers are unable to deliver aid to the north as the ground war intensifies. According to the Hamas-run Ministry of Health, 8,805 Palestinians have been killed since 7 October, including at least 3,648 children and 2,187 women, and some 22,240 have been injured, UN humanitarian coordination affairs office OCHA said (UN 2023).

Despite the protection that should be provided to all children by international law, during the first month of this war, there have been devastating reports of acts that are forbidden by international humanitarian law, including maiming, injury, abduction, forcible displacement, deprivation of medical care, food, and water. According to article 38 of the Convention on the Rights of the Child, States have an obligation to respect and ensure respect for the rules of international humanitarian law, and to take all feasible measures to ensure the protection and care of children affected by armed conflict (OHCHR 2023). The Committee calls for an end to the devastating harm being wreaked on children's lives in the occupied Palestinian Territory. We add our voice to those calling for an immediate ceasefire. We urge the immediate release of child hostages, with their caregivers, as a first urgent phase towards the release of all hostages. We call on all parties to protect all children and provide all the necessary medical and protective support, including psychological support, to begin the long process of overcoming the consequences of these grave violations. We plead that all humanitarian convoys be permitted to enter the Gaza Strip and provide humanitarian aid to all children in need, as required by international law (OHCHR 2023).

15 November 2023 - The Security Council has passed a resolution calling for the immediate release of all hostages held by Hamas, and for urgent and extended humanitarian corridors throughout the enclave to save and protect civilian lives (UN 2023).

5.2 Trump's Proposals

Trump advanced several proposals aimed at ending the conflict, including:

A ceasefire framework and hostage exchanges;

Disarmament of Hamas;

Transitional governance arrangements for Gaza.

Earlier proposals suggesting U.S. control or population relocation generated strong international criticism.

5.3 Legal Analysis

Under international law:

Ceasefires and negotiations are consistent with IHL and the UN Charter.

Forced displacement of civilians from Gaza would violate the Fourth Geneva Convention and could constitute a grave breach.

Any external administration of Gaza without Security Council authorization or consent of the Palestinian people risks violating the right to self-determination. Thus, while Trump's later peace initiatives align with humanitarian objectives, aspects of earlier proposals conflict with fundamental IHL and human rights norms.

6. Comparative Assessment

The Ukraine and Gaza cases reveal a pattern in Trump's foreign policy:

Preference for pragmatic negotiation over sustained military involvement;

Willingness to reinterpret or pressure existing legal frameworks;

Tension between efficiency in conflict resolution and adherence to international legal norms.

In both cases, Trump's actions highlight the fragility of the international legal order when powerful states prioritize expediency over institutional legality.

7. Conclusion

President Trump's second-term engagement with armed conflicts illustrates the complex relationship between international law and great-power politics. While his emphasis on diplomacy reflects the UN Charter's commitment to peaceful dispute resolution, certain strategies particularly those involving coercive bargaining or population transfer risk undermining core legal principles. Ultimately, Trump's legacy in international law will depend not only on whether conflicts were ended,

but on how they were resolved and whether fundamental norms of sovereignty, civilian protection, and self-determination were preserved.

The implementation of international humanitarian law is crucial for setting standards in conflicts. While the goal is to avoid war, if unavoidable, the law aims to limit damage to civilians, facilities, and combatants. In the Ukraine situation, implementing humanitarian law proved challenging. Despite Russia's global influence, an international arrest warrant for the Russian president for suspected war crimes exists.

References

1. Cassese, A. (2005). *International law* (2nd ed.). Oxford University Press.
2. Gray, C. (2018). *International law and the use of force* (4th ed.). Oxford University Press.
3. International Court of Justice. (1986). *Military and paramilitary activities in and against Nicaragua* (Nicaragua v. United States of America). ICJ Reports.
4. Koh, H. H. (2017). The Trump administration and international law. *American Journal of International Law*, 111(4), 708–716. <https://doi.org/10.1017/ajil.2017.67>
5. Schmitt, M. N. (2020). Targeted killing and the law of self-defense. *Journal of National Security Law & Policy*, 10(2), 1–28.
6. Meurant, Jacques. (September 1, 1987) "Inter Arma Caritas: Evolution and Nature of International Humanitarian Law." *Journal of Peace Research* 24, no. 3: 237–49. <https://doi.org/10.1177/002234338702400304>.
7. United Nations. (1945). Charter of the United Nations. <https://www.un.org/en/about-us/un-charter>
8. "Commission of Inquiry collecting evidence of war crimes committed by all sides in Israel and Occupied Palestinian Territories since 7 October 2023" (Press release). UN Office of the High Commissioner for Human Rights.
9. "International legal protection of human rights in armed conflict." n.d. https://www.ohchr.org/sites/default/files/Documents/Publications/HR_in_armed_conflict.pdf.
10. International Committee of the Red Cross, *Customary International Humanitarian Law*, by Jean-Marie Henckaerts and Louise Doswald-Beck (Cambridge University Press, 2005).
11. "S Ossetia 'war crimes' condemned". BBC News. 23 January 2009. Archived from the original on 26 January 2009. Retrieved 11 April 2009.
12. "Executive Summary". *Up in Flames*. Human Rights Watch. 23 January 2009. Archived from the original on 30 September 2012. Retrieved 26 April 2019.
13. "Up in Flames | Humanitarian Law Violations and Civilian Victims in the Conflict over South Ossetia." 2015. Human Rights Watch. April 29, 2015. <https://www.hrw.org/report/2009/01/23/flames/humanitarian-law-violations-and-civilian-victims-conflict-over-south>.
14. Dickinson, Peter. 2021. "The 2008 Russo-Georgian War: Putin's Green Light." Atlantic Council. August 7, 2021. <https://www.atlanticcouncil.org/blogs/ukrainealert/the-2008-russo-georgian-war-putins-green-light/>.
15. Makszimov, Vlad. 2021. "Strasbourg Court Rules Russia Has 'Direct Control' over Abkhazia, South Ossetia." *Www.euractiv.com*. January 21, 2021. <https://www.euractiv.com/section/europe-s-east/news/strasbourg-court-rules-russia-has-direct-control-over-abkhazia-south-os>.
16. Syzov, Vitaliy. 2023. "Four Reasons Why Supporting Ukraine Is a Good Investment | Wilson Center." *Www.wilsoncenter.org*. January 11, 2023. <https://www.wilsoncenter.org/blog-post/four-reasons-why-supporting-ukraine-good-investment>.
17. International Criminal Court. 2023. "Situation in Ukraine: ICC Judges Issue Arrest Warrants against Vladimir Vladimirovich Putin and Maria Alekseyevna Lvova-Belova." International Criminal Court. March 17, 2023. <https://www.icc-cpi.int/news/situation-ukraine-icc-judges-issue-arrest-warrants-against-vladimir-vladimirovich-putin-and>.
18. Beauchamp, Zack. 2023. "What Are Israel and Palestine? Why Are They Fighting?" *Vox*. November 9, 2023. <https://www.vox.com/2018/11/20/18080002/israel-palestine-conflict-history-overview-map>.
19. "Foreign Terrorist Organizations | Office of Justice Programs." n.d. *Www.ojp.gov*. <https://www.ojp.gov/ncjrs/virtual-library/abstracts/foreign-terrorist-organizations>.

20. Beauchamp, Zack. 2023. "What Are Israel and Palestine? Why Are They Fighting?" Vox. November 9, 2023. <https://www.vox.com/2018/11/20/18080002/israel-palestine-conflict-history-overview-map>.
21. Haaretz. n.d. "Hostages Held by Hamas: The Names of Those Abducted from Israel." Accessed January 4, 2024. <https://www.haaretz.com/israel-news/2023-10-22/ty-article-magazine/hostages-held-by-hamas-the-names-of-those-abducted-from-israel/0000018b-55f8-d5d2-afef-d5fdd04e0000>.
22. "Israel-Palestine Crisis: Gaza's North Cut off from Aid; Death Toll Rising | UN News." 2023. News.un.org. November 2, 2023. <https://news.un.org/en/story/2023/11/1143107>.
23. Nations, United. 2023. "The Situation in the Occupied Palestinian Territory and Israel." United Nations. November 22, 2023. <https://www.un.org/en/situation-in-occupied-palestine-and-israel>.

THE MONROE DOCTRINE RECONSIDERED: A REALIST DEFENSE OF U.S. REGIONAL HEGEMONY IN THE EMERGING WORLD ORDER

Mentor Isufaj

Phd., Department of Justice
Faculty of Political Sciences and Law
"Aleksandër Moisiu" University, Durrës

Abstract

The Monroe Doctrine, originally articulated in 1823 as a defensive policy against European colonialism in the Western Hemisphere, has undergone significant reinterpretation in the twenty-first century. In the context of an emerging multipolar world order, the doctrine is no longer a mere historical statement but a strategic framework invoked explicitly or implicitly to justify spheres of influence, geopolitical competition, and selective adherence to international law. This paper examines the evolution of the Monroe Doctrine, its contemporary applications, and its compatibility with modern international legal principles, particularly sovereignty, non-intervention, and collective security. It argues that the renewed use of Monroe Doctrine like logic reflects broader tensions between power politics and rule-based international order in the new world order. The reemergence of the Monroe Doctrine in contemporary United States foreign policy has drawn significant criticism from scholars of international law who view it as incompatible with the principles of sovereignty, non-intervention, and legal equality of states. This paper offers a realist defense of the modern application of Monroe Doctrine logic, arguing that U.S. regional primacy in the Western Hemisphere is not only consistent with the structural realities of the international system but also contributes to international stability. From a realist perspective, international law does not operate independently of power but is embedded within it. This paper contends that the Monroe Doctrine represents a pragmatic adaptation to multipolarity, reinforcing deterrence, reducing great-power competition in the Americas, and preserving regional order in a legally imperfect but politically necessary manner.

1. Introduction

The international system is undergoing a profound transformation marked by the decline of unipolar dominance, the rise of regional powers, and increasing challenges to the post-World War II legal and institutional framework. Within this context, historical doctrines are being reinterpreted to serve modern strategic objectives. One such doctrine is the Monroe Doctrine, a foundational element of United States foreign policy.

Originally designed to prevent European intervention in the Americas, the Monroe Doctrine has evolved into a broader justification for regional dominance and exclusion of external powers. In the twenty-first century, its logic reappears in debates over influence in Latin America, responses to extra-regional actors such as China and Russia, and broader discussions about spheres of influence. This paper explores how the modern use of the Monroe Doctrine intersects with international law and what this reveals about the emerging world order. The international system is undergoing a structural transition from post-Cold War unipolarity toward an increasingly multipolar order. As power diffuses and strategic competition intensifies, great powers have revived doctrines emphasizing regional control and exclusion of rival influence. In this context, the United States' renewed invocation of the Monroe Doctrine has become a focal point of debate in both international law and international relations scholarship.

Critics argue that the doctrine undermines the United Nations Charter and erodes the rule-based international order. Yet such critiques often rest on a legal idealism that underestimates the role of power in sustaining order. From a realist standpoint, international law reflects not restrains underlying distributions of power. This paper advances the thesis that the modern application of Monroe Doctrine logic is a legitimate and stabilizing expression of U.S. regional hegemony, consistent with realist theory and historically embedded within the evolution of international law itself.

Classical and structural realism posit that the international system is anarchic and that states prioritize survival and security above legal or moral considerations.¹ International law, from this perspective, does not constrain great powers in existential matters but serves as a coordinating mechanism where interests align.²

¹ Kenneth N. Waltz, *Theory of International Politics* (Reading, MA: Addison-Wesley, 1979), 88–93.

² Stephen D. Krasner, *Sovereignty: Organized Hypocrisy* (Princeton: Princeton University Press, 1999), 6–9.

Hans Morgenthau explicitly argued that international law “operates in a decentralized system of power” and cannot be detached from political reality.³ Similarly, Kenneth Waltz maintained that stability emerges not from legal norms but from balances or concentrations of power.⁴

The Monroe Doctrine, viewed through this lens, is not an aberration from international order but a functional mechanism for regional stability. By establishing a clear sphere of influence, the United States reduces uncertainty, deters external intervention, and minimizes the likelihood of great-power conflict in the Western Hemisphere.

2. Historical Origins of the Monroe Doctrine

The Monroe Doctrine was articulated by U.S. President James Monroe in 1823, asserting that further European colonization or intervention in the Western Hemisphere would be viewed as a hostile act. At the time, the doctrine had limited practical enforcement capability and relied heavily on British naval power.

Initially, the doctrine emphasized:

Non-colonization by European powers

Non-intervention in the political affairs of the Americas

Reciprocal U.S. non-interference in European affairs.

Throughout the nineteenth and early twentieth centuries, the doctrine evolved from a defensive principle into a tool for U.S. expansionism, most notably through the Roosevelt Corollary, which justified intervention in Latin American states under the pretext of maintaining stability.

3. The Monroe Doctrine in the Post-Cold War Era

Following the Cold War, the United States emerged as the dominant global power, seemingly rendering the Monroe Doctrine obsolete. However, rather than disappearing, its logic was absorbed into broader strategic concepts such as regional hegemony and security primacy.

In recent decades, the doctrine has resurfaced in:

U.S. opposition to Russian and Chinese influence in Latin America

Security narratives surrounding Venezuela, Cuba, and Nicaragua

Diplomatic rhetoric emphasizing the Western Hemisphere as a distinct strategic space.

Unlike its original formulation, the modern invocation of the Monroe Doctrine is less about colonialism and more about geopolitical competition and control over economic, military, and technological influence. *The Monroe Doctrine as a Historical Security Instrument*

The Monroe Doctrine, articulated in 1823, was fundamentally a security declaration rather than a legal instrument.⁵ It sought to prevent European powers from extending rival military and political influence into a region vital to U.S. security. Importantly, the doctrine emerged in a world lacking formal international legal institutions and should be understood as an early expression of regional security ordering.

Throughout the nineteenth and early twentieth centuries, the doctrine evolved alongside U.S. power capabilities. The Roosevelt Corollary expanded its scope, explicitly linking regional stability to U.S. intervention.⁶ While often criticized, this evolution reflected the logic that weak governance in the Americas could invite external intervention, thereby threatening U.S. security.

From a realist perspective, these interventions were not violations of an established legal order but contributors to the emergence of a stable regional hierarchy.

4. International Law and the Principle of Non-Intervention

Modern international law, particularly as codified in the United Nations Charter, rests on principles that appear to conflict with Monroe Doctrine-style thinking. These include:

Sovereign equality of states

Prohibition on the use of force

Non-intervention in internal affairs

The assertion of exclusive spheres of influence challenges these principles by implying unequal rights among states based on geography or power. While powerful states may justify such policies under national security or regional stability, international law does not formally recognize unilateral doctrines that override sovereign consent. *International Law and the Limits of Sovereign Equality*

³ Hans J. Morgenthau, *Politics Among Nations* (New York: Knopf, 1978), 286.

⁴ Waltz, *Theory of International Politics*, 118.

⁵ James Monroe, “Seventh Annual Message to Congress,” December 2, 1823.

⁶ Theodore Roosevelt, “Fourth Annual Message to Congress,” December 6, 1904.

The United Nations Charter enshrines the principle of sovereign equality, yet realist scholars have long observed that this principle is more formal than substantive.⁷ In practice, states possess vastly unequal capacities to shape outcomes, enforce norms, and absorb costs.

Article 2(4) of the UN Charter prohibits the use of force, but its enforcement depends on the very great powers it seeks to restrain.⁸ Similarly, the principle of non-intervention has been repeatedly subordinated to security imperatives, humanitarian claims, and geopolitical competition.

The Monroe Doctrine does not uniquely violate international law; rather, it reflects the structural reality that powerful states shape regional orders. The legal system tolerates this behavior implicitly, as evidenced by the lack of meaningful enforcement against great-power spheres of influence.

5. Spheres of Influence and the New World Order

The reemergence of Monroe Doctrine-like policies is not unique to the United States. Russia's claims over its "near abroad" and China's strategic posture in the South China Sea reflect similar approaches. This convergence suggests a shift toward a world order where power politics increasingly overshadow legal norms.

In this emerging system:

International law is selectively interpreted rather than universally applied

Great powers assert regional dominance while rejecting similar claims by rivals

Multilateral institutions struggle to enforce norms consistently.

The Monroe Doctrine thus serves as a case study of how historical doctrines are repurposed to legitimize contemporary geopolitical strategies.

The Modern Revival: Strategic Competition in the Americas:

The renewed relevance of Monroe Doctrine logic stems from intensified extra-regional engagement by China and Russia in Latin America. Chinese infrastructure investments, technological penetration, and military cooperation agreements represent long-term strategic positioning.⁹ Russian military presence and arms transfers further challenge U.S. regional dominance.

From a realist perspective, allowing rival great powers to establish military or strategic footholds in the Western Hemisphere would constitute a severe security failure. The Monroe Doctrine provides a clear deterrent signal, reducing miscalculation and escalation.

Importantly, this approach does not require constant intervention; its primary function is preventive. By signaling resolve, the doctrine reduces the likelihood of direct confrontation, thereby contributing to regional and global stability.

Spheres of Influence as Stabilizing Structures:

Although often criticized in normative terms, spheres of influence have historically reduced the likelihood of great-power war.¹⁰ The Cold War division of Europe, while legally imperfect, provided predictability and deterrence.

The Monroe Doctrine operates similarly. By asserting regional primacy, the United States limits strategic ambiguity and discourages external powers from testing boundaries. This clarity aligns with realist assumptions that order emerges from hierarchy rather than legal equality.

Critics who condemn U.S. regional dominance while tolerating similar behavior by other powers implicitly acknowledge the functional necessity of such arrangements.

Addressing Legal and Normative Critiques:

Legal critics argue that the Monroe Doctrine undermines Latin American sovereignty. However, sovereignty in international law has never implied immunity from great-power influence.¹¹ Smaller states routinely navigate asymmetric relationships to secure economic and security benefits.

Moreover, the U.S.-led hemispheric order has coincided with the absence of inter-state great-power warfare in the Americas for over a century. From a realist cost-benefit perspective, this outcome outweighs abstract legal inconsistencies.

International law remains relevant, but only insofar as it accommodates the strategic imperatives of systemically significant states.

6. Legal and Normative Implications: the Monroe Doctrine and the New World Order

As multipolarity intensifies, regional orders anchored by dominant powers are likely to proliferate. The Monroe Doctrine represents an early and enduring model of such ordering. Rather than signaling

⁷ Martti Koskeniemi, *From Apology to Utopia* (Cambridge: Cambridge University Press, 2005), 17–20.

⁸ United Nations Charter, art. 2, para. 4.

⁹ Evan Ellis, *China in Latin America: The Whats and Wherefores* (Boulder: Lynne Rienner, 2018).

¹⁰ John J. Mearsheimer, *The Tragedy of Great Power Politics* (New York: Norton, 2001), 41–43.

¹¹ Krasner, *Sovereignty*, 24–27.

legal decay, it reflects a transition toward decentralized stability mechanisms. Attempts to enforce strict legal universalism in a competitive multipolar system risk increasing instability by denying power realities. A realist accommodation of regional hierarchies may better preserve peace than rigid legal formalism. The renewed relevance of the Monroe Doctrine raises critical questions about the future of international law. If spheres of influence become normalized, the foundational legal principles of sovereignty and equality risk erosion. Smaller states may find their legal rights subordinated to strategic calculations made by major powers. However, defenders argue that international law has always operated alongside power realities and that regional stability sometimes necessitates informal hierarchies. This tension underscores the fragile balance between normative ideals and geopolitical practice in the new world order.

During news conference at the Mar-a-Lago resort in Florida, (January, 03, 2026), the US president commented on how the Venezuelan operation advanced his "American First" priorities.

The action in Venezuela, Trump said, shows that "American dominance in the Western Hemisphere will never be questioned again".

Trump has said the attack closely aligns with the "Monroe Doctrine" - named after the fifth president of the US, James Monroe, which Trump rebranded the "Donroe Doctrine".¹²

The US seizing of Venezuela's leader has faced strong criticism from both America's friends and foes at an emergency meeting of the United Nations Security Council.

Many member states agreed with the US that Nicolás Maduro had been an illegitimate and repressive leader.

But many also condemned the US military action as a breach of international law and the UN Charter, and they demanded a democratic transition that reflected the will of the Venezuelan people.

Among US allies, France was by far the most outspoken. The deputy ambassador, Jay Dharmadhikari, said Maduro's taking by the US runs "counter to the principle of peaceful dispute resolution and runs counter to the principle of the non-use of force".

He told the Council: "The proliferation of violations of the Charter of the UN and the violations of international law by states vested with responsibility as permanent members of Security Council chips away at the very foundation of the international order, contravening the principles of the charter, including the principle of respect for independence and territorial integrity of states, undermines the foundation of the UN and weakens international peace and security."¹³

The deputy UN ambassador for Denmark, Sandra Jensen Landi, voiced her country's "deep concern" at the evolving situation and said: "These developments constitute a dangerous precedent. International law and the UN Charter... must be respected."

Both these statements – by France and Denmark - represent a significant stiffening of European criticism of the seizing of Maduro after some initial equivocation by many EU members. In contrast, both UK and Greek diplomats at the UN did not condemn the US military operation.

Colombia's ambassador Leonor Zalabata Torres said there is no justification for the unilateral use of force to commit an act of aggression: "Such actions constitute a serious violation of international law and the UN Charter."

Russia's ambassador, Vassili Nebenzia, accused the US of "international banditry" and "neo-colonialism and imperialism".

He said there was no justification for "US domination by force" and accused US allies of hypocrisy and double standards for failing to criticise Trump.

China's Chargé d'Affaires, Sun Lei, said Beijing was "deeply shocked and strongly condemned" what he called the "unilateral, illegal and bullying acts of the US".

In a statement read out on his behalf, Antonio Guterres, the UN Secretary General, said he remained "deeply concerned that rules of international law have not been respected" during the US action: "The power of the law must prevail."

By contrast, the acting UK ambassador, James Kariuki, gave a very brief statement, saying merely the UK wanted to see a "safe and peaceful transition to a legitimate government that reflects the will of the Venezuelan people".

He added, without being specific, that the UK "reaffirms its commitment to international law and the principles enshrined in the charter of the UN". Greece's deputy ambassador, Ioannis Stamatekos, also failed to condemn Trump's seizure of Maduro, calling instead for "dialogue and diplomacy" to resolve the

¹² <https://www.bbc.com/news/live/c5yqygxe41pt?post=asset%3Ac63dc58-ce5a-4807-b0a2-53c6157e418c#post>

¹³ James Landale, US sharply criticised by foes and friends over Maduro seizure, <https://www.bbc.com/news/articles/cwy1812n13eo>

crisis. For the US, UN ambassador Mike Waltz said the capture of Maduro was a law-enforcement operation against an illegitimate leader responsible for both drug trafficking and terrorism. "You can't turn Venezuela into the operating hub for Iran, for Hezbollah, for gangs, for the Cuban intelligence agents and other malign actors that control that country," Waltz told the Council. "You cannot continue to have the largest energy reserves in the world under the control of adversaries of the US."¹⁴

7. Conclusion

The modern reinterpretation of the Monroe Doctrine illustrates the ongoing struggle between rule-based international order and the reassertion of power politics. While framed as a security doctrine, its contemporary use challenges key principles of international law and reflects broader systemic changes in global governance.

As the world moves toward a more multipolar structure, the persistence of doctrines rooted in exclusivity and dominance suggests that international law will continue to be shaped and constrained by the strategic interests of powerful states. The Monroe Doctrine, far from being a relic, remains a revealing lens through which to examine the legal and political dynamics of the emerging world order.

The modern invocation of the Monroe Doctrine should be understood not as a rejection of international law but as a realist adaptation to structural change in the international system. While it challenges idealized notions of sovereignty and equality, it reinforces deterrence, reduces uncertainty, and preserves regional stability.

International law has never existed independently of power. The Monroe Doctrine exemplifies how legal norms and hegemonic authority interact to produce order in an anarchic system. In the emerging world order, such arrangements are not only inevitable but necessary.

References

1. United Nations Charter (1945)
2. Monroe, J. (1823). *Seventh Annual Message to Congress*
3. Koskenniemi, M. (2001). *The Gentle Civilizer of Nations*
4. Ikenberry, G. J. (2011). *Liberal Leviathan*
5. Kenneth N. Waltz, *Theory of International Politics* (Reading, MA: Addison-Wesley, 1979), 88–93.
6. Stephen D. Krasner, *Sovereignty: Organized Hypocrisy* (Princeton: Princeton University Press, 1999), 6–9.
7. Hans J. Morgenthau, *Politics Among Nations* (New York: Knopf, 1978), 286.
8. Waltz, *Theory of International Politics*, 118.
9. James Monroe, "Seventh Annual Message to Congress," December 2, 1823.
10. Theodore Roosevelt, "Fourth Annual Message to Congress," December 6, 1904.
11. Martti Koskenniemi, *From Apology to Utopia* (Cambridge: Cambridge University Press, 2005), 17–20.
12. United Nations Charter, art. 2, para. 4.
13. Evan Ellis, *China in Latin America: The Whats and Wherefores* (Boulder: Lynne Rienner, 2018).
14. John J. Mearsheimer, *The Tragedy of Great Power Politics* (New York: Norton, 2001), 41–43.
15. Krasner, *Sovereignty*, 24–27.
16. <https://www.bbc.com/news/live/c5yqygxe41pt?post=asset%3Acf63dc58-ce5a-4807-b0a2-53c6157e418c#post>

¹⁴ James Landale, *US sharply criticised by foes and friends over Maduro seizure*, <https://www.bbc.com/news/articles/cwy1812n13eo>

Medical sciences

IMPACT OF PULMONARY HYPERTENSION ON THE FORMATION OF CIRCADIAN BLOOD PRESSURE PROFILE IN PATIENTS WITH SEVERE COPD

Babets A.A.¹

Konopkina L.I.¹

Dziublyk Ya.O.²

Shchudro O.O.¹

Dnipro State Medical University¹

State organization "National scientific center of phthisiology, pulmonology, and allergology named after F. G. Yanovsky NAMS of Ukraine"²

Introduction. Pulmonary hypertension (PH) is one of the key complications of severe chronic obstructive pulmonary disease (COPD) and has a significant impact on cardiopulmonary hemodynamics and patient prognosis. At the same time, interpretation of ambulatory blood pressure monitoring (ABPM) results in this patient population may be complicated by the phenomenon of pseudonormalization of blood pressure due to limited cardiac reserve. In this context, evaluation of echocardiographic signs of PH according to the type of circadian blood pressure profile in patients with severe COPD is of particular clinical relevance.

Aim. To assess echocardiographic features of PH in patients with severe COPD and arterial hypertension depending on the type of circadian blood pressure profile.

Materials and Methods. A total of 40 patients with severe COPD (GOLD III, FEV₁ 32 (28; 34)% of predicted) and comorbid arterial hypertension receiving ICS-containing inhalation therapy were examined. According to ABPM results, patients were divided into two subgroups: subgroup 1 with a formally physiological circadian blood pressure profile ($n = 21$) and subgroup 2 with a pathological circadian blood pressure profile ($n = 19$). All patients underwent Doppler echocardiography with assessment of maximal tricuspid regurgitation velocity, systolic pulmonary artery pressure (sPAP), interventricular septal eccentricity index, pulmonary artery diameter, inferior vena cava (IVC) diameter and collapsibility, as well as the presence of pericardial effusion.

Results. In patients with severe COPD, echocardiographic signs of PH differed significantly depending on the type of circadian blood pressure profile.

In subgroup 1, maximal tricuspid regurgitation velocity was significantly higher compared with subgroup 2 and amounted to 3.1 (2.8; 3.6) m/s versus 2.8 (2.4; 3.2) m/s, respectively ($p < 0.05$). In three patients from subgroup 1 (14.3%), tricuspid regurgitation velocity exceeded 3.4 m/s, indicating a high probability of PH; systolic pulmonary artery pressure in these patients reached 48, 52, and 54 mmHg.

Median sPAP values were significantly higher in subgroup 1 than in subgroup 2 (35.0 (30.0; 48.0) mmHg vs 30.0 (25.0; 35.0) mmHg, $p < 0.05$). Notably, cases of moderate PH were observed exclusively in subgroup 1, whereas all PH cases in subgroup 2 corresponded to a mild degree.

Analysis of additional echocardiographic markers demonstrated that subgroup 1 was characterized by a significantly higher prevalence of structural and hemodynamic signs of elevated pulmonary artery pressure. An interventricular septal eccentricity index > 1.1 was detected in 66.7% of patients in subgroup 1 compared with 15.8% in subgroup 2. Pulmonary artery dilatation was observed in 61.9% and 21.1% of patients, respectively.

Signs of elevated right heart filling pressure, including reduced IVC collapsibility and the presence of pericardial effusion, were found exclusively in subgroup 1 (19.0% and 14.3%, respectively).

Overall, echocardiographic signs of PH were diagnosed in 95.2% of patients in subgroup 1 and only in 36.8% of patients in subgroup 2 ($p < 0.05$). Odds ratio analysis showed that the presence of PH in patients with severe COPD was associated with a 34-fold increase in the likelihood of a formally physiological circadian blood pressure profile (OR = 34.3; 95% CI 3.7–313.8; $p = 0.002$).

Conclusions. In patients with severe COPD, a formally physiological circadian blood pressure profile is associated with a higher prevalence and greater severity of echocardiographic signs of PH. Normal ABPM values in this patient population may reflect blood pressure pseudonormalization caused by limited cardiopulmonary reserve due to progression of PH.

Keywords: Pulmonary hypertension; Chronic obstructive pulmonary disease; Ambulatory blood pressure monitoring; Echocardiography; Cardio-pulmonary interaction

Pedagogical sciences

CRITERION-BASED ASSESSMENT OF LISTENING SKILLS FOR SECONDARY SCHOOL STUDENTS (GRADES 7-8)

Daurenova Diana Daurenkyzy

4th Year Bachelor student

"6B01701-Teacher of two foreign languages"

KazUIR & WL Ablai Khan

Almaty, Kazakhstan

Zhumabekova Galiya Baiskanovna

Candidate of Pedagogy, Professor

KazUIR & WL Ablai Khan

Almaty, Kazakhstan

Abstract

This article argues for the evaluation of one of the most pivotal components of language in secondary stage of education, especially Kazakhstani schools. Listening comprehension is fundamental skill, yet it may be challenging in assessing in foreign language classrooms as discrete-point testing methods remain. This type of assessment may prioritize correct answers over understanding a gist of listening materials and its interpretation, therefore it has a potential to limited language competence. For the majority of secondary school students in EFL classrooms it may cause later issues in communication as they tend to lack of inference or interpretation. Considering different approaches, the study introduces a theoretical framework for criterion-based assessment (CBA) of listening skills for students in secondary school (Grades 7-8) due to the need in transition towards a descriptive and performance-focused approach in this stage. Based on the qualitative research, the article summarizes key insights of existing language testing theory, researches on listening and global evaluation. It does not include empirical data, the framework is constructed through literature review and its synthesis. Major models of listening comprehension (e.g. made by Buck or Field) and other cognitive theories regarding listening processes were the basis for finding the nature of target skill. It may be identified as an active meaning-making process that involves both bottom-up and top-down processing. Consequently, secondary school learners need several core elements in order to foster a strong foundation in a language competence that may include understanding of both main idea and specific details, the ability to make basic inference in context. These constructs align with assessment criteria provided by the descriptive philosophy in the Common European Framework of Reference for Languages. It highlights the way criterion-based descriptors may be organized across a limited set of proficiency levels that can be suitable for the A2-B1 range that is associated with secondary school learning. The framework proposes the significance of clarity and practical implementation, ensuring that the criteria are accessible to educators and meaningful for learners. Based on the aforementioned data, this paper is aimed at sharing key insights in CBA of listening comprehension as it may facilitate learning process through transparency and consistency.

Keywords: listening assessment, secondary stage of education, listening sub-skills, evaluation framework, criterion-based assessment, competence, inference.

Introduction

The evaluation of listening skill poses significant challenge in language education due to its covert and internally mediated nature. Unlike speaking or writing, the progress in listening comprehension may not be seen vividly, leading to some difficulties in identifying what learners have understood and whether they could grasp a whole concept of materials. Therefore, a variety of educators relies on multiple-choice or short answer questions, examples of discrete-point testing formats. While it may offer easy and quick grading, the true information about learner's understanding and the multidimensional nature of listening is likely to be left, that may be result in knowledge gaps. In this case, students may lose the ability to understand a context, which is essential as otherwise it hinders the development of communicative language. For the majority of students in foreign language classrooms, it is a serious issue as a variety of them fail to interpret the information. It may root in the type of assessment that was implemented throughout language learning. For secondary school learners in grades 7-8, it is an integral period when they shift from basic understanding towards more comprehensive and strategic language use. However, listening tasks may cause difficulty in interpreting the meaning beyond isolated words or phrases. This is

why assessment should not only measure final results of question answers, but also they should foster environment with clear criteria which can also measure the ongoing development by considering listening sub-skills as well. According to Brown (2004), traditional norm-referenced approach focus on limited scope of diagnostic value ranking learners to one another.

As a reaction towards these limitations, criterion-based assessment (CBA) has gained the attention in both research and practice. CBA offers the usage of scoring guides or rubrics that are smaller parts of standardized learning objectives. It might be helpful in assessing based on criteria, not a number, and it allows students to be aware of the aspects by which their works will be evaluated. Utilizing CBA may show areas in learning process, which cause difficulties in each student. Consequently, despite longer amount of time required for grading, educators are likely to tailor teaching style more efficiently and ensure quality education in classrooms. Black and William (1998) revealed that aiming at transparency, feedback and the use of evaluation findings criterion-based assessment is close to formative assessment principles. In terms of listening comprehension, a clear conceptualization of listening is needed if one would like to implement CBA. According to Buck (2001) and Field (2008), research in listening theory demonstrates that it is an active, meaning-oriented process grounded in the interaction of top-down interpretive mechanisms and bottom-up decoding. It can be seen that listening is highly demanding, cognitively complex and context-dependent process. Therefore, this article will explore existing information regarding listening comprehension and criterion-based assessment in order to propose its implementation in secondary school.

Theoretical Foundations of Criterion-Based Assessment

Listening comprehension is said to be a complex skill, which is different from other three (reading, writing, speaking) in terms of the progress monitoring. Vandergrift and Goh (2012) investigated this topic and found out that effective listening assessment should be rooted in an explicit model of listening comprehension. This may address its complexity and issue with the developmental progression among learners. During secondary school, especially grades 7-8 might struggle in foreign language classrooms due to a variety of reasons, yet listening and its evaluation are likely to be the foremost. Classroom assessment of listening comprehension can fail due to some obstacles in differentiation between types of understanding or levels of performance, leading to the learning environment with little support. As educators tend to organize classes on the basis of the results in tests or assignments, traditional assessment of listening might offer limited information about the strengths and weaknesses of students. On the contrary, criterion-based assessment has the potential to facilitate listening evaluation through clear descriptors that might be more precise and pedagogically informative. According to Kunanbayeva (2021), there has been a shift towards competence-based education, which values the development of transferable skills and the alignment between learning outcomes and assessment. This competence-based approach may be embodied in international frameworks such as the Common European Framework of Reference for Languages (CEFR), which has clear listening descriptors framed in "can do" statements suitable for action-oriented focus in evaluation (Council of Europe, 2020). It aligns with core principles of CBA such as the description of learner is able to do independently from peers in terms of specific competencies according to Brown (2004). In grades 7-8 among Kazakhstani students it is especially significant as learners may be used to the learning environment of previous classes, where the focus was on the collective collaborations and group assessments. In addition, learners of this age group may demand transparent and developmental descriptors in order to be aware of their goal in learning process as they become more conscious about their studies. Fulcher (2010) points out that CBA's key points interlinked with well-constructed evaluation descriptors that are not abstract. In terms of listening, this can require deeper analysis of what the skill includes, for instance, speech perception, bottom-up processing at the sentence level, conceptual or top-down processing (Buck, 2001).

Core Listening Constructs for Assessment

To evaluate listening effectively, a definition and break-down of listening sub-processes should be considered. According to Field (2008), listening is not simply the passive reception of sound waves but an active and constructive task. It follows by Vandergrift and Goh's investigation (2012) which may demonstrate listening encompasses the processing continuum from bottom-up processing theories that include the decoding of sounds at the phoneme, word, and sentence levels to top-down processing that emphasizes the utilization of prior linguistic and semantic understandings of the material being communicated. It is crucial to note that these processes are not sequential, but interactive and mutually supportive. While top-down expectations about the topic foster a listener to recognize relevant vocabulary helping bottom-up decoding, it might be vice versa. Bottom-up processing may trigger a rapid top-down reanalysis of a

context. Therefore, the proper assessment should not only focus on this two processes, but also on their integration.

A grade level analysis for the listening audience in grades 7-8 with more sophisticated listening skills would take into account several critical components such as the comprehension of main idea or gist, making inferences, understanding specific details, cohesion and discourse structure. According to Buck (2001), these skills are essential in designing rubrics of assessment. Comprehension of the gist refers to the learner's understanding of the central topic of a conversation, lecture or other audio materials, while understanding of specific details implies the recognition of detailed information during listening. It is interlinked with the ability to make an inference or the application of deduction to grasp a meaning expressed through attitude and voice, which also needs cohesion and discourse structure. The latter may be explained as the process of tracing the logical structure of extended speech.

Principles for CBA of Listening

Based on these foundations, the design process for a CBA framework in listening should follow these guidelines:

a) *Construct Validity*: Listening tasks and criteria should reflect genuine tests of the listening constructs they intend to measure (Buck, 2001).

b) *Clarity and Transparency*: The language used in performance criteria and levels must be clear for teachers as well as for the students (Brookhart, 2013).

c) *Developmental Appropriate Levels*: The descriptors should cover an ability range that is appropriate to the age group and level of ability, from A2 to B1 in the CEFR framework. This is usually during the period of grades 7-8.

d) *Usability*: The rubric should serve summative purposes in order to grade, but also serve formative purposes to give feedback (Black & Wiliam, 1998 Contextual Alignment). The criteria for judgement need to have connections with overall curricular objectives and competency-based outcomes (Kunanbayeva, 2021)

A Proposed Framework for Grades 7-8

The aforementioned investigation of existing literature about criterion-based assessment and listening comprehension might be helpful in designing the framework for evaluation. For instance, the proposed framework in Table 1, which integrates CEFR's descriptive philosophy along with Brookhart's rubric design (2013), can be implemented for grades 7-8 for listening assessment. It is organized around key listening constructs and based on the principles mentioned earlier.

Table 1.

Criterion	Level 1: Developing	Level 2: Proficient	Level 3: Advanced
Comprehension of Gist	Identifies only isolated and familiar words, cannot discern main topic	Can correctly identify the main topic or general purpose of short, clear monologues/dialogues on familiar topics	Can summarize the central idea and purpose of longer and slightly more complex audios
Comprehension of Specific details	Can extract 1-2 details when information is given with a slow pace	Can extract key explicit details (place, time, reason) from straightforward audio	Can extract details, even with some competing or faster speech
Making Inferences	Can struggle to move beyond literal meaning, inferences are often incorrect or absent	Can make simple and plausible inference about speaker feeling or intent in familiar contexts	Can make appropriate inference about attitudes, relationships and implicit meaning in less predictable contexts
Task Fulfillment	Responses are largely incomplete or irrelevant	Responses are mostly complete and relevant	Responses are fully complete, relevant and demonstrates efficient listening strategies

This article proposes this framework on a basis of theoretical data analysis, but it may be further enhanced through deeper research. Implementing such a framework might require a shift from "scoring tests" to more complex evaluation. The framework enables differentiated feedback as instead of merely marking an answer wrong, a teacher can note, for example, "You identified the gist well, but listen again for the specific time the event starts" (addressing Criterion 2).

Conclusion

This article has argued for the adoption of a theoretically grounded, criterion-based framework for assessing the listening skills of secondary school students in grades 7-8. By merging the modern approaches to the activity of listening as an interactive cognitive process and the well-established tenets of criterion-related language evaluation, this new framework provides a pedagogically well-informed and

theoretically consistent alternative to conventional and frequently reductionist evaluation procedures. The great strength of this framework is that it is aligned in two ways: it puts a premium upon the description and international framing of the CEFR (Council of Europe, 2020), and yet at the same time leverages the pedagogical power of rubric evaluation (Brookhart, 2013). This enables a shift from error measurement to a description of the process of acquisition.

It is essential to recognize that the framework, as discussed, is essentially a conceptual framework. The effectiveness, detail refinement of performance levels, and overall effectivity in terms of learning outcome need to be tested empirically. However, from the theoretic standpoint, the viability is convincing. A criterion-based assessment framework is equipped with great potential to overhaul the concept of listening assessment in the language learning class. It can significantly alter the percept from having an assessment as an end point to an integrated part of the process. It essentially provides learners with clear-cut aims and objectives ('can-do's) and teachers with diagnosing tools.

References

1. Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7–74. <https://doi.org/10.1080/0969595980050102>
2. Brookhart, S. M. (2013). *How to create and use rubrics for formative assessment and grading*. ASCD.
3. Brown, H. D. (2004). *Language assessment: Principles and classroom practices*. Pearson Education.
4. Buck, G. (2001). *Assessing listening*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511732959>
5. Council of Europe. (2020). *Common European Framework of Reference for Languages: Learning, teaching, assessment – Companion volume*. Council of Europe Publishing.
6. Field, J. (2008). *Listening in the language classroom*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511575945>
7. Fulcher, G. (2010). *Practical language testing*. Hodder Education.
8. Kunanbayeva, S. S. (2021). *Competence-based modelling of professional foreign language education*.
9. Vandergrift, L., & Goh, C. C. M. (2012). *Teaching and learning second language listening: Metacognition in action*. Routledge. <https://doi.org/10.4324/9780203843376>

FROM POLICY INTENTIONS TO CLASSROOM REALITIES: TEACHERS' READINESS FOR DEEP LEARNING PEDAGOGY IN THE GREEK EDUCATIONAL CONTEXT. A CRITICAL LITERATURE REVIEW

Gerasimos Kalogeratos

Department of Management Science and Technology, University of Patras, Greece

Eleni Anastasopoulou

Experimental Elementary

School of University of Patras, Patras, Greece

Konstantina Gkika

2nd Special Primary School of Patras, Patras, Greece.

Athina Spanou

Junior High School of Panopoulo, Ilea, Greece

Triada Kapota

Elementary School of Varda, Ilea, Greece

Abstract

Over the past two decades, educational systems worldwide have undergone profound transformations driven by technological advancement, socio-economic change, and the increasing demand for 21st-century competencies. In this evolving landscape, deep learning pedagogy has emerged as a dominant educational paradigm, emphasizing meaningful understanding, critical thinking, collaboration, and the application of knowledge in authentic contexts. Despite its growing prominence in international policy discourse, the practical enactment of deep learning remains uneven, particularly in highly centralized education systems.

This literature review critically examines teachers' readiness to adopt deep learning pedagogy within the Greek educational context. Drawing on international and Greek scholarly literature, the review explores the interrelationship between technological pedagogical knowledge, 21st-century competencies, and educational policy reforms. The findings indicate that teacher readiness in Greece is shaped not only by individual technological skills but also by structural constraints, institutional culture, and policy discontinuities. The review concludes that sustainable implementation of deep learning pedagogy requires systemic alignment between teacher professional development, curriculum reform, and school-level support structures.

Keywords: deep learning pedagogy; teacher readiness; Greek education system; TPACK; 21st-century skills; educational reform

1. Introduction

In the context of rapid digitalization and global uncertainty, education systems are increasingly called upon to prepare learners for complex, unpredictable futures. Contemporary educational discourse emphasizes the development of transferable competencies such as critical thinking, creativity, collaboration, and digital literacy commonly framed as 21st-century skills [1-3]. These demands have catalyzed a paradigmatic shift from content-driven instruction toward learner-centered and transformative pedagogies [1-3].

Deep learning pedagogy represents one such response to these challenges. Rather than prioritizing rote memorization or procedural knowledge, deep learning focuses on meaning-making, reflective thinking, and the ability to transfer knowledge across contexts. However, the successful enactment of this pedagogical approach depends largely on teachers' readiness to redesign instructional practices, integrate technology pedagogically, and navigate ongoing educational reforms [4-8].

In Greece, the issue of teacher readiness is particularly salient. The Greek education system is characterized by strong centralization, curriculum rigidity, and a long-standing examination-oriented culture. Although recent reforms have introduced digital platforms, competency-based curricula, and professional development initiatives, significant gaps persist between policy intentions and classroom practice. This review aims to synthesize existing literature to examine how teachers' readiness for deep learning pedagogy is conceptualized and enacted within the Greek educational landscape [9-12].

2. Methodological Approach

This study adopts a critical narrative literature review methodology, allowing for the synthesis and interpretation of theoretical frameworks and empirical findings relevant to teacher readiness and deep learning pedagogy. Sources were identified through searches in Scopus, Web of Science, ERIC, and Google

Scholar using keywords such as deep learning pedagogy, teacher readiness, Greek education, TPACK, digital competence, and 21st-century skills [13-16].

Priority was given to peer-reviewed journal articles, policy documents from the Greek Ministry of Education, and reports from European and international organizations (e.g., OECD, European Commission). Both international literature and Greek empirical studies were included to ensure contextual relevance [16-18].

3. Conceptualizing Deep Learning Pedagogy

The concept of deep learning originates from the seminal work of Marton and Säljö, who distinguished between surface and deep approaches to learning. Deep learning involves active engagement with ideas, conceptual understanding, and the integration of new knowledge with prior experiences. In contrast, surface learning is characterized by memorization and minimal cognitive engagement [18-22].

In contemporary pedagogy, deep learning extends beyond cognitive depth to include social, emotional, and ethical dimensions. Frameworks such as New Pedagogies for Deep Learning emphasize student agency, collaboration, real-world problem-solving, and the strategic use of digital technologies. Importantly, deep learning pedagogy should not be confused with deep learning in artificial intelligence; rather, it refers to a pedagogical orientation toward transformative learning experiences [23-28].

4. Teacher Readiness as a Multidimensional Construct

Teacher readiness is increasingly understood as a multidimensional construct encompassing cognitive, affective, and contextual components. It includes teachers' beliefs about teaching and learning, self-efficacy, professional identity, and capacity to adapt to innovation [29-30].

In the Greek context, research suggests that teachers often demonstrate strong subject-matter knowledge but experience uncertainty when asked to adopt student-centered and inquiry-based approaches. This uncertainty is amplified by limited autonomy in curriculum design, high administrative demands, and insufficient time for collaborative planning. Consequently, readiness cannot be reduced to individual competence but must be situated within broader institutional and policy environments [29-30].

5. Technological Pedagogical Knowledge and the Greek Context

The TPACK framework has been widely used to analyze teachers' capacity to integrate technology meaningfully into instruction. In Greece, national initiatives such as the Digital School, the e-me platform and the introduction of interactive textbooks have aimed to enhance digital teaching practices [31-32].

Despite these initiatives, empirical studies indicate that technology use in Greek classrooms often remains at a substitutional level, reinforcing traditional teacher-centered instruction. Teachers frequently report confidence in basic digital tools but limited understanding of how technology can support inquiry, collaboration, and deep learning. This pattern reflects a broader tendency to treat technology as an add-on rather than as a catalyst for pedagogical transformation [31-32].

6. 21st-Century Skills and Curriculum Reform in Greece

The integration of 21st-century skills into the Greek curriculum has gained momentum, particularly following alignment with European competence frameworks. Recent curriculum reforms emphasize creativity, critical thinking, and digital competence as transversal learning outcomes [33-34].

However, the literature highlights a persistent misalignment between curriculum goals and assessment practices. High-stakes examinations continue to prioritize content recall, discouraging teachers from experimenting with deep learning strategies. As a result, teachers may endorse 21st-century skills at a theoretical level while struggling to implement them in practice [33-34].

7. Educational Policy, Centralization, and Implementation Challenges

Educational policy enactment in Greece is strongly influenced by centralization. Curriculum changes, instructional guidelines, and assessment policies are typically introduced top-down, with limited teacher involvement in decision-making processes.

This structural characteristic affects teachers' readiness to adopt innovative pedagogies. Frequent reforms, combined with insufficient evaluation and follow-up support, contribute to reform fatigue and professional skepticism. Teachers often perceive innovation as externally imposed rather than professionally meaningful, which undermines sustained pedagogical change [35-36].

8. Discussion

The reviewed literature reveals that teachers' readiness for deep learning pedagogy in Greece is shaped by the interaction of individual competence, institutional culture, and policy context. While digital skills and awareness of 21st-century competencies are necessary, they are insufficient in isolation [37].

The persistence of examination-driven practices, limited professional autonomy, and fragmented professional development initiatives constrains teachers' capacity to engage in deep pedagogical

transformation. These findings align with international research suggesting that teacher readiness must be understood as a systemic rather than purely individual phenomenon [37].

9. Implications for Policy and Professional Development

For deep learning pedagogy to become a sustainable reality in Greek schools, several strategic priorities emerge:

- Professional development should prioritize reflective, practice-based, and collaborative learning rather than tool-focused training.
- Curriculum reform must be aligned with assessment practices to legitimize deep learning approaches.
- Teachers should be actively involved in policy design and curriculum adaptation to strengthen professional ownership.
- Schools should be supported as learning organizations that foster experimentation, dialogue, and collective reflection [38].

10. Conclusions

This literature review highlights that teachers' readiness to adopt deep learning pedagogy in Greece is neither a linear nor an individually bounded process, but rather a complex, multi-layered, and context-dependent phenomenon. Teacher readiness emerges at the intersection of personal competencies, professional beliefs, institutional cultures, and systemic policy conditions. Although Greek educational policy discourse has increasingly aligned with international agendas promoting innovation, digital transformation, and the development of 21st-century competencies, the translation of these aspirations into everyday classroom practice remains limited. Deeply entrenched structural characteristics of the Greek education system—such as strong centralization, curriculum rigidity, examination-oriented assessment regimes, and limited professional autonomy—continue to constrain teachers' capacity to enact pedagogical transformation in meaningful and sustainable ways [39-40].

The persistence of these constraints suggests that current reform efforts tend to emphasize formal compliance and technical implementation rather than substantive pedagogical change. While professional development initiatives have expanded teachers' exposure to digital tools and contemporary pedagogical concepts, they often remain fragmented, short-term, and insufficiently connected to teachers' lived classroom realities. As a result, technology is frequently integrated at a superficial level, reinforcing traditional instructional practices instead of enabling inquiry-based, collaborative, and reflective forms of deep learning. This disjunction between policy rhetoric and pedagogical enactment contributes to professional uncertainty and reform fatigue, further inhibiting teachers' willingness to experiment with innovative approaches [38-40].

Addressing these challenges requires a fundamental reorientation of educational reform in Greece—from isolated and episodic interventions toward coherent, long-term strategies that recognize pedagogy, technology, and professional learning as interdependent dimensions of systemic change. Such strategies must prioritize sustained, practice-oriented professional development grounded in collaborative learning communities, reflective inquiry, and continuous support. Equally important is the alignment of curriculum goals, assessment practices, and accountability mechanisms with the principles of deep learning, so that innovation is institutionally legitimized rather than perceived as a deviation from prescribed norms [38-40].

Crucially, this review argues for a reconceptualization of teacher readiness as a collective and systemic condition rather than an individual attribute or deficit. Teachers' capacity to adopt deep learning pedagogy is profoundly shaped by the organizational environments in which they work, the stability and coherence of policy frameworks, and the extent to which professional agency is encouraged and sustained. When readiness is framed solely as an individual responsibility, reform efforts risk overlooking the structural and cultural barriers that limit pedagogical innovation. Conversely, recognizing readiness as a systemic property foregrounds the shared responsibility of policymakers, school leadership, and professional communities in cultivating conditions conducive to deep learning [39].

In this sense, bridging the persistent gap between policy aspirations and classroom realities in Greek education depends less on the introduction of new reforms and more on the development of a stable, supportive, and reflective educational ecosystem. By fostering institutional trust, professional autonomy, and meaningful participation of teachers in curriculum and policy processes, Greek educational reform can move beyond rhetorical alignment with international trends and toward the sustainable enactment of deep learning pedagogy in everyday teaching practice [40].

References

1. Giotopoulos, K. (2024). A systematic review in digital entrepreneurship ecosystems. *Technium Social Sciences Journal*, 61 (1), 279–297. <https://doi.org/10.47577/tssj.v61i1.11562>
2. Kalliampakou, I., & Antonopoulou, H. (2024). Behavioral Insights into Shopping Addiction: Emotional and Cognitive Drivers. *Technium: Romanian Journal of Applied Sciences and Technology*, 24, 103–120. <https://doi.org/10.47577/technium.v24i.11972>
3. Kalliampakou, I., & Antonopoulou, H. (2025). The influence of emotional intelligence on consumer decision-making: Insights from recent studies. *Technium Soc. Sci. J.*, 67, 451.
4. Kalogeratos, G., & Pierrakeas, C. (2021). The COVID-19 pandemic as a reason for accelerating the transformation of the Greek primary school into a learning organization. In *EDULEARN21 Proceedings* (pp. 10333-10340). IATED.
5. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Gkika, K. & Pierrakeas C. (2025). COGNITIVE FOUNDATIONS OF EFFECTIVE EDUCATIONAL LEADERSHIP: A COMPREHENSIVE REVIEW. In *EDULEARN25 Proceedings* (pp. 5915-5925). IATED.
6. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Gkika, K. & Pierrakeas C. (2025). THE INTERPLAY OF COGNITIVE AND NON-COGNITIVE SKILLS IN EDUCATIONAL LEADERSHIP: A SYSTEMATIC REVIEW OF LEADERSHIP EFFECTIVENESS. In *EDULEARN25 Proceedings* (pp. 5854-5864). IATED.
7. Kalogeratos, G., & Pierrakeas, C. (2024). Use of learning theories and visual programming (scratch) in education. *Technium Education and Humanities*, 10, 41–54. <https://doi.org/10.47577/teh.v10i.11688>
8. Kalogeratos, G., Alexandropoulou, A., & Pierrakeas, C. (2023, July). Digital and socio-emotional benefits of the students and the teachers from the implementation of a STEAM education project. In *2023 14th International Conference on Information, Intelligence, Systems & Applications (IISA)* (pp. 1-8). IEEE.
9. Kalogeratos, G., Anastasopoulou, E., & Pierrakeas, C. (2024). Myschool: The key role of the information system in the Greek public school. A case study on the prefecture of Achaia. In *EDULEARN24 Proceedings* (pp. 9700-9706). IATED
10. Giotopoulos, K., Halkiopoulou, C., Papadopoulos, D., & Antonopoulou, H. (2019). Towards Bring Your Own Device marketing policy. *International Journal of Technology Marketing*, 13(2), 156–164.
11. Kalogeratos, G., Anastasopoulou, E., Stavrogianopoulos, A., Tsagri, A., Tsogka, D., & Lourida, K. (2023). Enhancing emotional intelligence in pervasive developmental disorders: The autism paradigm. *Technium Education and Humanities*, 6, 61–69. ISSN: 2821-5079. <http://www.techniumscience.com>
12. Kalogeratos, G., Anastasopoulou, E., Tsagri, A., Tseremegklis, C., & Kriparopoulou, A. (2024). Psychotraumatic childhood experiences and anxiety in educational settings. *Technium Education and Humanities*, 7, 29-41.
13. Kalogeratos, G., Anastasopoulou, E., Tsagri, A., Tseremegklis, C., & Asimakopoulou, S. (2023). Interpersonal skills with a focus on creativity in attention deficit hyperactivity disorder. *Technium Soc. Sci. J.*, 52, 197.
14. Giotopoulos, K. C., Michalopoulos, D., Vonitsanos, G., Papadopoulos, D., Giannoukou, I., & Sioutas, S. (2024). Dynamic workload management system in the public sector. *Information*, 15 (6), 335. <https://doi.org/10.3390/info15060335>
15. Kalogeratos, G., Anastasopoulou, E., Tsagri, A., Tseremegklis, C., Tsogka, D., Lourida, K., & Dronigitis, A. (2024). Adolescent Trauma and Impact of the COVID-19 Pandemic in the School Context. *Technium Soc. Sci. J.*, 55, 262.
16. Mourelatos, E., Krimpas, G., & Giotopoulos, K. (2024). Sexual identity and gender gap in political leadership ambition: An experiment. *Review of Behavioral Economics*, 11(1), 73–121. <http://dx.doi.org/10.1561/105.00000181>
17. Kalogeratos, G., Anastasopoulou, E., Tseremegklis, C., & Avramidi, E. (2024). Enhancing quality of life for caregivers of adolescents with emotional disorders through digital skills. *Technium Education and Humanities*, 8, 58-77.
18. Kalogeratos, G., Lourida, K., Anastasopoulou, E., Tsogka, D., & Pierrakeas, C. (2024). Information systems usage in the Greek primary school: The case of the Prefecture of Achaia. *INTED2024 Proceedings*, 1652–1657.
19. Kalogeratos, G., Anastasopoulou, E., & Pierrakeas, C. (2024). Novel technologies using educational scenarios for elementary school and kindergarten students. *EDULEARN24 Proceedings*, 9682–9693.

20. Karras, A., Theodorakopoulos, L., Karras, C., & Antonopoulou, H. (2024, December). *Cyber Threat Intelligence in Smart Cities: Bayesian Inference and Energy Optimization in LoRa Networks for Big Data Applications*. In *2024 IEEE International Conference on Big Data (BigData)* (pp. 2635-2644). IEEE.
21. Karras, A., Karras, C., Giotopoulos, K. C., Tsolis, D., Oikonomou, K., & Sioutas, S. (2023). *Federated edge intelligence and edge caching mechanisms*. *Information*, 14(7), 414. <https://doi.org/10.3390/info14070414>
22. Antonopoulou, H. (2024) *The Role of Gamification in Enhancing Cognitive and Neuropsychological Learning: A Review*. *Tech. BioChemMed*, 11, 45–46.
23. Papadopoulos, D. F. (2024). *A parametric six-step method for second-order IVPs with oscillating solutions*. *Mathematics*, 12(23), 3824. <https://doi.org/10.3390/math12233824>
24. Theodorakopoulos, L., Halkiopoulos, C., & Papadopoulos, D. (2023). *Applying big data technologies in tourism industry: A conceptual analysis*. In V. Katsoni (Ed.), *Tourism, travel, and hospitality in a smart and sustainable world* (pp. 273–283). Springer. https://doi.org/10.1007/978-3-031-26829-8_21
25. Tzimas, G., Zotos, N., Mourelatos, E., Giotopoulos, K. C., & Zervas, P. (2024). *From data to insight: Transforming online job postings into labor-market intelligence*. *Information*, 15(8), 496. <https://doi.org/10.3390/info15080496>
26. Theodorakopoulos, L., Karras, A., Theodoropoulou, A., & Kampiotis, G. (2024). *Benchmarking Big Data Systems: Performance and Decision-Making Implications in Emerging Technologies*. *Technologies*, 12(11), 217.
27. Vasilopoulos, Ch., Theodorakopoulos, L. L., & Giotopoulos, K. K. (2023). *The promise and peril of big data in driving consumer engagement*. *Technium Social Sciences Journal*, 45, 489–499.
28. Karras, A., Giannaros, A., Theodorakopoulos, L., Krimpas, G. A., Kalogeratos, G., Karras, C., & Sioutas, S. (2023). *FLIBD: A federated learning-based IoT big data management approach for privacy-preserving over Apache Spark with FATE*. *Electronics*, 12(22), 4633.
29. Antonopoulou, H. (2024). *Neuroleadership and Its Role in Educational Settings: A Review of Current Practices*. *Technium Education and Humanities*, 10, 143–154. <https://doi.org/10.47577/teh.v10i.11976>
30. Kalogeratos, G., Tsogka, D., Tseremegklis, C., Anastasopoulou, E., & Pierrakeas, C. (2024). *DIGITAL SKILLS IN EDUCATION: BRIDGING THE GAP BETWEEN TRADITIONAL LEARNING AND MODERN TECHNOLOGY*. *ICERI2024 Proceedings*, 4409-4418.
31. Kalogeratos, G., Tsogka, D., Tseremegklis, C., Anastasopoulou, E., & Pierrakeas, C. (2024). *THE CONTRIBUTION OF ERASMUS+ KA2 TO IMPROVEMENT OF EDUCATIONAL WORK. THE CASE OF THE SCHOOL UNITS OF THE REGION OF WESTERN GREECE*. *ICERI2024 Proceedings*, 4258-4263.
32. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Lourida, K., & Pierrakeas, C. (2025). *ENHANCING EDUCATIONAL OUTCOMES THROUGH DIGITAL SKILLS: ADDRESSING LIFELONG LEARNING AND DISTANCE EDUCATION CHALLENGES*. *INTED2025 Proceedings*, 6720-6730.
33. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Lourida, K., & Pierrakeas, C. (2025). *THE INTERPLAY OF COGNITIVE AND NON-COGNITIVE SKILLS IN EDUCATIONAL LEADERSHIP: A SYSTEMATIC REVIEW OF LEADERSHIP EFFECTIVENESS*. *INTED2025 Proceedings*, 5854-5864.
34. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Gkika, K., & Pierrakeas, C. (2025). *THE INTERPLAY OF COGNITIVE AND NON-COGNITIVE SKILLS IN EDUCATIONAL LEADERSHIP: A SYSTEMATIC REVIEW OF LEADERSHIP EFFECTIVENESS*. *EDULEARN25 Proceedings*, 5854-5864.
35. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Gkika, K., & Pierrakeas, C. (2025). *COGNITIVE FOUNDATIONS OF EFFECTIVE EDUCATIONAL LEADERSHIP: A COMPREHENSIVE REVIEW*. *EDULEARN25 Proceedings*, 5915-5925.
36. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Lourida, K., & Pierrakeas, C. (2025). *ENHANCING EDUCATIONAL LEADERSHIP THROUGH GAMIFICATION: THEORY AND PRACTICE IN PRIMARY SCHOOLS*. *INTED2025 Proceedings*, 6690-6700.
37. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Lourida, K., & Pierrakeas, C. (2025). *ENHANCING EDUCATIONAL OUTCOMES THROUGH DIGITAL SKILLS: ADDRESSING LIFELONG LEARNING AND DISTANCE EDUCATION CHALLENGES*. *INTED2025 Proceedings*, 6720-6730.
38. Theodorakopoulos, L., Kalliampakou, I., Theodoropoulou, A., & Kalogeratos, G. (2025). *Chapter 18: Pandemic-driven innovations: Utilizing online learning and big data analysis for decision-making in educational environments*. In Y. Dimotikalis & C. H. Skiadas (Eds.), *[Data Analysis and Related Applications 5]* (pp. 259–279). Wiley. <https://doi.org/10.1002/9781394401604.ch18>

39. Karras, A., Theodorakopoulos, L., Karras, C., Theodoropoulou, A., Kalliampakou, I., & Kalogeratos, G. (2025). LLMs for Cybersecurity in the Big Data Era: A Comprehensive Review of Applications, Challenges, and Future Directions. *Information*, 16 (11), 957.
40. Kalogeratos, G., Gkekas, K., Tseremegklis, C., Anastasopoulou, E., & Pierrakeas, C. (2024). The contribution of Erasmus+ KA2 to improvement of educational work: The case of the school units of the region of Western Greece. In *ICERI2024 Proceedings* (pp. 4258–4263). IATED.

RECONCEPTUALIZING TEACHERS' DIGITAL COMPETENCE IN AI-ENHANCED EDUCATIONAL ECOSYSTEMS: A NARRATIVE LITERATURE REVIEW

Gerasimos Kalogeratos

Department of Management Science and Technology, University of Patras, Greece

Eleni Anastasopoulou

Experimental Elementary School of University of Patras, Patras, Greece

Konstantina Gkika

2nd Special Primary School of Patras, Patras, Greece.

Athina Spanou

Junior High School of Panopoulo, Ilea, Greece

Triada Kapota

Elementary School of Varda, Ilea, Greece

Abstract

The rapid integration of artificial intelligence (AI), augmented reality (AR), and other emerging digital technologies into education has fundamentally reshaped expectations of teachers' professional competence. Teachers are no longer required merely to operate digital tools but to design, adapt, and critically integrate technology in ways that enhance pedagogy, content understanding, and learner engagement. This article presents a narrative literature review examining contemporary conceptualizations of teachers' digital competence within AI-enhanced educational ecosystems. Drawing on international frameworks such as DigCompEdu and the updated TPACK-in-Context model, the review synthesizes current research on AI-supported pedagogy, AR-based learning environments, and interactive digital content. The analysis highlights key trends, conceptual shifts, opportunities, and challenges associated with developing teachers' digital competence without introducing new empirical data. The paper concludes by proposing future research directions and implications for teacher education, professional development, and educational policy.

Keywords: teacher, digital competence, artificial intelligence, education, augmented reality, TPACK, DigCompEdu, interactive learning

1. INTRODUCTION

Digital transformation has become a defining characteristic of contemporary education systems worldwide. Advances in artificial intelligence (AI), augmented reality (AR), virtual reality (VR), learning analytics, and generative technologies have expanded the possibilities of how knowledge is represented, accessed, and constructed [1-2]. These developments have coincided with changing learner profiles, particularly among digitally native generations who demonstrate preferences for visual, interactive, and personalized learning experiences. As a result, teachers are increasingly expected to design learning environments that are not only technologically rich but also pedagogically meaningful and ethically responsible [2-4].

Within this context, teachers' digital competence has emerged as a critical component of educational quality and equity. Digital competence is no longer understood as a static set of technical skills; rather, it is viewed as a dynamic, context-dependent capability that integrates technological, pedagogical, and content knowledge. The rise of AI-supported learning environments further intensifies this shift, as teachers must develop new forms of literacy related to automation, data-informed decision-making, prompt engineering, and human-AI collaboration [5-8].

While a growing body of empirical research explores teachers' attitudes, readiness, and self-efficacy regarding digital technologies, there remains a need for integrative conceptual analyses that synthesize existing theoretical and review-based literature. This article addresses this need by offering a narrative literature review that examines how teachers' digital competence is conceptualized in AI-enhanced educational ecosystems, with particular attention to interactive and AR-based learning environments [8-11].

2. METHODOLOGICAL APPROACH: NARRATIVE LITERATURE REVIEW

This article adopts a narrative literature review methodology, which is well suited for synthesizing diverse theoretical perspectives, conceptual frameworks, and review studies. Unlike systematic reviews or meta-analyses, narrative reviews allow for interpretive integration of literature across disciplines and

research traditions, facilitating the identification of conceptual patterns, gaps, and emerging themes [11-13].

The review draws on peer-reviewed journal articles, international policy reports, and foundational theoretical works published primarily in the fields of educational technology, teacher education, and digital pedagogy. Particular emphasis is placed on literature addressing digital competence frameworks, AI in education, augmented and immersive learning technologies, and pedagogical design models. No original empirical data are introduced, and all interpretations are grounded in existing scholarly discourse [14-17].

3. CONCEPTUAL FOUNDATIONS OF TEACHERS' DIGITAL COMPETENCE

3.1 DIGITAL COMPETENCE AS A MULTIDIMENSIONAL CONSTRUCT

Early conceptions of teachers' digital competence focused predominantly on operational skills, such as the ability to use productivity software or digital presentation tools. Over time, this narrow view has been widely criticized for failing to capture the pedagogical and contextual dimensions of technology integration. Contemporary scholarship emphasizes that digital competence encompasses cognitive, pedagogical, ethical, and creative capacities [18-23].

Digital competence is increasingly framed as situational and developmental, shaped by teaching context, subject domain, institutional culture, and available infrastructure. This perspective aligns with sociocultural theories of learning, which view competence as enacted through practice rather than possessed as a fixed attribute [18-23].

3.2 DIGCOMPEDU AND INTERNATIONAL POLICY PERSPECTIVES

The European Digital Competence Framework for Educators (DigCompEdu) represents one of the most influential policy-oriented models for conceptualizing teachers' digital competence. DigCompEdu identifies multiple competence areas, including professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and the facilitation of learners' digital competence [23-24].

A key contribution of DigCompEdu lies in its progression model, which conceptualizes competence development as a continuum from basic awareness to innovative practice. This developmental logic resonates with lifelong professional learning approaches and underscores the importance of sustained, cumulative competence building rather than one-off training initiatives [24-28].

3.3 TPACK AND THE EMERGENCE OF CONTEXTUAL KNOWLEDGE

The Technological Pedagogical Content Knowledge (TPACK) framework provides a complementary theoretical lens by emphasizing the interdependence of technology, pedagogy, and subject matter knowledge. Rather than treating technology as an add-on, TPACK positions it as an integral component of instructional design [29-30].

Recent extensions of the TPACK model highlight the importance of contextual knowledge, acknowledging that effective technology integration depends on learners' characteristics, institutional constraints, curricular goals, and sociocultural factors. In AI-enhanced environments, this contextual dimension becomes particularly salient, as teachers must make informed decisions about when, how, and why AI tools should be used [29-30].

4. ARTIFICIAL INTELLIGENCE IN EDUCATION AND TEACHER COMPETENCE

4.1 FROM TOOL USE TO AI-SUPPORTED PEDAGOGY

The integration of AI into education marks a qualitative shift in digital pedagogy. AI-powered systems support automated feedback, adaptive learning pathways, content generation, and data-driven insights. Consequently, teachers' roles are evolving from content transmitters to learning designers, facilitators, and critical mediators of AI-supported processes [28-30].

Scholarly literature emphasizes that effective AI integration requires teachers to develop AI literacy, including an understanding of algorithmic decision-making, data ethics, bias, and transparency. This expands the scope of digital competence beyond technical proficiency to include critical and ethical reasoning [27-30].

4.2 GENERATIVE AI AND CREATIVE INSTRUCTIONAL DESIGN

Generative AI tools have introduced new opportunities for creative instructional design, enabling rapid generation of texts, images, simulations, and learning scenarios. Reviews in the literature suggest that such tools can reduce teachers' workload and support innovation, provided they are used with pedagogical intentionality [30-32].

However, concerns are also raised regarding overreliance on automation, intellectual property, and the potential erosion of teachers' professional agency. As a result, teacher competence in AI-enhanced environments is increasingly associated with reflective judgment and responsible design rather than mere efficiency gains [32-33].

5. AUGMENTED REALITY AND INTERACTIVE LEARNING ENVIRONMENTS

5.1 PEDAGOGICAL AFFORDANCES OF AR

Augmented reality has been widely discussed in the literature as a technology that enhances visualization, spatial reasoning, and experiential learning. AR enables learners to interact with digital representations of abstract or inaccessible phenomena, supporting inquiry-based and constructivist pedagogies[33-34].

Narrative and systematic reviews consistently report that AR-based learning environments can increase learner engagement, motivation, and conceptual understanding, particularly in science, technology, engineering, and mathematics (STEM) education. These benefits, however, are contingent on thoughtful pedagogical integration[33-34].

5.2 IMPLICATIONS FOR TEACHERS' DIGITAL COMPETENCE

From a competence perspective, AR challenges teachers to move beyond consumption of ready-made resources toward design and adaptation. Even when technical development is simplified through AI-assisted tools, teachers must still align AR experiences with curricular goals, assessment strategies, and learners' needs[33-34].

The literature highlights persistent barriers, including limited time, insufficient training, and lack of institutional support. These challenges reinforce the argument that digital competence development must be embedded within broader professional learning ecosystems rather than treated as an individual responsibility[33-34].

6. INTERACTIVE AND SENSITIVE DIGITAL PEDAGOGY

An emerging theme in recent literature is the notion of sensitive or responsive digital pedagogy. This concept emphasizes the alignment of technological affordances with learners' cognitive, emotional, and social needs. Interactive tools such as simulations, gamified assessments, and adaptive systems are viewed as mechanisms for fostering active learning and formative feedback[33-34].

Teachers' digital competence in this context involves the ability to design iterative learning processes, interpret learner data, and adjust instruction dynamically. Reviews suggest that such practices contribute to more inclusive and equitable learning environments, particularly when supported by accessible digital platforms[33-34].

7. CHALLENGES AND TENSIONS IN DEVELOPING DIGITAL COMPETENCE

Despite widespread consensus on the importance of teachers' digital competence, the literature identifies several unresolved tensions. These include the gap between policy aspirations and classroom realities, disparities in access to digital infrastructure, and variability in institutional support[33-34].

Another recurring challenge concerns sustainability. Short-term professional development initiatives often lead to temporary gains that are not sustained without ongoing support. Narrative reviews emphasize the need for longitudinal, community-based professional learning models that integrate mentoring, collaboration, and reflective practice[33-34].

8. IMPLICATIONS FOR TEACHER EDUCATION AND PROFESSIONAL DEVELOPMENT

The literature reviewed in this article suggests several implications for teacher education and professional development. First, digital competence should be embedded across initial teacher education curricula rather than addressed in isolated courses. Second, professional development programs should emphasize design-based learning, allowing teachers to experiment with AI and AR tools in authentic contexts[34-35].

Third, policy frameworks such as DigCompEdu should be adapted to local contexts, acknowledging cultural, curricular, and infrastructural differences. Finally, ethical considerations related to AI use should be explicitly addressed as a core component of teachers' digital competence[36].

9. FUTURE RESEARCH DIRECTIONS

Although the existing literature provides rich conceptual insights, several gaps remain. Future research should further explore how teachers develop contextual digital competence over time, particularly in AI-enhanced environments. Longitudinal and mixed-methods studies could illuminate how competence evolves through practice and collaboration.

Additionally, comparative reviews across educational systems may shed light on how policy, culture, and infrastructure shape digital competence development. Greater attention is also needed to interdisciplinary perspectives that integrate educational technology with learning sciences and ethics[37-38].

10. CONCLUSIONS

This narrative literature review has examined contemporary conceptualizations of teachers' digital competence within AI-enhanced educational ecosystems. The analysis demonstrates a clear shift from

technology-centered skill acquisition toward context-sensitive, pedagogically grounded competence development. Frameworks such as DigCompEdu and TPACK provide valuable foundations, while emerging research on AI and AR highlights new demands on teachers' professional knowledge and agency[39].

Overall, the literature suggests that developing teachers' digital competence is a long-term, systemic endeavor that requires alignment between policy, professional learning, and classroom practice. By synthesizing current theoretical and review-based research, this article contributes to ongoing scholarly discussions and provides a conceptual foundation for future empirical and design-oriented studies[40].

References

1. Giotopoulos, K. (2024). A systematic review in digital entrepreneurship ecosystems. *Technium Social Sciences Journal*, 61 (1), 279–297. <https://doi.org/10.47577/tssj.v61i1.11562>
2. Kalliampakou, I., & Antonopoulou, H. (2024). Behavioral Insights into Shopping Addiction: Emotional and Cognitive Drivers. *Technium: Romanian Journal of Applied Sciences and Technology*, 24, 103–120. <https://doi.org/10.47577/technium.v24i.11972>
3. Kalliampakou, I., & Antonopoulou, H. (2025). The influence of emotional intelligence on consumer decision-making: Insights from recent studies. *Technium Soc. Sci. J.*, 67, 451.
4. Kalogeratos, G., & Pierrakeas, C. (2021). The COVID-19 pandemic as a reason for accelerating the transformation of the Greek primary school into a learning organization. In *EDULEARN21 Proceedings* (pp. 10333-10340). IATED.
5. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Gkika, K. & Pierrakeas C. (2025). COGNITIVE FOUNDATIONS OF EFFECTIVE EDUCATIONAL LEADERSHIP: A COMPREHENSIVE REVIEW. In *EDULEARN25 Proceedings* (pp. 5915-5925). IATED.
6. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Gkika, K. & Pierrakeas C. (2025). THE INTERPLAY OF COGNITIVE AND NON-COGNITIVE SKILLS IN EDUCATIONAL LEADERSHIP: A SYSTEMATIC REVIEW OF LEADERSHIP EFFECTIVENESS. In *EDULEARN25 Proceedings* (pp. 5854-5864). IATED.
7. Kalogeratos, G., & Pierrakeas, C. (2024). Use of learning theories and visual programming (scratch) in education. *Technium Education and Humanities*, 10, 41–54. <https://doi.org/10.47577/teh.v10i.11688>
8. Kalogeratos, G., Alexandropoulou, A., & Pierrakeas, C. (2023, July). Digital and socio-emotional benefits of the students and the teachers from the implementation of a STEAM education project. In *2023 14th International Conference on Information, Intelligence, Systems & Applications (IISA)* (pp. 1-8). IEEE.
9. Kalogeratos, G., Anastasopoulou, E., & Pierrakeas, C. (2024). Myschool: The key role of the information system in the Greek public school. A case study on the prefecture of Achaia. In *EDULEARN24 Proceedings* (pp. 9700-9706). IATED
10. Giotopoulos, K., Halkiopoulos, C., Papadopoulos, D., & Antonopoulou, H. (2019). Towards Bring Your Own Device marketing policy. *International Journal of Technology Marketing*, 13(2), 156–164.
11. Kalogeratos, G., Anastasopoulou, E., Stavrogiannopoulos, A., Tsagri, A., Tsogka, D., & Lourida, K. (2023). Enhancing emotional intelligence in pervasive developmental disorders: The autism paradigm. *Technium Education and Humanities*, 6, 61–69. ISSN: 2821-5079. <http://www.techniumscience.com>
12. Kalogeratos, G., Anastasopoulou, E., Tsagri, A., Tseremegklis, C., & Kriparopoulou, A. (2024). Psychotraumatic childhood experiences and anxiety in educational settings. *Technium Education and Humanities*, 7, 29-41.
13. Kalogeratos, G., Anastasopoulou, E., Tsagri, A., Tseremegklis, C., & Asimakopoulou, S. (2023). Interpersonal skills with a focus on creativity in attention deficit hyperactivity disorder. *Technium Soc. Sci. J.*, 52, 197.
14. Giotopoulos, K. C., Michalopoulos, D., Vonitsanos, G., Papadopoulos, D., Giannoukou, I., & Sioutas, S. (2024). Dynamic workload management system in the public sector. *Information*, 15 (6), 335. <https://doi.org/10.3390/info15060335>
15. Kalogeratos, G., Anastasopoulou, E., Tsagri, A., Tseremegklis, C., Tsogka, D., Lourida, K., & Drongitis, A. (2024). Adolescent Trauma and Impact of the COVID-19 Pandemic in the School Context. *Technium Soc. Sci. J.*, 55, 262.
16. Mourelatos, E., Krimpas, G., & Giotopoulos, K. (2024). Sexual identity and gender gap in political leadership ambition: An experiment. *Review of Behavioral Economics*, 11(1), 73–121. <http://dx.doi.org/10.1561/105.00000181>

17. Kalogeratos, G., Anastasopoulou, E., Tseremegklis, C., & Avramidi, E. (2024). Enhancing quality of life for caregivers of adolescents with emotional disorders through digital skills. *Technium Education and Humanities*, 8, 58-77.
18. Kalogeratos, G., Lourida, K., Anastasopoulou, E., Tsogka, D., & Pierrakeas, C. (2024). Information systems usage in the Greek primary school: The case of the Prefecture of Achaia. *INTED2024 Proceedings*, 1652–1657.
19. Kalogeratos, G., Anastasopoulou, E., & Pierrakeas, C. (2024). Novel technologies using educational scenarios for elementary school and kindergarten students. *EDULEARN24 Proceedings*, 9682–9693.
20. Karras, A., Theodorakopoulos, L., Karras, C., & Antonopoulou, H. (2024, December). Cyber Threat Intelligence in Smart Cities: Bayesian Inference and Energy Optimization in LoRa Networks for Big Data Applications. In *2024 IEEE International Conference on Big Data (BigData)* (pp. 2635-2644). IEEE.
21. Karras, A., Karras, C., Giotopoulos, K. C., Tsolis, D., Oikonomou, K., & Sioutas, S. (2023). Federated edge intelligence and edge caching mechanisms. *Information*, 14(7), 414. <https://doi.org/10.3390/info14070414>
22. Antonopoulou, H. (2024) The Role of Gamification in Enhancing Cognitive and Neuropsychological Learning: A Review. *Tech. BioChemMed*, 11, 45–46.
23. Papadopoulos, D. F. (2024). A parametric six-step method for second-order IVPs with oscillating solutions. *Mathematics*, 12(23), 3824. <https://doi.org/10.3390/math12233824>
24. Theodorakopoulos, L., Halkiopoulos, C., & Papadopoulos, D. (2023). Applying big data technologies in tourism industry: A conceptual analysis. In V. Katsoni (Ed.), *Tourism, travel, and hospitality in a smart and sustainable world* (pp. 273–283). Springer. https://doi.org/10.1007/978-3-031-26829-8_21
25. Tzimas, G., Zotos, N., Mourelatos, E., Giotopoulos, K. C., & Zervas, P. (2024). From data to insight: Transforming online job postings into labor-market intelligence. *Information*, 15(8), 496. <https://doi.org/10.3390/info15080496>
26. Theodorakopoulos, L., Karras, A., Theodoropoulou, A., & Kampiotis, G. (2024). Benchmarking Big Data Systems: Performance and Decision-Making Implications in Emerging Technologies. *Technologies*, 12(11), 217.
27. Vasilopoulos, Ch., Theodorakopoulos, L. L., & Giotopoulos, K. K. (2023). The promise and peril of big data in driving consumer engagement. *Technium Social Sciences Journal*, 45, 489–499.
28. Karras, A., Giannaros, A., Theodorakopoulos, L., Krimpas, G. A., Kalogeratos, G., Karras, C., & Sioutas, S. (2023). FLIBD: A federated learning-based IoT big data management approach for privacy-preserving over Apache Spark with FATE. *Electronics*, 12(22), 4633.
29. Antonopoulou, H. (2024). Neuroleadership and Its Role in Educational Settings: A Review of Current Practices. *Technium Education and Humanities*, 10, 143–154. <https://doi.org/10.47577/teh.v10i.11976>
30. Kalogeratos, G., Tsogka, D., Tseremegklis, C., Anastasopoulou, E., & Pierrakeas, C. (2024). DIGITAL SKILLS IN EDUCATION: BRIDGING THE GAP BETWEEN TRADITIONAL LEARNING AND MODERN TECHNOLOGY. *ICERI2024 Proceedings*, 4409-4418.
31. Kalogeratos, G., Tsogka, D., Tseremegklis, C., Anastasopoulou, E., & Pierrakeas, C. (2024). THE CONTRIBUTION OF ERASMUS+ KA2 TO IMPROVEMENT OF EDUCATIONAL WORK. THE CASE OF THE SCHOOL UNITS OF THE REGION OF WESTERN GREECE. *ICERI2024 Proceedings*, 4258-4263.
32. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Lourida, K., & Pierrakeas, C. (2025). ENHANCING EDUCATIONAL OUTCOMES THROUGH DIGITAL SKILLS: ADDRESSING LIFELONG LEARNING AND DISTANCE EDUCATION CHALLENGES. *INTED2025 Proceedings*, 6720-6730.
33. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Lourida, K., & Pierrakeas, C. (2025). THE INTERPLAY OF COGNITIVE AND NON-COGNITIVE SKILLS IN EDUCATIONAL LEADERSHIP: A SYSTEMATIC REVIEW OF LEADERSHIP EFFECTIVENESS. *INTED2025 Proceedings*, 5854-5864.
34. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Gkika, K., & Pierrakeas, C. (2025). THE INTERPLAY OF COGNITIVE AND NON-COGNITIVE SKILLS IN EDUCATIONAL LEADERSHIP: A SYSTEMATIC REVIEW OF LEADERSHIP EFFECTIVENESS. *EDULEARN25 Proceedings*, 5854-5864.
35. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Gkika, K., & Pierrakeas, C. (2025). COGNITIVE FOUNDATIONS OF EFFECTIVE EDUCATIONAL LEADERSHIP: A COMPREHENSIVE REVIEW. *EDULEARN25 Proceedings*, 5915-5925.

36. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Lourida, K., & Pierrakeas, C. (2025). *ENHANCING EDUCATIONAL LEADERSHIP THROUGH GAMIFICATION: THEORY AND PRACTICE IN PRIMARY SCHOOLS*. *INTED2025 Proceedings*, 6690-6700.
37. Kalogeratos, G., Travlou, C., Tseremegklis, C., Anastasopoulou, E., Lourida, K., & Pierrakeas, C. (2025). *ENHANCING EDUCATIONAL OUTCOMES THROUGH DIGITAL SKILLS: ADDRESSING LIFELONG LEARNING AND DISTANCE EDUCATION CHALLENGES*. *INTED2025 Proceedings*, 6720-6730.
38. Theodorakopoulos, L., Kalliampakou, I., Theodoropoulou, A., & Kalogeratos, G. (2025). Chapter 18: Pandemic-driven innovations: Utilizing online learning and big data analysis for decision-making in educational environments. In Y. Dimotikalis & C. H. Skiadas (Eds.), *[Data Analysis and Related Applications 5]* (pp. 259–279). Wiley. <https://doi.org/10.1002/9781394401604.ch18>
39. Karras, A., Theodorakopoulos, L., Karras, C., Theodoropoulou, A., Kalliampakou, I., & Kalogeratos, G. (2025). LLMs for Cybersecurity in the Big Data Era: A Comprehensive Review of Applications, Challenges, and Future Directions. *Information*, 16 (11), 957.
40. Kalogeratos, G., Gkekas, K., Tseremegklis, C., Anastasopoulou, E., & Pierrakeas, C. (2024). The contribution of Erasmus+ KA2 to improvement of educational work: The case of the school units of the region of Western Greece. In *ICERI2024 Proceedings* (pp. 4258–4263). IATED.

INTEGRATING GENERAL, FLUID, AND CRYSTALLIZED INTELLIGENCE THEORIES INTO ENGLISH LANGUAGE INSTRUCTION IN MILITARY HIGHER EDUCATION

Sona Safarova

Military Institute named after Heydar Aliyev, Baku

ORCID ID: 0009-0000-9251-8306

Abstract

English language instruction in military higher education has become increasingly important as armed forces operate more frequently in multinational and multilingual environments. In such contexts, English functions not only as an academic subject but also as a professional and operational tool that supports coordination, decision-making, and mission effectiveness. These demands place significant cognitive pressure on military learners, highlighting the need for instructional approaches that take into account how language is processed, adapted, and retained under complex conditions.

This study examines the integration of general, fluid, and crystallized intelligence theories into English language instruction in military higher education. Adopting a cognitive and theory-driven perspective, the paper argues that traditional language teaching models, which primarily emphasize grammar and vocabulary, are insufficient for addressing the cognitive and operational demands of military contexts. Instead, effective instruction should be aligned with learners' intellectual capacities that influence analytical reasoning, adaptability, and long-term knowledge consolidation.

Using a qualitative methodological approach based on theoretical analysis and pedagogical interpretation, the study explores how different dimensions of intelligence relate to key components of language learning. General intelligence is associated with analytical processing, grammatical accuracy, and structured comprehension. Fluid intelligence is linked to adaptive language use, problem-solving, and effective communication in unfamiliar and dynamic situations. Crystallized intelligence supports the accumulation and long-term retention of vocabulary, terminology, and standardized discourse forms essential for professional military communication. These cognitive dimensions are systematically mapped onto instructional practices commonly used in military English programs, including analytical exercises, scenario-based tasks, and structured reinforcement activities.

The analysis demonstrates that intelligence-informed instruction contributes to improved analytical accuracy, greater adaptability in communicative situations, and more stable long-term retention of language knowledge. Importantly, the interaction between general, fluid, and crystallized intelligence supports a balanced development of language skills and facilitates the transfer of learning from instructional settings to professional and operational contexts.

The study concludes that integrating intelligence theories into English language instruction offers a robust cognitive framework for military higher education. Such an approach enhances cognitive readiness and communicative competence while addressing the unique linguistic and cognitive demands faced by military learners. The findings have practical implications for curriculum development, instructional design, and teacher training in military education.

Keywords: Cognitive learning, intelligence models, language acquisition, military pedagogy, operational communication, cognitive readiness, instructional design

Introduction

English language proficiency has become an increasingly important component of military higher education as armed forces operate more frequently within multinational and multilingual environments. Contemporary military activities such as joint exercises, peacekeeping operations, international training programs, and academic cooperation require personnel to communicate effectively in English. In these settings, language competence is directly linked to operational coordination, situational awareness, and professional credibility, extending far beyond the boundaries of traditional academic achievement.

Despite this growing importance, English language instruction in many military institutions remains largely grounded in conventional pedagogical models. These models typically emphasize grammatical accuracy, vocabulary acquisition, and standardized testing outcomes. While such elements are undeniably essential, they often fail to reflect the cognitive realities of military learning environments. Research in educational psychology has consistently shown that learning effectiveness is strongly influenced by individual cognitive differences, particularly under conditions of high cognitive load and time

pressure (Deary, 2012). Military learners are frequently required to process large amounts of information rapidly, make decisions in unfamiliar contexts, and maintain linguistic accuracy under stress, all of which place substantial demands on their intellectual capacities.

Cognitive theories of intelligence offer a valuable framework for understanding why learners differ in their ability to acquire and use a foreign language. Early psychometric research introduced the concept of general intelligence as a core cognitive factor underlying performance across a wide range of learning tasks, including language learning (Spearman, 1927). General intelligence has been associated with analytical reasoning, pattern recognition, and learning efficiency—abilities that are particularly relevant in structured instructional environments such as military education. From a cognitive perspective, these abilities support grammatical analysis, comprehension of complex texts, and the systematic organization of linguistic knowledge (Anderson, 2015).

Subsequent developments in intelligence research expanded this framework by distinguishing between fluid and crystallized intelligence. Fluid intelligence refers to the capacity to reason, identify relationships, and solve problems in novel situations, whereas crystallized intelligence reflects the accumulation of knowledge and skills acquired through learning and experience (Cattell, 1963). This distinction has been refined and empirically supported in later work, demonstrating that both dimensions contribute in complementary ways to learning processes (Horn & Cattell, 1966). In the context of language learning, fluid intelligence supports the interpretation of unfamiliar linguistic input and adaptive language use, while crystallized intelligence underpins the retention of vocabulary, grammatical structures, and standardized discourse forms.

Foreign language acquisition is therefore best understood as an interaction between analytical reasoning, adaptive problem-solving, and knowledge consolidation rather than as a uniform process. Studies in applied linguistics emphasize that instructional effectiveness depends not only on exposure and practice but also on learners' cognitive capacities, including their ability to process information, manage cognitive load, and integrate new knowledge with existing mental representations (DeKeyser, 2007; Ellis, 2008). These factors are especially salient in military education, where instructional time is often limited and performance expectations are high.

In military English instruction, the interaction between general, fluid, and crystallized intelligence becomes particularly significant. Analytical reasoning supports structured learning and accuracy, adaptive intelligence enables flexible communication in unfamiliar situations, and accumulated knowledge ensures stability and reliability in professional discourse. Understanding how these cognitive dimensions interact provides an opportunity to design instructional approaches that better align with the demands of military education.

The purpose of this study is to examine how general, fluid, and crystallized intelligence theories can be systematically integrated into English language instruction in military higher education. By grounding language teaching in cognitive theory, the study aims to contribute to the development of more effective instructional frameworks that address both the linguistic and cognitive challenges faced by military learners.

Methods

This study employs a qualitative, theory-driven methodological approach to examine how intelligence theories can be systematically integrated into English language instruction in military higher education. The research design is non-experimental and focuses on conceptual analysis, theoretical synthesis, and pedagogical interpretation rather than on statistical measurement. Such an approach is appropriate for educational research aimed at developing instructional frameworks grounded in cognitive theory.

The methodological foundation of the study draws on established principles from cognitive psychology, applied linguistics, and instructional design. In particular, the study adopts a task-oriented and cognitively informed perspective on language instruction, recognizing that learning effectiveness depends on how instructional activities align with learners' cognitive capacities. Research on task complexity and sequencing suggests that learning outcomes are influenced not only by the content of instruction but also by how tasks are structured and ordered (Robinson, 2005). This perspective is especially relevant in military education, where instructional time is limited and tasks often involve high cognitive demands.

A central methodological consideration in this study is the management of cognitive load during language instruction. Military learners are frequently required to process complex information under time pressure, making it essential to design instructional activities that optimize cognitive resources. Cognitive load theory provides a framework for understanding how instructional design can support learning by balancing intrinsic, extraneous, and germane cognitive load (Sweller, 2011). In this study, cognitive

load principles are used to guide the selection and sequencing of language learning activities to ensure that learners can engage effectively with both analytical and communicative tasks.

The study also draws on instructional design models that emphasize the integration of complex skills through structured learning processes. Research on complex learning highlights the importance of combining analytical instruction, guided practice, and gradual skill integration to support durable learning outcomes (Van Merriënboer & Kirschner, 2018). These principles are applied to the design of military English instruction by aligning analytical language tasks with opportunities for contextualized and scenario-based practice.

In addition, the methodological framework considers the role of working memory in language learning. Studies in second language acquisition indicate that working memory capacity influences learners' ability to process linguistic input, manage multiple sources of information, and maintain accuracy during communication (Williams, 2013). This consideration is particularly important in military contexts, where learners must often comprehend and respond to spoken and written information simultaneously.

Within this methodological framework, intelligence theories are operationalized through instructional alignment rather than learner classification. The study does not seek to measure intelligence levels or to categorize learners based on cognitive ability. Instead, the focus is on demonstrating how instructional strategies can be designed to engage different dimensions of intelligence through task selection, sequencing, and pedagogical emphasis.

The methodological approach outlined above provides the basis for identifying pedagogical outcomes associated with intelligence-informed English language instruction in military higher education. These outcomes are presented in the following section.

Results

The analysis of intelligence-informed instructional principles yields several interrelated outcomes relevant to English language instruction in military higher education. These outcomes emerge from aligning instructional practices with the cognitive capacities associated with general, fluid, and crystallized intelligence. Rather than resulting from isolated teaching techniques, the observed outcomes reflect a coherent instructional framework grounded in cognitive theory.

One significant result concerns the development of analytical accuracy in language use. Instructional practices aligned with general intelligence contribute to learners' ability to analyze grammatical structures, recognize linguistic patterns, and comprehend complex written and spoken texts. This analytical competence supports accuracy and consistency in language performance, which are essential in military communication contexts where standardized procedures and precise interpretation are required. These findings are consistent with broader cognitive models that emphasize structured reasoning and hierarchical organization of knowledge in learning processes (Schneider & McGrew, 2012).

A second result relates to learners' adaptive use of language in unfamiliar communicative situations. When instructional activities are designed to engage fluid intelligence through problem-solving, inferencing, and scenario-based tasks, learners demonstrate greater flexibility in responding to new linguistic input. This adaptability is particularly relevant in military environments characterized by uncertainty, time constraints, and rapidly changing conditions. The results suggest that engaging adaptive cognitive processes enhances learners' confidence and effectiveness in dynamic communication settings.

The analysis also highlights the role of crystallized intelligence in supporting long-term retention and stability of language knowledge. Instructional strategies emphasizing repetition, reinforcement, and systematic exposure to vocabulary and terminology contribute to durable learning outcomes. Learners demonstrate improved recall of technical terms, standardized expressions, and procedural language, even under conditions of cognitive load. This outcome aligns with research emphasizing the importance of accumulated lexical knowledge in sustaining effective communication over time (Nation, 2013).

Another important result is the balanced interaction between different dimensions of intelligence. Intelligence-informed instruction does not privilege analytical accuracy or adaptive flexibility in isolation; instead, it promotes their integration. This balance supports the transfer of language skills from instructional settings to professional and operational contexts. Learners are better able to apply previously acquired knowledge while adapting to new communicative demands, a process that reflects broader models of successful performance that integrate analytical, creative, and practical abilities (Sternberg, 2018).

Overall, the results indicate that integrating general, fluid, and crystallized intelligence theories into English language instruction contributes to improved analytical performance, adaptive communication, and long-term retention. These outcomes collectively enhance cognitive readiness and communicative competence among military learners, providing a strong empirical-theoretical basis for the interpretation of findings in the following discussion.

Discussion

The results of this study provide strong support for the value of integrating general, fluid, and crystallized intelligence theories into English language instruction in military higher education. The discussion of these findings suggests that language learning outcomes are not solely determined by instructional content but are deeply influenced by how well teaching practices align with learners' cognitive capacities. In military contexts, where language use is closely connected to operational performance, such alignment becomes particularly critical.

The role of general intelligence in supporting analytical language learning is evident in the emphasis on grammatical accuracy, structured comprehension, and rule-based processing. These findings are consistent with cognitive models that highlight the importance of hierarchical knowledge organization and reasoning ability in academic learning (Spearman, 1927; Anderson, 2015). In military education, where standardized procedures and precise communication are essential, analytical competence provides a stable foundation for both written and spoken language use. However, the discussion also confirms that analytical accuracy alone does not fully prepare learners for the unpredictable communicative demands of real-world military environments.

The integration of fluid intelligence addresses this limitation by emphasizing adaptability and flexible problem-solving. The findings indicate that engaging learners in scenario-based and problem-oriented tasks enhances their ability to interpret unfamiliar linguistic input and respond effectively under changing conditions. This observation aligns with intelligence research emphasizing the role of adaptive reasoning in novel situations (Cattell, 1963; Horn & Cattell, 1966). In operational military settings, where communicative challenges often arise unexpectedly, such adaptability is a crucial component of effective performance.

Crystallized intelligence plays a complementary role by supporting the long-term retention and reliable recall of language knowledge. The discussion highlights that systematic reinforcement of vocabulary, terminology, and standardized discourse forms contributes to stable language performance over time. This stability is particularly important in military communication, where errors or misunderstandings can have serious consequences. The findings are consistent with research demonstrating the importance of accumulated lexical and procedural knowledge for maintaining performance under cognitive load (Nation, 2013; Sweller, 2011).

An important implication of these findings is the value of balanced instructional design. Intelligence-informed instruction does not prioritize a single cognitive dimension but instead encourages the interaction of analytical reasoning, adaptive flexibility, and knowledge consolidation. This balance supports the transfer of language skills from instructional settings to professional and operational contexts, a process that has been highlighted as a key challenge in second language acquisition and instructional design research (Ellis, 2008; Van Merriënboer & Kirschner, 2018).

The discussion also reinforces the relevance of individual differences in cognitive capacity. Research in applied linguistics and cognitive psychology suggests that learners vary in their ability to manage cognitive load, process linguistic input, and sustain performance under pressure (Deary, 2012; Williams, 2013). By adopting an intelligence-informed approach, military educators can design instruction that accommodates such variability without categorizing or labeling learners, thereby maintaining both pedagogical flexibility and institutional practicality.

Overall, the discussion underscores that integrating intelligence theories into English language instruction offers a coherent and context-sensitive framework for military higher education. By grounding instructional practices in cognitive theory, military institutions can enhance language learning effectiveness while addressing the complex cognitive and operational demands placed on contemporary military learners.

Conclusion

This study has examined the integration of general, fluid, and crystallized intelligence theories into English language instruction in military higher education, emphasizing the importance of cognitive alignment in instructional design. The analysis demonstrates that effective military English instruction cannot rely solely on traditional language teaching approaches focused on grammar and vocabulary. Instead, it must be informed by an understanding of how different dimensions of intelligence shape learning processes, adaptability, and long-term performance.

The findings highlight that general intelligence provides a foundational role in supporting analytical language learning. Skills such as grammatical analysis, structured comprehension, and accurate interpretation of information are essential in military contexts, where standardized communication and precision are critical. Instructional practices that engage analytical reasoning contribute to consistency

and reliability in language use, supporting both academic and professional requirements within military education.

At the same time, the study underscores the significance of fluid intelligence in preparing learners for dynamic and unpredictable communicative situations. Military environments frequently require personnel to interpret unfamiliar information, respond under time pressure, and adjust to rapidly changing contexts. By incorporating instructional activities that promote problem-solving and adaptive reasoning, language instruction can better equip learners to handle such challenges effectively.

Crystallized intelligence emerges as an equally important component, supporting the accumulation and long-term retention of language knowledge. The ability to reliably recall terminology, procedural language, and standardized discourse forms is essential for maintaining effective communication in operational settings. Instructional strategies that reinforce and consolidate learned material contribute to the stability and durability of language performance, even under conditions of cognitive load.

Taken together, these findings emphasize the value of a balanced, intelligence-informed approach to English language instruction in military higher education. Rather than prioritizing a single cognitive dimension, such an approach recognizes the complementary roles of analytical accuracy, adaptive flexibility, and knowledge consolidation. This balance facilitates the transfer of language skills from instructional environments to professional and operational contexts, addressing a key challenge in military language education.

Although the present study is theoretical in nature, it offers important implications for curriculum development, instructional planning, and teacher training in military institutions. By grounding English language instruction in cognitive theory, military educators can design more effective and context-sensitive learning environments that reflect the complex demands faced by military learners.

In conclusion, integrating general, fluid, and crystallized intelligence theories into English language instruction provides a robust and coherent framework for enhancing language learning effectiveness in military higher education. Such an approach supports cognitive readiness, communicative competence, and operational effectiveness, contributing to the overall quality and relevance of military language education.

References

1. Anderson, J. R. (2015). *Cognitive psychology and its implications* (8th ed.). Worth Publishers.
2. Cattell, R. B. (1963). Theory of fluid and crystallized intelligence: A critical experiment. *Journal of Educational Psychology*, 54(1), 1–22.
3. Deary, I. J. (2012). Intelligence. *Annual Review of Psychology*, 63, 453–482.
4. DeKeyser, R. (2007). *Practice in a second language: Perspectives from applied linguistics and cognitive psychology*. Cambridge University Press.
5. Ellis, R. (2008). *The study of second language acquisition* (2nd ed.). Oxford University Press.
6. Horn, J. L., & Cattell, R. B. (1966). Refinement and test of the theory of fluid and crystallized general intelligences. *Journal of Educational Psychology*, 57(5), 253–270.
7. Nation, I. S. P. (2013). *Learning vocabulary in another language* (2nd ed.). Cambridge University Press.
8. Robinson, P. (2005). Cognitive complexity and task sequencing: Studies in a componential framework for second language task design. *International Review of Applied Linguistics*, 43(1), 1–32.
9. Schneider, W. J., & McGrew, K. S. (2012). The Cattell–Horn–Carroll theory of cognitive abilities. In D. P. Flanagan & P. L. Harrison (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 99–144). Guilford Press.
10. Spearman, C. (1927). *The abilities of man: Their nature and measurement*. Macmillan.
11. Sternberg, R. J. (2018). *The theory of successful intelligence*. Cambridge University Press.
12. Sweller, J. (2011). *Cognitive load theory*. Springer.
13. Van Merriënboer, J. J. G., & Kirschner, P. A. (2018). *Ten steps to complex learning* (3rd ed.). Routledge.
14. Williams, J. N. (2013). Working memory and second language acquisition. In P. Robinson (Ed.), *The Routledge handbook of second language acquisition* (pp. 427–441). Routledge.

Philological sciences

INTEGRATING ARTIFICIAL INTELLIGENCE AND TRADITIONAL TEACHING METHODS: THE BLENDED LEARNING MODEL

Sarymbetova A.A

*Phd, Senior lecturer, Q, University
(Almaty, Kazakhstan)*

Myrzabaeva Danekul

*Master of Philology, Senior lecturer
Kazakh Ablai Khan University Of International Relations And World Languages
(Almaty, Kazakhstan)*

Raisa Khusain

*Master of Pedagogical Science, Senior teacher,
Kazakh National Women's Teacher Training University
(Almaty, Kazakhstan)*

ИНТЕГРАЦИЯ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА И ТРАДИЦИОННЫХ МЕТОДОВ ОБУЧЕНИЯ: МОДЕЛЬ BLENDED LEARNING

Сарымбетова А.А.

*Кандидат филологических наук, старший преподаватель, Университет Q
(Алматы, Казахстан)*

Мырзабаева Данекул

*Магистр филологии, старший преподаватель
Казахский университет международных отношений и мировых языков имени Абляйхана
(Алматы, Казахстан)*

Раиса Хусаин

*Магистр педагогических наук, старший преподаватель,
Казахский национальный женский педагогический университет
(Алматы, Казахстан)*

Abstract

This article examines the theoretical and methodological foundations of the blended learning model based on the integration of Artificial intelligence and traditional teaching methods in English language instruction at higher education institutions. Contemporary digitalization, the globalization of education, and the rapid development of Artificial intelligence technologies impose new requirements on higher education systems. In this context, the study systematically analyzes the concept of blended learning, its structural components, the didactic potential of Artificial intelligence tools, and strategies for their integration with traditional teaching methods. The research findings highlight the potential of the blended learning model to enhance students' language competence, learning motivation, and independent study skills. The article is intended for university instructors, educational methodologists, and students.

Аннотация

В статье рассматриваются теоретико-методологические основы модели blended learning, основанной на интеграции искусственного интеллекта и традиционных методов обучения в процессе преподавания английского языка в высших учебных заведениях. Современная цифровизация, глобализация образования и стремительное развитие технологий искусственного интеллекта предъявляют новые требования к системе высшего образования. В этом контексте в статье систематически анализируются понятие blended learning, его структурные компоненты, дидактический потенциал инструментов искусственного интеллекта и пути их сочетания с традиционными методами обучения. Результаты исследования демонстрируют потенциал модели blended learning в развитии языковой компетенции студентов, учебной мотивации и навыков самостоятельного обучения. Статья предназначена для преподавателей, методистов и студентов высших учебных заведений.

Keywords: artificial intelligence, blended learning, traditional teaching, English language teaching, higher education, methodology, digital pedagogy

Ключевые слова: искусственный интеллект, blended learning, традиционное обучение, преподавание английского языка, высшее образование, методика, цифровая педагогика

INTRODUCTION

The 21st century education system is increasingly defined by rapid technological progress, pervasive digitalization, and the widespread adoption of artificial intelligence. Higher education institutions are no longer solely centers for knowledge acquisition; they have evolved into scientific and methodological platforms for testing innovative pedagogical solutions. These dynamics are particularly pronounced in the field of foreign language education, including English, where traditional classroom instruction is supplemented by digital platforms, online resources, and Artificial intelligence-assisted tools.

The blended learning model represents a pedagogical approach that harmoniously integrates traditional face-to-face instruction with online and digital learning modalities. This model accommodates individual learner characteristics, cognitive needs, and self-directed learning paces, offering a highly flexible and adaptive educational environment. Artificial intelligence technologies — such as intelligent chatbots, automated feedback systems, and adaptive learning platforms — serve as vital instruments that augment the effectiveness of blended learning by providing personalized support and immediate learning analytics.

Since Kazakhstan's higher education system joined the Bologna Process, a series of reforms have modernized curricula, refined teaching methodologies, and promoted digital integration. Within this framework, the use of innovative approaches, particularly Artificial intelligence -based solutions, in English language instruction has become a critical priority. Despite this, the theoretical and methodological principles for systematically integrating Artificial intelligence with traditional pedagogical strategies remain underdeveloped, warranting in-depth research.

This study investigates the theoretical foundations of the blended learning model, its integration with Artificial intelligence, and its methodological potential for enhancing English language instruction at the university level. The research emphasizes both pedagogical efficacy and the development of learners' language competence, self-regulated learning skills, and academic motivation.

THEORETICAL FOUNDATIONS OF BLENDED LEARNING

Blended learning is variably defined in pedagogical literature, but it generally refers to the purposeful integration of traditional classroom instruction and digital/online learning. This pedagogical approach is distinguished by its flexibility, adaptability, and the enhancement of learner–instructor interactions (Garrison & Vaughan, 2008).

The primary theoretical advantages of the blended learning model include:

1. **Personalization of Learning Content** – Tailoring materials to individual learners' proficiency levels, learning preferences, and prior knowledge.
2. **Flexibility of Time and Space** – Enabling asynchronous engagement with learning materials and accommodating diverse learning schedules.
3. **Enhanced Self-Regulated Learning** – Encouraging learners to take responsibility for their progress, fostering autonomous learning strategies.
4. **Continuous Monitoring and Feedback** – Facilitating real-time assessment of learning outcomes and adaptive instructional adjustments.

Blended learning also redefines the instructor's role: educators function not merely as content providers but as facilitators, advisors, and orchestrators of the learning environment. By integrating face-to-face interactions with online learning components, the model promotes deeper cognitive engagement and collaborative knowledge construction.

Structurally, blended learning typically consists of three components:

1. **Traditional face-to-face classes** – Facilitating direct interaction, discussion, and immediate clarification.
2. **Online learning elements** – Enabling flexible access to materials, interactive exercises, and digital collaboration.
3. **Independent and project-based work** – Fostering autonomous learning, critical thinking, and applied knowledge integration.

The effective alignment and interconnection of these components are critical for achieving pedagogical outcomes, enhancing learner engagement, and sustaining motivation over time.

DIDACTIC POTENTIAL OF ARTIFICIAL INTELLIGENCE IN EDUCATION

Artificial intelligence encompasses technologies that enable automation, personalization, and analytics in educational processes. In the context of English language learning, AI offers substantial didactic potential, including:

- **Automated Error Detection and Correction** – Tools such as Grammarly or AI-assisted writing platforms identify grammatical, lexical, and syntactical errors, providing immediate corrections.
- **Real-Time Feedback on Language Production** – AI systems can assess oral and written outputs, giving rapid and precise feedback to enhance learner performance.
- **Adaptive Task Assignment** – AI algorithms tailor exercises according to learners' individual proficiency levels, ensuring optimal challenge and progression.
- **Learning Analytics and Predictive Insights** – Artificial intelligence platforms can track performance trends, identify learning gaps, and predict outcomes to inform instructional strategies.

In addition, Artificial intelligence - powered tutoring systems, including ChatGPT, facilitate autonomous practice and scaffolded learning experiences, allowing students to actively engage with academic English and build higher-order cognitive skills. It is crucial to note, however, that Artificial intelligence tools do not replace instructor oversight; they complement pedagogical guidance by extending feedback mechanisms and supporting evidence-based instructional decisions.

INTEGRATION OF ARTIFICIAL INTELLIGENCE AND TRADITIONAL TEACHING METHODS

The synergy between AI technologies and traditional teaching methods forms the core of the blended learning model. Conventional pedagogical approaches, such as lectures, sessions, discussions, and practical exercises, are strategically combined with AI-assisted interventions.

For instance, during a classroom lecture, the instructor introduces new grammatical structures or vocabulary. Simultaneously, learners engage with Artificial intelligence - driven exercises online, submit written outputs, and receive automated feedback. This integrative approach reinforces learning, promotes error correction, and cultivates learner accountability.

Moreover, Artificial intelligence tools enable instructors to perform data-driven analyses of student performance, identify areas requiring targeted intervention, and refine instructional strategies accordingly. Through this integration, blended learning ensures a learner-centered approach, personalized pathways, and outcome-oriented education, aligning with contemporary pedagogical theories such as constructivism and cognitivism.

METHODOLOGICAL ADVANTAGES OF THE BLENDED LEARNING MODEL

The methodological benefits of Artificial intelligence - enhanced blended learning include:

- **Comprehensive Development of Language Competence** – Simultaneous reinforcement of listening, speaking, reading, and writing skills.
- **Enhanced Motivation and Engagement** – Gamified Artificial intelligence tools and interactive platforms stimulate sustained learning interest.
- **Cultivation of Independent Study and Reflective Practices** – Encouraging learners to monitor progress, reflect on errors, and self-regulate learning activities.
- **Flexibility and Accessibility** – Overcoming constraints of physical presence, enabling anytime, anywhere learning.
- **Strengthened Feedback Mechanisms** – Combining Artificial intelligence analytics with instructor evaluation to provide holistic insights into learner progress.

This model enhances the overall quality of English language instruction in higher education and equips graduates with competencies aligned with labor market demands in an increasingly digitalized global environment.

CONCLUSION

The Artificial intelligence - integrated blended learning model provides a robust theoretical and methodological framework for English language instruction in higher education. By maintaining traditional pedagogical values while leveraging modern digital technologies, it fosters enhanced learner engagement, academic motivation, and independent study skills.

The theoretical insights gained from this study emphasize the model's potential to transform higher education practices, improve teaching quality, and optimize learning outcomes. Future research should empirically examine blended learning across diverse disciplinary contexts and further refine Artificial intelligence - driven strategies to maximize pedagogical effectiveness.

REFERENCES

1. Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. *Annual Review of Psychology*, 52, 397–422.
2. Graham, C. R. (2006). Blended learning systems: Definition, current trends, and future directions. In *Handbook of Blended Learning* (pp. 3–21).
3. Garrison, D. R., & Vaughan, N. D. (2008). *Blended Learning in Higher Education*. San Francisco: Jossey-Bass.
4. Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education*. Boston: Center for Curriculum Redesign.
5. Bates, T. (2015). *Teaching in a Digital Age*. Vancouver: BCcampus.
6. Bonk, C. J., & Graham, C. R. (2012). *The Handbook of Blended Learning: Global Perspectives, Local Designs*. San Francisco: Pfeiffer.
7. Siemens, G., & Long, P. (2011). Penetrating the fog: Analytics in learning and education. *EDUCAUSE Review*, 46(5), 30–40.

EMOTIONAL PALETTE OF YULIA KRAPIVA'S COLLECTION «MY POEMS»

Zarudniak Natalia Ivanivna

Senior Lecturer at the Ukrainian literature, Ukrainian Studies and Methodology Department, Pavlo Tychyna State Pedagogical University
orcid.org/0000-0002-7736-0341

Lopushan Tetiana Volodymyrivna

Candidate of Philological Sciences, Associate Professor at the Ukrainian literature, Ukrainian Studies and Methodology Department, Pavlo Tychyna State Pedagogical University
orcid.org/0000-0003-4408-6877

ЕМОЦІЙНА ПАЛІТРА ЗБІРКИ ЮЛІЇ КРАПИВИ «МОЇ ВІРШІ»

Зарудняк Наталія Іванівна

старший викладач кафедри української літератури,
 українознавства та методик їх навчання

Уманського державного педагогічного університету імені Павла Тичини

orcid.org/0000-0002-7736-0341

Лопушан Тетяна Володимирівна

Кандидат філологічних наук, доцент, доцент кафедри української літератури, українознавства та методик їх навчання

Уманського державного педагогічного університету імені Павла Тичини

orcid.org/0000-0003-4408-6877

Дебютна збірка Юлії Крапиви «Мої вірші» [3] викликала і захоплені відгуки читачів, і прихильно-замиловані оцінки дослідників: щирість, шляхетність, пристрасність, розмаїття емоцій побачив у ній Василь Пахаренко [4], Володимир Поліщук виокремив наскрізну «жіночість» і «жіночність», він же звернув увагу на те, що поезії Юлії – «переважно ліричні мініатюри на 2-4 катрени як сплески чи вияви емоції ліричної героїні з приводу якихось епізодів чи подій, переажно з буття «я» і «ти». Присутня низка поетичних діалогів «я» із «ти» (луна без відлуння), незрідка на тлі якоїсь пейзажної картини чи синоптичного явища [5, с. 493]. Про особливості образів, алюзії на творчість Лесі Українки йшлося у нашому дослідженні «Особливості інтимної лірики збірки Юлії Крапиви «Мої вірші»» [1].

Не випадково збірка «Мої вірші» «залишає у читача відчуття якоїсь внутрішньої невтоленої цікавості: а далі?» [1, с. 45], адже, як слушно зауважив Василь Пахаренко, у ній переважно відтворюються почуття саме зародження кохання, хочеться пережити з ліричною героїнею його розквіт.

У поезіях Юлії – найрізноманітніший спектр емоцій: розпач, бо не вдається переконати його у своєму коханні («Ти не віриш словам моїм. // Гірко пахне осінній дим» [3, с. 8]), скам'яніння, навіть смерть («Здається, світ від горя скам'янів. // А ти чомусь не помічаєш смерті» [3, с. 9]), безпорадність, заціпеніння («А зрештою, весь світ – лиш тінь від тіні» [3, с. 11]; «...Проходить літо, як проходиш ти – // Не помічаючи моєї безпорадності...» [3, с. 9]), осліплення й оглушення («Отак бреду серед напівсліпої тиші» [3, с. 11]), намагання позбутися болю поєднується із впевненістю в неможливості його позбутися (зворушливий оксюморон («Найнезабутніший! Пустки з свого полону!» [3, с. 11]); натрапляємо у її текстах навіть на любов до болю («Від твоїх поглядів – опіки. // Без них я помру, напевне» [3, с. 12]), на щастя (у мріях), ніжність (у спогадах), біль («Дивлюся, немов востаннє // на рідну до болю постать» [3, с. 13]; «Сніжинка на долоні – біла квіточка. // Ти глянеш – і сльоза вона... Сльоза...» [3, с. 21]; «Мій біль ховається в долонях неба сонного» [3, с. 31]; «У житті ти приніс лише сум мені...» [3, с. 30]), лірична героїня намагається приховати свій біль («І знову, знову, знову зустрічатимуть // Холодний ранок снігом сміху білого» [3, с. 31]), є у збірці захоплення, замилювання, спустошеність («Без тебе тьмяніє золото, // І світ цей великий – пуста» [3, с. 13]), ніжність, пристрасність («Я пірнаю в огонь золотий, // Я горю... я згораю. А ти?» [3, с. 8]), задуха, відчуття абсурдності («І рукою доторкатись до плеча – // Нервового, чужого, непотрібного...» [3, с. 31]), відчуття спеки, горіння, пожежі, опіків, міражів («Мені так набридли ці тропіки // і ці міражі пустельні...» [3, с. 12]), сполоханість.

Вражаючою життєствердністю звучить у вірші Юлії «Моя прапрабаба» понадчасова бажаність («Вона вечорами просида Пресвяту // Богородицю, щоб колись народилась // праправнучка // Юлія – я» [3, с. 14]).

Надibuємо у текстах авторки звихреність, обпікаємося об самотність («Я у вогні самотності згораю...» [3, с. 15]; «І ніч, самотня ніч Різдва Христового» [3, с. 31]), відчуваємо разом із героїнею Ю. Крапиви викривлення часу («Зараз дні – як ледачі хмари – // Ледве сунуть в життєвий простір» [3, с. 17]). Героїня переживає печаль («Печаль по шибі, наче голос твій» [3, с. 33]), втому, відчуває тремтіння, дезорієнтацію, забуття, втрату, прощення («Минулося. Забулося. Пробачила. // Твоя душа – осіння ніч німа» [3, с. 21]), приречену поступливість («...Я навіть попрошу в тебе пробачення, та так швидко в осінь не відходь» [3, с. 22]), трапляються у збірці і пригоди, інколи внутрішній світ озивається музикою («І лине ця мелодія в світі...» [3, с. 24]; «В очах його акорди // Сумної ніжності, кохання і жалю» [3, с. 23]; «Мелодія, що лине в невідомість» [3, с. 24]; «Пісня вітру холодна й нудна» [3, с. 30]), лірична героїня може відчувати як злість («Сама на себе злюся – сльози зникли» [3, с. 29]), так і безмежне кохання, якому не може завадити навіть відсутність юнака поряд («Цей день, як ти. Я так його люблю! // І не віддам, напевно, вже нікому...» [3, с. 23]). У збірці «Мої вірші» ми знайдемо і голосіння, і диво, і байдужість, і невіру, сердитість, сум («Ходжу сама – сердита і сумна» [3, с. 29]; «блакитним смутком вечір догора» [3, с. 31]), страждання («І сонячне непрохане проміння, // Мов сивина, влітається до скронь» [3, с. 16]), виклик, відчуття зайвості («Ну а мені в весні подітись де? // Вона зі мною стримана і строга» [3, с. 29]), зраду, відкритість, щирість («Я кохаю тебе. А ти?» [3, с. 8]), ламання канонів («Якби на те воля була моя – // змінила б я всі назви затерті, // і тобі інше дала б ім'я – Жовтогарячий Серпень» [3, с. 12]; «порушивши всі канони – весь світ я тобі віддам» [3, с. 33]), віру, надію («Я не вірю в цей дощ самотній, // Я не чую тебе, тривого...» [3, с. 17]), страх, зражену гордість («Скажу одне-однісіньке «прощаю»... // Нехай почується тобі – «прощай» [3, с. 24]), співчуття («В кімнаті я, і сум, і квіти – поряд // А ти окремо. Ти, нещасний, сам» [3, с. 25]), відчуття претензії, навіть ревностів до пір року, які віддалили коханого («...а ти йдеш із такою красунею... // Осінь звуть її. Зрада вона» [3, с. 30]; «Тобі, як дівчина, всміхається весна. // Я це приймаю, як зухвалий виклик» [3, с. 29]).

У збірці присутнє відчуття минулості. Авторка неодноразово звертається до образу кле нових мостів (їх палить осінь, благає коханого не ступати на них лірична героїня, то вони, як передчуття втрати («Там все не так, там ти – такий осінній, // там вже палають полум'ям мости...» [3, с. 22])), що, за В. Калашником [2], символізує плинність часу.

Кожна мить неповторності (перший дощ, весняний перший зрїм) викликає смуток, бо не пережита разом із коханим («Як жаль, що ти далеко // й не побачиш, // як за тобою сіре небо плаче, // ... // І жаль мені, що ти вже не почувеш, // Як за тобою за одним сумує...» [3, с. 32]).

Лірична героїня буває зворушливо-невибагливою, а коханий лише своїм існуванням змушує її бути: «Я вдячна тобі, що ти є. // Що просто живеш на світі. // Від цього лиш б'ється моє // серце...» [3, с. 33]. Оскільки юнак зрадив, вона переносить бажані почуття на явища природи: «Замість тебе мене покохає // Вітерець незрадливий, весняний. // Він сумує за мною, я знаю – // За моїми очима й словами // ... // За руками сумує моїми, // І за тим, що сказати не сміє...» [3, с. 34].

Палка і пристрасна героїня буквально змушує палахкотіти збірку. Кохання вогненне, і тому у текстах розлито золотий, багряний, жовтий, жовтогарячі кольори: у вогні догорає серпень, він «жовтогарячий», вії у коханого сонячні, «палають полум'ям мости...» (алітерації ще більше підсилюють відчуття) [3, с. 22]. Золото є одним із мірил: «Без тебе тьмяніє золото» [3, с. 13], листя «відверто-жовтого» кольору, осінь асоціюється з жовтим: «На ту осінь, де жовте листя» [3, с. 28], «Залило ніби жовтою фарбою // Древнє місто і вигляд з вікна» [3, с. 30], золота добавляють у тексти Юлії зірки, які бувають навіть розпеченими, зоряні ночі, місяць, «палке» сонце, зоряні орбіти, навіть «оранжевий, як кавун» [3, с. 43] вечір. Пристрасність, чутливість натури ліричної героїні проявляється і в тому, що вона відчуває страх до об'єкта своєї симпатії: «Я боюся тебе. Обминаю. // Намагаюсь тебе не помітити» [3, с. 48]. Вона буквально закохує читача в нього: «Ти високий, вродливий, ти ввічливий, // Ти стрункий, ти засмаглий і дужий» [3, с. 48], а потім не стримується від істерики: ««Навіть часом впадаю у відчай я: // Ну чому ти до мене байдужий? // Я, напевне, ніколи не знатиму // (і нікому цього не збагнути) – // Ну чому повз мою симпатію // Пролягають твої маршрути?»» [3, с. 48].

Збірка Юлії Крапиви своєю красою, чистотою, пристрасністю, відвертістю, шляхетністю почуттів перегукується з лірикою та ліро-епічною драмою Лесі Українки «Лісова пісня», не випадково ж читач у поезії Юлії «Я холонула в обіймах» безпомилково відчуває перегук «темноликої й зоряної» ночі з ніччю Лукаша і Мавки, але коли в Лукаша очі були непрозорі, то в коханого Юліної

ліричної героїні – прозорі: «Ну і як же було не вірити, // Коли очі були прозорі, // Коли руки були гарячі...» [3, с. 55]. Що Мавці, що ліричній героїні Ю. Крапиви кохання принесло сльози: «А сьогодні я плачу, плачу, // Що не можу тебе забути...» [3, с. 55], але вони обидві люблять, плачуть свій біль. До вірша «Я не вірю в цей дощ самотній» Юлія Крапива дібрала навіть епіграф з Лесі Українки. Обидві авторки, попри страждання, все ж оптимістки: «Зараз осінь – похмура, сива... // Але справжня весна потому!..» [3, с. 17]; «Мов після наркозу в кімнаті німії // Повільно приходжу до тями. // Ні, це не кінець. Все одно будеш мій – Перерва між почуттями!» [3, с. 40]. Волюнтаристичні акценти також наявні у збірці «Мої вірші», як і в творчості Лесі Українки.

References

1. Zarudniak N.I. Features of intimate lyrics in Yuliia Kravycha's collection "My Poems". / *Meta-modernism in Literature and Literary Criticism: "Mirror in the Mirror": Materials of the All-Ukrainian Scientific and Pedagogical Advanced Training, April 14 – May 25, 2025*. Lviv – Toruń: Liha-Pres, 2025, p:45–47.
2. Kalashnyk V. Formation and modern functioning of the poetic image "kalynovyi mist". / *Linguopoetics*. Kharkiv, 1992, p:114–123. [Electronic resource]: <https://ekhnuir.karazin.ua/server/api/core/bitstreams/d3ade27f-2bfe-48b0-b4f9-ee3aacb59dd1/content> (Accessed: 22.05.2025).
3. Kravycha Yu. *My Poems*. Cherkasy: publisher Chabanenko Yu. A., 2024, 60 p.
4. Pakhareno V. Primrose poems. Kravycha Yu. *My Poems*. Cherkasy: publisher Chabanenko Yu.A., 2024, p:6–7.
5. Polishchuk V. Kravycha Yuliia Borysivna. *Literary Encyclopedia of Cherkasy Region*. Vol.3: S-Ya. Cherkasy: publisher Chabanenko Yu. A., 2025, p:493.

Technical sciences

DEVELOPMENT OF A KNEE JOINT PROSTHESIS

¹Muratov Dias Muratovich

²Ozhikenov Kassymbek Adilbekovich

¹ 2nd year Master's student, specialty "Biomedical engineering",
Satbayev University, Almaty, Kazakhstan

² Candidate of technical sciences, professor, Satbayev University, Almaty, Kazakhstan

Introduction

Knee replacement is one of the most common and effective methods of restoring the function of the musculoskeletal system in patients suffering from degenerative-dystrophic diseases, the consequences of injuries and deformities of the knee joint[1].

Due to the increase in the number of knee replacement surgeries, the requirements for the durability of implants, their biomechanical compatibility with bone tissue and resistance to prolonged cyclic loads are increasing.

Despite the improvement of materials and manufacturing technologies for prostheses, one of the main reasons for the failures of prosthetics and subsequent revision interventions remains the aseptic loosening of the tibial component caused by a violation of the stability of fixation in bone tissue.

An analysis of the existing structures of the tibial components allows us to conclude that a significant part of the loads is transmitted through the intramedullary rod to the walls of the bone marrow canal. With prolonged cyclic loading, this leads to local overload of the spongy bone, its resorption and the formation of micro-displacements at the bone-prosthesis interface.

This effect is enhanced due to the discrepancy between the stiffness of the implant and the mechanical characteristics of the bone tissue, as well as the lack of conditions for full-fledged secondary fixation due to osseointegration in anatomically significant areas of the tibia.

In this regard, it is important to develop constructive solutions aimed at optimizing load distribution and increasing the stability of the tibial component during long-term operation.

The aim of this work is to develop a prosthesis design for knee replacement, which provides increased reliability of fixation of the tibial component and reduces the risk of aseptic loosening by improving the biomechanical interaction of the bone-prosthesis system.

To achieve this goal, an analysis of existing design solutions was carried out and a modified design of the tibial component was proposed. It includes an intramedullary rod with a gradient perforation system and an integrated outer annular reinforcing element.

A feature of the proposed design is the presence of an intramedullary rod with a gradient perforation system that provides spatially heterogeneous porosity along the length of the rod.

The perforations are mainly located in the metaphysical zone, which corresponds to the area of active restructuring of spongy bone tissue and has the greatest biomechanical significance.

Through holes of increased diameter with reduced pitch are made in the proximal part of the rod. This ensures high porosity and an increase in the contact area with bone tissue, which creates favorable conditions for osseointegration.

In the middle part, the diameter of the holes gradually decreases, and the distance between them increases. This allows you to maintain the necessary structural rigidity and resistance to axial and bending loads.

The implementation of the porosity gradient makes it possible to combine the mechanical strength of the implant with the possibility of forming a zone of strong mechanical connection between the bone tissue and the prosthesis.

It is assumed that after implantation and subsequent osteoregeneration, the bone tissue partially grows into the perforations of the rod, forming a stable bone-prosthesis contact zone. This helps to reduce relative micro-displacements and reduce the risk of aseptic loosening of the tibial component.

An additional structural element is an integrated outer annular reinforcing element located in the metaphysical region of the tibia directly under the tibial platform and structurally connected to it in a single rigid system. Its purpose is to limit deformations of the cortical bone layer under the influence of operational loads, which reduces the risk of expansion of the bone marrow canal and the occurrence of microcracks during prolonged operation of the implant.

The design of the annular reinforcement element is designed taking into account the anatomical features of the knee joint, as well as the location of tendons and ligaments. Local cutouts are provided in the medial and lateral zones, which prevent compression of soft tissues. The back of the ring is solid, which is due to the absence of tendon attachments and the need to ensure sufficient structural strength.

Thus, the proposed design solution is a combination of intraosseous osseointegration provided by gradient perforation of the intramedullary rod and external stabilization of the cortical layer using an annular reinforcing element. This increases the reliability of fixation of the tibial component and potentially increases the service life of the knee arthroplasty.

The scientific novelty of the work lies in the development of an innovative design of the tibial component of the knee prosthesis, based on the principle of spatially differentiated porosity of the intramedullary rod and the integration of the outer annular reinforcing element. This ensures a more even distribution of loads, reduces the concentration of stresses in the bone tissue and reduces the likelihood of aseptic loosening during prolonged use.

Literature review

Total knee arthroplasty has been widely recognized as a highly effective surgical treatment for restoring joint functionality and alleviating pain in patients suffering from advanced knee joint disorders. However, despite ongoing improvements in implant design and materials, aseptic loosening of the tibial implant continues to be one of the primary causes of long-term implant failure and subsequent revision surgery.

Numerous studies have investigated the biomechanical factors underlying implant instability, with a particular focus on load transfer, stress shielding, and the interaction between bone and implant[2].

Jia X. and his colleagues noted that inadequate fixation of the tibial component frequently leads to non-uniform stress distribution in the proximal tibia[3]. Based on their findings, they suggested that excessive loading through rigid intramedullary stems may cause stress concentration in trabecular bone, resulting in bone resorption and progressive micro-motion at the bone-implant interface. They emphasized the significance of optimizing stem geometry in order to minimize peak stresses and enhance long-term stability of fixation.

Lei H. and his colleagues conducted a study on the influence of implant structure with porosity on bone integration and secondary fixation[4]. The study demonstrated that the use of controlled porosity can significantly enhance osteointegration, as it increases the available surface area for bone attachment and promotes mechanical interlocking between the implant and bone tissue. However, the study also noted that excessive porosity can compromise the structural stability of the implant, emphasizing the importance of balancing mechanical strength with biocompatibility in the design of such implants.

Lee H. H. and her colleagues conducted a study analyzing the biomechanical behavior of various tibial stem designs using both experimental testing and numerical simulation[5]. The study demonstrated that stem length and stiffness significantly influence the pattern of load transfer within the tibia. It was found that shorter or optimally designed stems reduce stress shielding in the metaphysis, thereby preserving bone mass and minimizing the risk of implant failure. The authors conclude that gradual changes in stiffness can enhance the mechanical performance of tibial implants.

Korn P. and his colleagues focused on patient-specific and functionally graded implant designs[6]. Their research demonstrated that implants with spatially varying structural properties can more accurately replicate the natural load distribution of bone tissue. It was shown that functionally graded designs can reduce interfacial micromotion and enhance long-term implant stability, particularly under cyclic loading conditions. This approach has been identified as a promising avenue for the development of next-generation knee prostheses.

The reviewed literature suggests that aseptic component loosening in the tibia is closely associated with inadequate load distribution, excessive implant rigidity, and limited bone integration. While porous designs and optimized stem configurations have demonstrated positive effects individually, the combination of graded porosity and additional stabilization mechanisms has not been sufficiently explored. This emphasizes the importance of developing advanced tibia component designs that integrate controlled bone integration with enhanced structural support in order to improve the longevity and clinical efficacy of knee arthroplasty.

Research methodology

In the course of the study, the method of constructive justification was applied, which served as the basis for the development of an improved knee prosthesis design.

This method consisted in analyzing existing solutions for fixing the tibial component and identifying their main disadvantages related to uneven load distribution and the risk of aseptic loosening.

Based on the analysis, it was proposed to add an intramedullary rod with a gradient perforation system and an integrated outer annular reinforcing element to the prosthesis design.

The application of this method allowed us to form a new constructive concept of the tibial component, aimed at increasing the stability of fixation and improving the interaction of the bone–prosthesis system.

The second research method was a comparative analysis, the purpose of which was to evaluate the effectiveness of the proposed constructive solutions.

As part of this method, the traditional structures of the tibial component were compared with the developed prosthesis, which includes an intramedullary rod with a gradient perforation system and an integrated outer annular reinforcing element.

The analysis allowed us to assess how each of the proposed solutions, as well as their combined application, affects load distribution, fixation stability and reduction of micro-displacements of the tibial component.

The use of comparative analysis allowed us to substantiate that the combination of gradient perforation of the rod and the outer ring element provides more effective fixation compared to traditional designs.

Results and discussion

Within the framework of the method of constructive justification, a comprehensive analysis of the structures of the tibial components of the knee joint was carried out. Special attention was paid to the geometric features of the components, the mounting schemes used, as well as the load transfer paths under various operating conditions.

During the analysis, areas were identified in which traditional structures create an increased load on the material, which can lead to micro-damage. The areas where the fixing elements exhibit the highest rate of loosening and changes during prolonged operation were also studied.

The results of the analysis allow us to formulate specific recommendations for optimizing the design, aimed at increasing the reliability of fixation of the tibial component and reducing the risk of aseptic loosening of the prosthesis.

An analysis of existing structures has shown that one of the key problems is the transfer of loads through the intramedullary rod to the walls of the bone marrow canal, which, under cyclic loading, leads to local overload of the spongy bone, its resorption and the formation of micro-displacements of the prosthesis.

As part of the research, it was proposed to add an intramedullary rod with a gradient perforation system in this regard (figure 1).



Figure 1 – intramedullary rod with a gradient perforation system

Source – developed by the author

The key design feature of the final model is an intramedullary rod with a gradient perforation system. The perforations are located mainly in the metaphysical part of the rod, which corresponds to the zone of the greatest restructuring of the spongy bone tissue and allows the mechanism of osseointegration to be realized precisely in the area of maximum biomechanical significance.

In the proximal part, through cylindrical holes of increased diameter are arranged with a smaller step along the length, which provides increased porosity and an increase in the contact area with bone tissue. In the middle part, the diameter of the holes decreases, and the distance between them increases. The distal section of the rod remains continuous, which allows maintaining the necessary structural rigidity and resistance to bending and axial loads.

Thus, the design implements a porosity gradient along the length of the rod: a higher density and size of perforations are used in the proximal zone, and a reduced one in the distal zone. This allows you to combine conditions for bone ingrowth.

It is assumed that after implantation and subsequent osteoregeneration, the bone tissue partially grows into the perforations of the rod, forming a zone of mechanical connection "bone-prosthesis". This helps to reduce relative micro-displacements at the interface and reduces the risk of aseptic loosening of the tibial component.

An additional result of the constructive justification was the introduction of an integrated outer annular reinforcing element located in the metaphysical area directly under the tibial platform (figure 2).



Figure 2 – Integrated outer ring reinforcement element

Source – developed by the author

The ring element is structurally connected to the tibial part of the prosthesis and forms a single rigid system with it. Its main purpose is to stabilize the cortical layer of the tibia and limit its deformations under the influence of loads transmitted through the intramedullary rod.

As shown in figure 2, the annular element is made taking into account the anatomical features of the knee joint. Local cutouts are provided in the medial and lateral zones to prevent compression of tendons and ligaments, while the back of the ring is made solid, due to the absence of tendon attachments and the need to ensure sufficient structural strength. This solution reduces the risk of expansion of the bone marrow canal and the formation of microcracks in the cortical bone during prolonged use of the implant.

The modern use of an intramedullary rod with a gradient perforation system and an integrated outer annular drive element makes it possible to create a combined fixation system for the tibial component. This design simultaneously affects two key mechanisms: intraosseous osseointegration due to gradient perforations of the rod and external cortical stabilization due to the annular enlarging element. As a result, a more uniform distribution of bone tissue is achieved, reducing local stress concentrations and minimizing the risks of damage.

The data obtained during the research show that the proposed combined fastening system has the potential to significantly change the sensitivity of the knee joint prosthesis. The integration of the two positions allows for the limitation of aseptic loosening of components during prolonged operation. This

approach opens up opportunities for the further appearance of prostheses, taking into account the individual anatomical features of the patient and the specifics of load distribution in the knee joint.

As a result of a comparative analysis of the structures of the tibial component, the main advantages and disadvantages of both traditional structures and the proposed innovative model were identified. The analysis was carried out according to the parameters of transmission circuits, interaction with bone tissue, reserve stress zone and fixation conditions. The use of SWOT analysis allowed us to systematize the results and show the effectiveness of new solutions (table 1).

Table 1 – SWOT analysis

Strengths	Weaknesses
<i>The proposed designs provide broader support, improved osseointegration, and increased stabilization of the tibial component compared to advanced models.</i>	<i>Complicated designs can guarantee a high cost of the prosthesis</i>
Opportunities	Threats
<i>The innovative solution opens up prospects for further optimization of prosthetics, taking into account the anatomical features of the patient and the development of new materials with improved biomechanical characteristics.</i>	<i>Possible unforeseen reactions of bone tissue to new structural elements.</i>

Source – developed by the author

As a result of the analysis, it can be concluded that the proposed structures have a number of design features and are innovative. This helps to increase the stability of the prosthesis and reduce the risk of its loosening.

In the course of the study, two complementary methods were applied: constructive justification and comparative design analysis. The method of constructive justification identifies stressed areas of critical organ zones and mechanical instabilities in traditional prostheses, and also identifies ways to optimize structures to increase the reliability of fixation of the tibial component and reduce the risk of aseptic loosening. A comparative analysis using the SWOT technique confirmed that the proposed innovative designs, including an intramedullary rod with a gradient shape of the perforations and an outer annular driving element, allow for advantages over sequences of solutions.

SWOT analysis has shown that they expand the possibilities and increase the stability of the attachment. The main weaknesses of the strain are related to the particular complexity of manufacturing and the need for precise surgical control.

Summarizing the results of the two methods, it can be noted that the proposed design of the tibial component combines intraosseous and external stabilization, high potential for uniqueness and reliability, and justifiably the method as an innovative solution in knee arthroplasty. The results of the study provide a theoretical and practical basis for further optimization of the prosthesis design and development of methods for its clinical application.

Conclusion

The study confirmed the effectiveness of an integrated approach to the design of a knee prosthesis. The method of constructive analysis made it possible to study in detail the geometry of the components, mounting schemes and transportation methods.

Based on the data obtained, a design optimization strategy was developed aimed at increasing the reliability of fixation of the tibial component, uniform load distribution and reducing the risk of aseptic complications.

A comparative analysis of the structures using the SWOT technique revealed the advantages of the proposed innovative structures, including an intramedullary rod with a gradient perforation system and an outer annular driving element.

The advantages of these designs include improved osseointegration, broader capabilities, and an increased stabilization component. However, the higher cost are the main disadvantages of the design.

Summarizing the results of the two methods, it can be concluded that the developed structures combine intraosseous and external stabilization, which provides high potential for liquidity and reliability. This is justifiably an innovative solution in knee arthroplasty.

The data obtained form the theoretical and practical basis for further optimization of the prosthesis and developments.

The combination of an intramedullary rod with an external factor allows not only to increase mechanical stability, but also to improve biological compatibility with bone tissue. This reduces the risk of developing diseases and promotes more reliable osseointegration.

This approach opens up new perspectives for personalized prosthetics and the introduction of innovative materials and technologies, including 3D printing. This expands the possibilities of clinical application of modern knee joint prosthesis designs.

Further development of this topic may be related to the introduction of digital technologies, such as finite element modeling and simulation of results, which will make it possible to more accurately predict the behavior of the prosthesis in the context of the patient's individual anatomy[7],[8].

A promising area is the development of "smart" materials and sensor systems that can track the degree of osseointegration and the load on the components of the prosthesis[9],[10]. This will make it possible to adapt treatment and rehabilitation taking into account the patient's characteristics, increase the safety and effectiveness of endoprosthesis.

References

1. Shmeleva S. V. et al. Overview of Modern Approaches to the Restoration of the Anatomical and Functional State of the Hip Joint in Various Pathologies //Biomedical and pharmacology Journal. – 2019. – T. 12. – №. 2. – P. 915-923.
2. Hériveaux Y. et al. Mechanical micromodeling of stress-shielding at the bone-implant interphase under shear loading //Medical & Biological Engineering & Computing. – 2022. – T. 60. – №. 11. – P. 3281-3293.
3. Jia X. et al. How does the stress in the fixation device change during different stages of bone healing in the treatment of fractures? A finite element study of external fixation for tibial fractures //Orthopaedic Surgery. – 2024. – T. 16. – №. 11. – P. 2821-2833.
4. Lei H. et al. Structural Optimization of 3D-Printed Porous Titanium Implants Promotes Bone Regeneration for Enhanced Biological Fixation //ACS Applied Materials & Interfaces. – 2025. – T. 17. – №. 12. – P. 18059-18073.
5. Lee H. H. et al. Optimization of Tibial Stem Geometry in Total Knee Arthroplasty Using Design of Experiments: A Finite Element Analysis //Bioengineering. – 2025. – T. 12. – №. 2. – P. 172.
6. Korn P. et al. A new strategy for patient-specific implant-borne dental rehabilitation in patients with extended maxillary defects //Frontiers in Oncology. – 2021. – T. 11. – P. 718872.
7. Cabrera I. A. et al. Digital healthcare technologies: Modern tools to transform prosthetic care //Expert Review of Medical Devices. – 2021. – T. 18. – №. sup1. – P. 129-144.
8. Paxton N. C., Nightingale R. C., Woodruff M. A. Capturing patient anatomy for designing and manufacturing personalized prostheses //Current Opinion in Biotechnology. – 2022. – T. 73. – P. 282-289.
9. Eskandar K. Smart orthopedic implants: the future of personalized joint replacement and monitoring //The genesis of orthopedics. – 2025. – Vol. 31. – No. 3. – P. 388-398.
10. Resendes T. et al. Advanced medical monitoring: 3D printed prosthetics with integrated strain sensor //Progress in Additive Manufacturing. – 2025. – T. 10. – №. 1. – P. 219-229.

TOP 200 TERMS USED IN SEWING OR TEXTILE (LIGHT INDUSTRY) ENTERPRISES

Mirzayev Razil Tofig oğlu
PhD in Engineering
Hubatova Maya Huseyinqulu qızı
Taghiyeva Tamam Ahmad qızı
Azerbaijan University of Technology

TIKİŞ VƏ YA TEKSTİL (YÜNGÜL SƏNAYE) MÜƏSSISƏLƏRİNDƏ İŞLƏDİLƏN ƏN ÇOX 200 TERMIN

Mirzəyev Razil Tofig oğlu
t.f.d.
Hübətova Maya Hüseynqulu qızı
Tağıyeva Tamam Əhməd qızı
Azərbaycan Texnologiya Universiteti

200 НАИБОЛЕЕ ЧАСТО ИСПОЛЬЗУЕМЫХ ТЕРМИНОВ В ШВЕЙНОЙ ИЛИ ТЕКСТИЛЬНОЙ (ЛЕГКОЙ ПРОМЫШЛЕННОСТИ) ОТРАСЛЯХ

Мирзоев Разил Тофиг оглу
Доктор технических наук
Хубатова Майя Гусейнгулу кызы
Тагиева Тамам Ахмад кызы
Азербайджанский Технологический Университет

Abstract

This thesis systematizes the main terms used in sewing (light industry, textile) enterprises and explains their role in the production process. Terminology in sewing enterprises is important for proper communication, quality management and production efficiency at all stages, from the receipt of raw materials to the packaging of finished products. The work explains the definition of terms, explains why and how terms are used, and presents the 200 most commonly used terms in Azerbaijani, English and Russian.

Xülasə

Bu tezisdə tikiş (yüngül sənaye, tekstil) müəssisələrində istifadə olunan əsas terminlər sistemləşdirilir və onların istehsal prosesində rolu izah edilir. Tikiş müəssisələrində terminologiya xammalın qəbulundan hazır məhsulun qablaşdırılmasına qədər bütün mərhələlərdə düzgün kommunikasiya, keyfiyyətin idarə olunması və istehsalın səmərəliliyi üçün vacibdir. İşdə termin anlayışı açıqlanır, terminlərin niyə və necə istifadə edildiyi izah olunur və ən çox işlədilən 200 termin Azərbaycan, ingilis və rus dillərində təqdim edilir.[1]

Аннотация

В данной работе систематизируются основные термины, используемые на швейных (легкая промышленность, текстиль) предприятиях, и объясняется их роль в производственном процессе. Терминология на швейных предприятиях важна для эффективной коммуникации, управления качеством и повышения эффективности производства на всех этапах, от получения сырья до упаковки готовой продукции. В работе дается определение терминов, объясняется, почему и как используются те или иные термины, и представлены 200 наиболее часто используемых терминов на азербайджанском, английском и русском языках.

Keywords: Sewing industry, terminology, light industry, production process, quality control, clothing production.

Açar sözlər: Tikiş sənayesi, terminologiya, yüngül sənaye, istehsal prosesi, keyfiyyət nəzarət, geyim istehsalı.

Ключевые слова: Швейная промышленность, терминология, легкая промышленность, производственный процесс, контроль качества, швейное производство.

Termin nədir? Termin müəyyən bir elm, texnika və ya istehsal sahəsində dəqiq və birmənalı mənanı ifadə edən xüsusi sözdür və ya söz birləşməsidir. Terminlər ümumi danışiq dilindən fərqli olaraq konkret anlayışı bildirir və qarışıqlığın qarşısını alır.

Tikiş müəssisəsində terminlər niyə işlədilir?[2]

İstehsal prosesində dəqiqliyi təmin etmək üçün

İşçilər arasında düzgün və sürətli ünsiyyət yaratmaq üçün

Texnoloji əməliyyatları standartlaşdırmaq üçün

Keyfiyyətə nəzarəti asanlaşdırmaq üçün

Beynəlxalq əməkdaşlıqda (ixrac, idxal) anlaşmanı təmin etmək üçün

Aşağıda terminlər Azərbaycan – İngilis – Rus dillərində verilmişdir:

1. Tikiş – Sewing – Шитьё
2. Parça – Fabric – Ткань
3. Konstruksiya – Construction – Конструкция
4. Modelləşdirmə – Modeling – Моделирование
5. Eskiz – Sketch – Эскиз
6. Şablon (Patron) – Pattern – Выкройка
7. Biçim – Cutting – Крой
8. Tikiş maşını – Sewing machine – Швейная машина
9. Overlok – Overlock – Оверлок
10. İynə – Needle – Игла
11. Səp – Thread – Нитка
12. Düymə – Button – Пуговица
13. Səp – Zipper – Молния
14. Qayçı – Scissors – Ножницы
15. Astar – Lining – Подкладка
16. Ütə – Iron – Утюг
17. Əl tikişi – Hand sewing – Ручной шов
18. Seriyalı istehsal – Mass production – Серийное производство
19. Yığım – Gathering – Сборка
20. Bəzək – Decoration – Украшение
21. Qol – Sleeve – Рукав
22. Bel – Waist – Талия
23. Ətək – Hem / Skirt – Подол / Юбка
24. Yaxa – Collar – Воротник
25. Kəmər – Belt – Пояс
26. Astarlamaq – To line – Подкладка
27. Parça ehtiyatı – Seam allowance – Припуск на шов
28. Tikiş xətti – Stitch line – Линия шва
29. Bərkidici tikiş – Reinforcement stitch – Закрепляющий шов
30. Əyrilik – Curve – Изгиб
31. Çiyin xətti – Shoulder line – Линия плеча
32. Yan tikiş – Side seam – Боковой шов
33. Ön ortası – Center front – Передняя середина
34. Arxa ortası – Center back – Задняя середина
35. Bədən ölçüsü – Body measurement – Размер тела
36. Geyimi bədənə ölçmə (piremerka) – Fitting – Примерка
37. Texniki çertyoj – Technical drawing – Технический чертёж
38. İstehsal – Production – Производство
39. Hazır məhsul – Finished product – Готовое изделие
40. Keyfiyyətə nəzarət – Quality control – Контроль качества
41. Parça növü – Fabric type – Тип ткани
42. Təbii parça – Natural fabric – Натуральная ткань
43. Süni parça – Artificial fabric – Искусственная ткань
44. Sintetik parça – Synthetic fabric – Синтетическая ткань
45. İpək – Silk – Шёлк
46. Yun – Wool – Шерсть

47. *Pambıq – Cotton – Хлопок*
48. *Kətan – Linen – Лён*
49. *Dəri – Leather – Кожа*
50. *Trikotaj – Knitwear – Трикотаж*
51. *Cins parça – Denim – Джинсовая ткань*
52. *Flanel – Flannel – Фланель*
53. *Şəbəkə (hörmə bəzək) – Lace – Кружево*
54. *Orqanza (nazik parça) – Organza – Органза*
55. *Atlas – Satin – Атлас*
56. *Tafta (ipəkdən hazırlanan parça növü) – Taffeta – Тафта*
57. *Kral tikişi – Royal stitch – Королевский шов*
58. *Zigzag tikişi – Zigzag stitch – Зигзагообразный шов*
59. *Maşın sapı – Machine thread – Машинная нить*
60. *Əlcək – Glove – Перчатка*
61. *Paraq – Hat – Шапка / Головной убор*
62. *Ayaqqabı – Shoes – Обувь*
63. *Aksesuar – Accessory – Аксессуар*
64. *Remen – Buckle – Пряжка*
65. *Etiket – Label – Этикетка*
66. *Rəng uyğunluğu – Color matching – Сочетание цветов*
67. *Stil – Style – Стиль*
68. *Moda – Fashion – Moda*
69. *Trend – Trend – Тренд*
70. *Geyim – Garment – Одежда*
71. *Üslub(stil) – Design style – Дизайнерский стиль*
72. *Çertyoj – Draft / Plan – Чертёж*
73. *Geyim hissələri – Garment parts – Части одежды*
74. *Tərtibat – Design layout – Компоновка*
75. *Kolleksiya – Collection – Коллекция*
76. *Kataloq – Catalogue – Каталог*
77. *Muncuq – Bead – Бисер*
78. *Qaş – Rhinestone – Страз*
79. *Sapın gərilməsi – Thread tension – Натяжение нити*
80. *Parça sınağı – Fabric testing – Тест ткани*
81. *Forma sabitliyi – Shape stability – Стабильность формы*
82. *Nəmlik davamlılığı – Moisture resistance – Влагостойкость*
83. *Tikmə texnologiyası – Sewing technology – Технология шитья*
84. *Naxış – Pattern / Embroidery – Узор / Вышивка*
85. *Ornament – Ornament – Орнамент*
86. *Daxili tikiş – Inner seam – Внутренний шов*
87. *Xarici tikiş – Outer seam – Внешний шов*
88. *Termal işləmə – Heat processing – Тепловая обработка*
89. *Qalınlıq – Thickness – Толщина*
90. *Elastiklik – Elasticity – Эластичность*
91. *Ağırlıq – Weight – Вес*
92. *Tikiş gərginliyi – Seam stress – Напряжение шва*
93. *Tikiş cizgisi – Stitch trace – Контур шва*
94. *Möhkəmlik – Durability – Прочность*
95. *Dərinin işlənməsi – Leather processing – Обработка кожи*
96. *Layihələndirmə – Projecting – Проектирование*
97. *Tədarük – Supply – Снабжение*
98. *Müəssisə – Factory / Enterprise – Предприятие*
99. *Tikiş sexi – Sewing workshop – Швейный цех*
100. *Dərzi – Tailor – Портной*
101. *Lövhə – Board – Доска*
102. *Tikmə xətti – Stitch line – Линия строчки*

103. Çevrilmə – Turning – Выворачивание
104. Çiyin tikişi – Shoulder seam – Плечевой шов
105. Yan tikiş – Side seam – Боковой шов
106. Qolluq (manjet) – Sleeve cuff – Манжета
107. Düymə deşiyi – Buttonhole – Петля
108. Biçim – Cut – Покрой
109. Naxış – Embroidery – Вышивка
110. Yüksək moda – Haute couture – Высокая мода
111. Qalstuk – Tie – Галстук
112. Şərf – Cravat – Шейный платок
113. Qatlama lenti və ya ətəkaltı lent – Hem tape – Подгибочная лента
114. Parça kodu – Fabric code – Код ткани
115. Sancaqlar – Pins – Булавки
116. Daxili astar – Inner lining – Внутренняя подкладка
117. Sürüşkən parça – Slippery fabric – Скользящая ткань
118. İstiyə davamlı – Heat resistant – Термостойкий
119. Tikiş sıxlığı – Stitch density – Плотность строчки
120. Əyri tikiş – Curved stitch – Кривой шов
121. Dəri geyim – Leather garment – Кожаная одежда
122. İdman geyimi – Sportswear – Спортивная одежда
123. Gündəlik geyim – Casual wear – Повседневная одежда
124. Ütüləmə – Ironing – Глажка
125. Döşəmə – Layering – Наслаивание
126. Hazır biçim – Pre-cut – Готовый крой
127. Çəkidəyişmə – Shrinkage – Усадка
153. Xarici hissə – Outer part – Внешняя часть
154. Tikmə izi – Seam trace – След от шва
155. Simmetriya xətti – Symmetry line – Линия симметрии
156. Dizayn mərkəzi – Design center – Центр дизайна
157. Moda evi – Fashion house – Дом моды
158. Parça çatışmazlığı – Fabric shortage – Недостаток ткани
159. Parça istiqaməti – Fabric direction – Направление ткани
160. Ülgü – Patterns – Лекал
161. Gərginlik ölçüsü – Tension level – Уровень натяжения
162. Ölçü cədvəli – Size chart – Таблица размеров
163. Qəlip – Mold – Форма (для лекал)
164. Modelin kodu – Style code – Код модели
165. Tikilmə cizgisi – Sewing guide – Направляющая шитья
166. Əl tikişi – Manual sewing – Ручное шитьё
167. İkiqat parça – Double fabric – Двойная ткань
168. Qatlama – Folding – Складывание
169. Buxarlanma – Steaming – Отпаривание
170. Xəttli eskiz – Line sketch – Линейный эскиз
171. Formalaşdırma – Shaping – Формирование
172. Texniki fiqur – Technical figure – Технический рисунок
173. Konstruksiya xətləri – Construction lines – Линии конструкции
174. Bədən fiquru – Body figure – Фигура тела
175. Çevik biçim – Flexible cut – Гибкий крой
176. Kнопка maşını – Snap machine – Машина для кнопок
177. Yumuşaldıcı – Softener – Смягчитель
178. Parça sıxlığı – Fabric density – Плотность ткани
179. Əymə bucağı – Fold angle – Угол сгиба
180. Sınaq nümunəsi – Sample – Образец
181. Əllə tikmə – By hand – Ручная работа
182. Əlavə hissə – Extra piece – Дополнительная часть
183. Baş geyimi – Headwear – Головной убор

184. Aşağı hissə – Lower part – Нижняя часть

185. Gödəkçə – Jacket – Куртка

186. Palto – Coat – Пальто

187. Moda jurnalı – Fashion magazine – Журнал мод

188. Parça material – Woven material – Тканый материал

189. Boyanmış parça – Dyed fabric – Окрашенная ткань

190. Nəmləndirib-isitmə əməliyyatları – Wet heat treatment – Влажно-тепловая обработка

191. Antibakterial material – Antibacterial fabric – Антибактериальная ткань

192. Möhkəm parça – Durable fabric – Прочная ткань

193. Bitki mənşəli lif – Plant-based fiber – Растительное волокно

194. Sintepən – Padding – Синтепон

195. Yaxalıq – Neckline – Вырез горловины

196. Dəst – Set – Комплект

197. Uzunluq – Length – Длина

198. Qol tikişi – Armhole seam – Шов проймы

199. Qol oyuntusu – Armhole – Пройма

200. Etiket dizaynı – Label design – Дизайн ярлыка

Tikiş müəssisələrində terminologiyanın düzgün və sistemli istifadəsi istehsalın keyfiyyətini, əmək məhsuldarlığını və beynəlxalq əməkdaşlığı artırır. Üç dilli terminlər isə global bazara çıxış və rəqəkar ünsiyyət üçün xüsusi əhəmiyyət daşıyır.

Literature

1. Нотехнологии в текстильной промышленности. БАГИРОВА В.Ш., РАМАЗАНОВА Х.А., МАМЕДОВА С.Д., АЛИЕВА Н.Х.1, РАМАЗАНОВА С.Б., МИРЗОЕВ Р.Т. ИНТЕРНАУКА.2025.с 27-34.

2. Перспективные направления развития современных промышленных швейных машин.МИРЗОЕВ Т.Г, МИРЗОЕВ Р.Т, МАММЕДОВ Е.П. ИНТЕРНАУКА.2025.с 14-20.

INVESTIGATION OF THE TRIBOELECTRIC EFFECT IN VARIOUS MATERIALS

*Roza Zhumagulova**International Educational Corporation, 050028, Almaty**Galiya Azhieva,**International Educational Corporation, 050028, Almaty, Kazakhstan**Gulzhanar Zharaspaeva**International Educational Corporation, 050028, Almaty, Kazakhstan*

ИССЛЕДОВАНИЕ ТРИБОЭЛЕКТРИЧЕСКОГО ЭФФЕКТА В РАЗЛИЧНЫХ МАТЕРИАЛАХ

*Роза Жумагулова**Международная образовательная корпорация, г. Алматы, 050028, Казахстан**Галия Ажиева**Международная образовательная корпорация, г. Алматы, 050028, Казахстан**Гульжанар Жараспаева**Международная образовательная корпорация, г. Алматы, 050028, Казахстан***Abstract**

This article provides a comprehensive analysis of the prospects and current achievements in the field of triboelectric energy generation, with a particular focus on the opportunities provided by water resources, particularly atmospheric moisture. In the context of the global drive towards sustainable development and the transition to renewable energy sources, the triboelectric effect, which relies on the generation of electric charge through the contact and separation of dissimilar materials, is becoming an increasingly attractive option for extracting energy from the environment.

The article provides an overview of current research conducted at leading global scientific centers, focusing on the development and optimization of triboelectric nanogenerators (TEGs) designed to convert the energy of water droplets and other aqueous flows into electrical energy. Special attention is given to the study of the ballo-electric and triboelectric mechanisms underlying the generation of energy during the interaction of water with various materials. The experimentally confirmed phenomenon of voltage generation on metal surfaces upon contact with a humid environment is considered as a starting point for the development of innovative devices capable of generating energy directly from the atmosphere.

The central idea is to exploit the potential of water vapor in the atmosphere as an effective and affordable source of renewable energy. Unlike traditional hydropower systems, which require significant investment and have a negative impact on the environment, this approach utilizes a widespread and relatively stable resource: atmospheric moisture. Electrical energy is generated through the triboelectric interaction of water molecules with specially designed surfaces, which requires careful selection of materials, optimization of their structure, and consideration of external factors such as temperature, humidity, and pressure.

The article provides a detailed analysis of the factors affecting the efficiency of triboelectric energy generation from water vapor, including the choice of materials (metallic, polymeric, composite, and nanomaterials), surface geometry, and operating modes of the devices. Various designs of TEGs designed to convert atmospheric moisture energy into electrical energy are considered, and their potential characteristics are evaluated.

It is emphasized that this technology is currently under active development, and several technical and economic challenges need to be addressed in order to commercialize it. These challenges include improving energy conversion efficiency, ensuring the stability and durability of devices, and developing cost-effective production methods. In conclusion, this article provides an overview of research in the field of triboelectric energy generation from water vapor, describes the main achievements, identifies areas of concern, and outlines future prospects.

This research area has significant potential and can contribute significantly to creating a sustainable, environmentally friendly, and diversified future energy system based on renewable resources. Developments in this field can help address global energy challenges and reduce dependence on traditional energy sources.

Аннотация

Настоящая статья посвящена всестороннему анализу перспектив и современных достижений в области трибоэлектрической генерации энергии, с особым акцентом на возможности, предоставляемые водными ресурсами, в частности, атмосферной влагой. В условиях глобального стремления к устойчивому развитию и переходу к возобновляемым источникам энергии, трибоэлектрический эффект, основанный на генерации электрического заряда при контакте и разделении разнородных материалов, становится все более привлекательным вариантом для извлечения энергии из окружающей среды.

В статье представлен обзор актуальных исследований, проводимых в ведущих мировых научных центрах, с акцентом на разработку и оптимизацию трибоэлектрических наногенераторов (ТЭНГ), предназначенных для преобразования энергии капель воды и других водных потоков в электрическую энергию. Особое внимание уделяется изучению баллоэлектрических и трибоэлектрических механизмов, лежащих в основе генерации энергии при взаимодействии воды с различными материалами. Экспериментально подтвержденный факт возникновения напряжения на металлических поверхностях при контакте с влажной средой рассматривается как отправная точка для разработки инновационных устройств, способных получать энергию непосредственно из атмосферы.

Центральная идея заключается в обосновании потенциала водяного пара, содержащегося в атмосфере, в качестве эффективного и доступного источника возобновляемой энергии. В отличие от традиционных гидроэнергетических систем, требующих значительных инвестиций и оказывающих воздействие на окружающую среду, предлагаемый подход позволяет использовать широко распространенный и относительно стабильный ресурс – атмосферную влагу. Электрическая энергия в данном случае генерируется в результате трибоэлектрического взаимодействия молекул воды со специально разработанными поверхностями, что требует тщательного подбора материалов, оптимизации их структуры и учета внешних факторов, таких как температура, влажность и давление.

В статье проводится детальный анализ факторов, влияющих на эффективность трибоэлектрической генерации энергии из водяного пара, включая выбор материалов (металлические, полимерные, композитные, наноматериалы), геометрию поверхности, а также режимы работы устройств. Рассматриваются различные конструкции ТЭНГ, предназначенные для преобразования энергии атмосферной влаги в электрическую энергию, и оцениваются их потенциальные характеристики.

Подчеркивается, что данная технология находится на стадии активного развития, и для ее коммерциализации необходимо решить ряд технических и экономических задач. В частности, требуется повышение эффективности преобразования энергии, обеспечение стабильности и долговечности устройств, а также разработка экономически целесообразных методов производства.

В заключение представлен обзор исследований в области трибоэлектрической генерации энергии из водяного пара, описываются основные достижения, выявлены проблемные области и намечены перспективы дальнейшего развития. Данное направление исследований обладает значительным потенциалом и может внести существенный вклад в создание устойчивой, экологически безопасной и диверсифицированной энергетической системы будущего, основанной на использовании возобновляемых ресурсов. Разработки в данной области могут способствовать решению глобальных энергетических проблем и снижению зависимости от традиционных источников энергии.

Keywords: triboelectric effect, metal plates, renewable energy, energy-generating medium, water vapor

Ключевые слова: трибоэлектрический эффект, металлические пластины, возобновляемая энергия, энергогенерирующая среда, водяной пар

1. Введение

Проявление трибоэлектрического эффекта при контакте трением в твердых телах можно объяснить перемещением носителей заряда от одного «контактного» тела к другому. При взаимодействии полупроводников и проводников (металлов) носители заряда (электроны) перемещаются от тела, изготовленного из материала с меньшей работой выхода к телу, материал которого имеет большую работу выхода. При трении проводника и диэлектрика

электроны переходят от проводника к диэлектрику, тем самым вызывая возникновение трибоэлектричества. Возникновение трибоэлектрического эффекта в диэлектриках объясняется взаимным перемещением ионов и электронов контактных диэлектриков (рис. 1). Кроме того, в твердых телах трибоэлектричество возникает в пьезоэлектриках или пирозлектриках за счет механического отделения частей взаимодействующей поверхности.



Рис. 1 Механизм трибоэлектрического эффекта

Вода как дипольная жидкость, состоит преимущественно из молекул H_2O , 1 моль которых содержит приблизительно 104 Кл/моль электричества. Генераторы, использующие балло- и трибоэлектрический эффект обладают незначительной мощностью, но достаточного для домашнего и уличного освещения, подзарядки носимой электроники.

Трибоэлектрификация, или контактная электрификация, — это физическое явление, описывающее перенос электронов между поверхностями при физическом контакте. Такое явление было обнаружено 2600 лет назад, а механизмы его возникновения до сих пор обсуждаются.

Трибоэлектрический наногенератор (ТЭНГ) — это новая технология, которая находит применение во многих областях, включая сбор энергии, автономное зондирование, лекарства и электронику. Материалы, используемые в качестве трибоэлектрических слоев, разнообразны и включают полимеры, металлы и неорганические материалы. Наиболее часто используемыми материалами являются диэлектрические полимеры, такие как ПТФЭ (политетрафторэтилен), ФЭП (фторированный этиленпропилен), ПДМС (полидиметилсилоксан) и каптон (пленка из полиамида). Зеленые материалы, такие как материалы на основе целлюлозы, в последнее время вызывают все больший интерес, а характеристики ТЭНов, использующих целлюлозные материалы, улучшились. Процесс трибоэлектрификации может быть процессом контакта/разделения или процессом скольжения.

В 2019 году группа Ванга из Технологического института Джорджии разработала новый метод 19, который позволяет количественно определять плотность трибоэлектрического заряда (TECD) различных материалов на основе их трибоэлектрификации ртутью в режиме разделения контактов.

Трибоэлектрификация может произойти на любом интерфейсе, где два материала вступают в физический контакт. Многие материалы были протестированы на предмет их трибоэлектрических эффектов и применены в ТЭНах. Фторполимеры, такие как ПТФЭ и ФЭП, являются наиболее широко используемыми трибоэлектрическими материалами в качестве акцепторов электронов в ТЭНГ, особенно для ТЭНГ, работающих в режиме бокового скольжения и в режиме отдельно стоящего трибоэлектрического слоя. Металлические пленки, такие как пленки Al и Cu, широко используются в качестве доноров электронов. Причины популярности металлов можно количественно объяснить с помощью недавно разработанного уравнения, в котором использование металлов может увеличить электростатическую индукцию в ТЭНах.

Можно ли использовать трибоэлектрический эффект в качестве возобновляемого источника энергии? Применение баллоэлектрического и трибоэлектрического эффектов к легкодоступным водным ресурсам позволит привести к созданию автономных электрических генераторов взамен используемых в настоящее время углеводородных, ядерных и др.

Проведем исследование по возможности возникновения напряжения на металлических пластинах при их контакте с влажной средой. Проверим различия в возможности накопления зарядов пластинами, изготовленными из разных металлов и отличающимися по размерам. Выясним обладает ли вода, содержащаяся в атмосфере в виде водяного пара, способностью выступить в качестве энергогенерирующей среды.

2 Обзор литературы

Не во всех веществах все электроны прочно связаны с атомами. Именно наличие большого количества свободных электронов обеспечивает электропроводность металлов.

Если привести в соприкосновение два вещества с принципиально различным количеством свободных электронов, то некоторое количество электронов из одного вещества перейдут в другое. Таким образом первое станет положительно заряженным, а второе - отрицательно. Трение одного вещества о другое только увеличивает площадь соприкосновения и убыстряет процесс. Учтём, что даже при комнатной температуре скорости частиц могут превышать значений в несколько сот метров в секунду.

Трибоэлектрический эффект всегда наблюдается при трении следующих пар различных или одинаковых материалов:

- полупроводник-полупроводник
- диэлектрик-диэлектрик
- металл-металл (при различной плотности структуры)
- металл-диэлектрик
- жидкий диэлектрик-металл
- твердый диэлектрик и его жидкий аналог

Вот некоторые примеры полимеров, которые часто используются для создания трибоэлектрического эффекта. Полиэтилен (PE) – низкая стоимость, легкость и химическая инертность, обладает хорошей трибоэлектрической эффективностью при контакте с другими материалами. Полистирол (PS)-хорошая электрическая изоляция, хороший трибоэлектрический эффект при контакте с другими материалами. Полиуретан (PU)-

гибкий, прочный, химически стойкий. Поливинилхлорид (PVC)-стойкий, долговечный.

Полимеры генерируют различные уровни напряжения при трении. Так, полиэтилен и полиамид, показали генерацию напряжений порядка десятков милливольт, полиэтилентерефталата (PET) и политетрафторэтилена (PTFE)-несколько десятков милливольт [1].

Использование биоматериалов представляет интересное направление исследований и разработок в области триботехники и энергетики. Биоматериалы, такие как целлюлоза, белки, и даже некоторые биологические ткани, могут обладать свойствами, способствующими эффективному трибоэлектрическому взаимодействию. Биodeградируемость и обилие целлюлозы делают ее привлекательным вариантом для использования в экологически чистых энергетических системах.

Исследования с использованием бумаги из целлюлозы при трении с полиэтиленом показало генерацию напряжения порядка нескольких десятков милливольт [2,3,4].

Используются и композитные материалы, состоящие из смеси полимеров или полимеров с добавками других веществ. Например, композитные материалы на основе полиэтилена и многослойных углеродных нанотрубок могут генерировать напряжение более 200 милливольт [5,6].

Многолетние наблюдения за трибоэлектрическим эффектом не только доказали возможность создания многих новых и полезных трибоустройств (например, трибоэлектрических наногенераторов), но и постоянно мотивировали исследование его загадочной природы [7,8,9].

Первые результаты исследований о влиянии электрических явлений на процесс трения были опубликованы в 1952 году А.Д. Дубининым. Им же были проанализированы и причины возникновения электрического тока при трении. В прямом эксперименте было установлено, что электрический ток возникает даже при трении образцов из одного материала. Природа возникновения электрических эффектов на трущихся поверхностях исследовалась и в других работах [10,11,12,13].

Китайский ученый Чжун Линь Ван совершил прорыв в энергетике. Он изобрел трибоэлектрический наногенератор (ТЭНГ) на основе органических материалов, который используется для преобразования механической энергии в электричество. ТЭН основан на сочетании трибоэлектрификации и электростатической индукции и использует наиболее распространенные материалы, доступные в нашей повседневной жизни, такие как бумага, ткани, ПТФЭ, ПДМС, алюминий, ПВХ и т. д. ТЭН можно применять для сбора всех видов механической энергии, доступной в нашей повседневной жизни, такой как движение человека, ходьба, вибрация, механическое срабатывание, энергия вращения, ветер, движущийся автомобиль, текущая вода, капли дождя, прилив и океан. волны. Таким образом, это новая парадигма сбора энергии. Кроме того, ТЭН может быть датчиком, который напрямую преобразует механический запуск в самогенерируемый электрический сигнал для обнаружения

движения, вибрации, механических раздражителей, физического прикосновения и биологического движения 14].

Цзин и др. разработали TENG в корпусе (сTENG) на основе скользящей электрификации, который может преобразовывать возвратно-поступательное движение в электрическую энергию и устранять вибрационные движения окружающей среды большой амплитуды и низкой частоты. Имея несколько наборов решетчатых электродов и смазанный наночастицами политетрафторэтилена (ПТФЭ), сTENG выдавал среднюю эффективную выходную мощность 12,2 мВт при внешней нагрузке 140 кОм при скорости скольжения 1 м/с, что соответствует плотности мощности 1,36. Вт/м². Скользящее движение может быть вызвано силами прямого действия, а также силами инерции, что позволяет использовать сTENG для борьбы с вибрационными движениями окружающей среды, которые имеют большую амплитуду и низкую частоту. Было продемонстрировано, что сTENG эффективно собирает энергию от движений человеческого тела и волнистой поверхности воды, что указывает на многообещающие перспективы сTENG в таких приложениях, как портативная и автономная электроника с автономным питанием [15].

В науке о трении полимеры породили множество новых задач, обусловленных специфическими свойствами этих материалов. Как показывает практика композиционные материалы на основе полимеров в значительно большей степени, чем металлы, чувствительны к воздействию многочисленных факторов, обусловленных трением и влиянием внешней среды. Значительный практический интерес представляют узлы трения, изготовленные с применением полимерных материалов, так как они имеют малую массу, работают практически бесшумно, обладают демпфирующей способностью, в большинстве случаев не требуют смазки [16].

Акустические вибрации, как широкодоступный источник энергии в нашей повседневной жизни, обычно воспринимаются как шумовое загрязнение и практически не используются в качестве источника энергии. Исследователи Технологического института Джорджии разработали тонкопленочный наногенератор на основе трибоэлектрификации для сбора акустической энергии из окружающей среды. Созданный с использованием тонкой пленки политетрафторэтилена и электрода из перфорированной алюминиевой пленки в тщательно разработанных условиях деформации, наногенератор способен преобразовывать акустическую энергию в электрическую посредством трибоэлектрического преобразования [17].

Специалисты рассматривают также водный трибоэлектрический наногенератор (ТЭН). Когда вода проходит через воздух или изолирующую трубку, она будет содержать не только механическую энергию, но и электростатическую энергию из-за существования трибоэлектрических зарядов на ее поверхности в результате контакта с воздухом/поверхностью твердого тела. Гибридный трибоэлектрический наногенератор (ТЭНГ) предназначен для одновременного сбора электростатической и механической энергии текущей воды.

Авторы статьи «Фундаментальные теории и основные принципы трибоэлектрического эффекта: обзор» Шуайхан ПАН, Чжинань ЧЖАН проанализировали то, как разрабатываются фундаментальные теории, и подтверждает их детерминированные функции в проектировании более эффективных трибоэлектрических систем с этими относительно точными математическими и физическими описаниями [18].

Таким образом, исследований в направлении использования трибоэлектрического эффекта довольно много, но в направлении поисков дополнительных источников энергии, они не прекращаются. Этим и объясняется выбор направления данного исследования.

3 Материалы и методы

Одним из примеров возобновляемых источников энергии является трибоэлектрический эффект, возникающий при контакте металлов с атмосферной влагой, а также баллоэлектрический эффект – это электризация водяных капель, которая возникает при разрушении воды на отдельные мелкодисперсные капли. Проведя анализ современных исследований в области трибоэлектрического эффекта и возможности использования данной энергии в качестве возобновляемого источника энергии проверим возможность возникновения напряжения на металлических пластинах при их контакте с влажной средой.

Экспериментальные методы включали: проведение исследований по изучению свойств воды и различных металлических пластин, исследование электрических явлений при трении и влияния трибоэлектризации на триботехнические свойства материалов. Использовались

расчетные методы включающие: математические методы планирования экспериментов, статические методы обработки экспериментальных данных и регрессионный анализ.

Для обнаружения трибоэлектрического и баллоэлектрического эффектов и энергогенерирующих свойств воды использованы металлические пластины (алюминий, цинк, никелированная поверхность, медь), изолирующие подставки, пульверизатор, вода, цифровой гигрометр с сенсорным датчиком, цифровой мультиметр EM 5801, ноутбук или планшет (для обработки результатов и подготовки диаграмм).

Проведение эксперимента заключалось в следующем. Металлические пластины закреплялись в изолирующих (пластмассовых) подставках. Датчик гигрометра размещался вблизи пластины. Фиксировались показания монитора гигрометра как начальные (до разбрызгивания воды) так и после. С помощью мультиметра замерялось напряжение на пластинах.

Пульверизатором вблизи пластин разбрызгивалась вода таким образом, чтобы капли попадали на поверхность металла. По мере роста влажности воздуха (что в конечном итоге показывает количество воды, контактирующей с металлическими поверхностями) снимаются показания напряжения. И так для каждого из металлов. Результаты измерений заносились в таблицу.

В основе данного исследования лежит комплексный подход:

- проверить различия в возможности накопления зарядов пластинами, изготовленными из разных металлов и отличающимися по размерам
- выяснить обладает ли вода, содержащаяся в атмосфере в виде водяного пара, способностью выступать в качестве энергогенерирующей среды
- проверить на практике возможность возникновения напряжения на металлических пластинах при их контакте с влажной средой
- проверить различия в возможности накопления зарядов пластинами, изготовленными из разных металлов и отличающимися по размерам
- выяснить обладает ли вода, содержащаяся в атмосфере в виде водяного пара, способностью выступать в качестве энергогенерирующей среды.

4 Обзор и обсуждение

Трибоэлектрический эффект в жидкостях (при взаимодействии двух жидкостей) становится возможным благодаря возникновению двойного электрического слоя на границе двух контактирующих жидкостей.

Рассмотрим явление трибоэлектрического эффекта при взаимодействии сред «жидкость»-«металл». При контакте металлов с жидкостью проявление трибоэлектрического эффекта оказывается возможным за счет возникновения двойных электрических слоев в пограничной области между жидкостью и твердым телом. При разделении зарядов в этой области, в результате течения жидкости или при разбрызгивании от удара (баллоэлектрический эффект) о поверхность, возникает трибоэлектричество.

Трибоэлектрический эффект в жидкостях (при взаимодействии двух жидкостей) становится возможным благодаря возникновению двойного электрического слоя на границе двух контактирующих жидкостей.

Исследования были разделены на два направления в соответствии поставленных целей:

1. Опыты по обнаружению трибоэлектрического и баллоэлектрического эффектов, наблюдаемых при контакте жидкостей и металлических пластин за счет трения и дробления жидкости при ударе.

2. Опыты по обнаружению энергогенерирующих свойств воды.

По мере роста влажности воздуха (что в конечном итоге показывает количество воды, контактирующей с металлическими поверхностями) снимаются показания напряжения (еще три значения). Пункты 1-5 повторяются для других металлов. В таблице 1 приводятся результаты опыта и на основе этих данных выполнены диаграммы (рис.2).

Таблица 1 Зависимость напряжения от влажности между контактирующими металлическими поверхностями

№	Материал пластин	Относительная влажность %	Напряжение В
1	Алюминий	34(до распыления воды)	0
2		66	0,461
3		78	0,571
4		84	0,654
5	Цинк	30(до распыления воды)	0
6		63	0,154
7		70	0,338
8		81	0,503
9	Никелированная поверхность	42(до распыления воды)	0
10		69	0,366
11		77	0,522
12		90	0,608
13	Медь	34(до распыления воды)	0
14		65	0,586
15		76	0,628
16		87	0,801

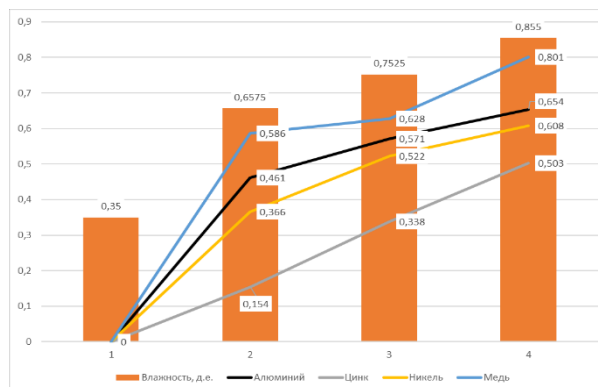
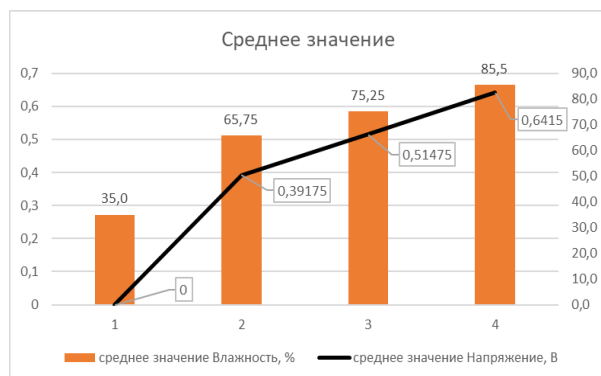
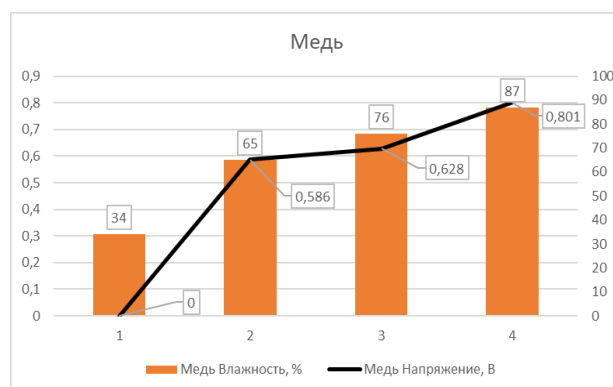
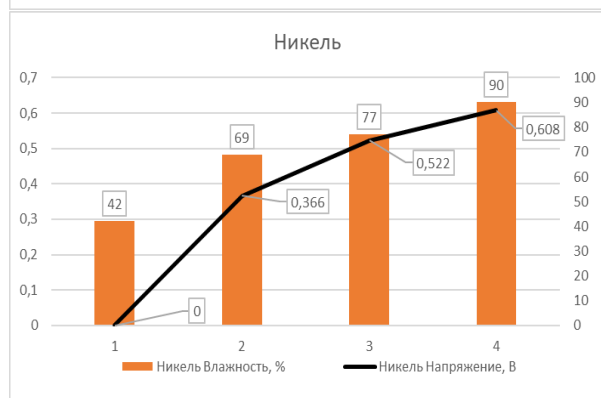
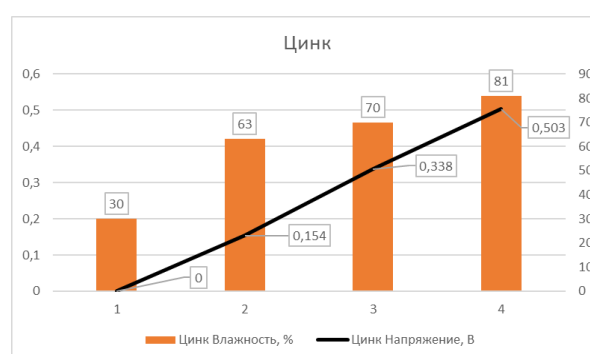
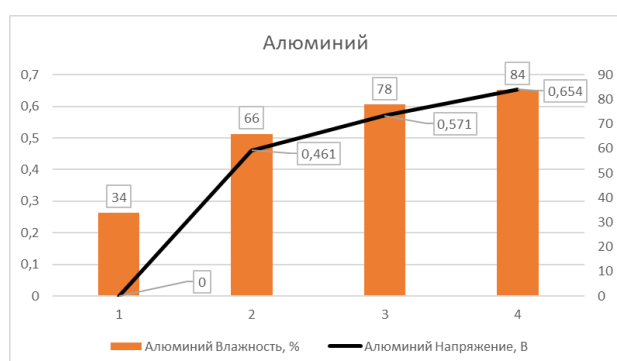


Рис.2 Диаграммы зависимости напряжения металлических пластин от количества контактирующей с ними воды.

Напряжение в диаграммах выражается в деци вольтах дВ. Эксперимент показал, что:

1. Трибоэлектричество возникает в металлах за счет трения водяных капель о поверхность пластин. Также дополнительный заряд образуется на поверхности металлов за счет дробления капель воды.

2. Чем больше капель воздействует на поверхность металла, тем выше значение напряжения.

3. Баллоэлектрический и трибоэлектрический эффекты заряжают металлические пластины отрицательным знаком, что видно по значению напряжения на мультиметре.

4. Отличие в значении напряжений для разных металлов объясняется их строением.

Для обнаружения энергогенерирующих свойств воды металлические пластины были закреплены в изолирующих (диэлектрических) подставках и внесены в небольшое помещение. С помощью гигрометра фиксируется начальная влажность (для чистоты эксперимента относительная влажность в помещении должна быть ниже 60%). Мультиметром замеряется начальное напряжение. Убеждаемся, что оно равно нулю.

В помещении повышается влажность за счет разбрызгиваемой воды. Обязательным условием является исключение попадания капель воды на поверхность металлических пластин. При повышении влажности до 60% снова замеряется напряжение на пластинах. Повторные показания снимаются с интервалом в 10-15%. После прекращения изменения напряжения эксперимент прекращается. Результаты измерений занесены в Таблицу 2.

Таблица 1 Зависимость напряжения от влажности между контактирующими металлическими поверхностями

№	Контактирующие материалы	Относительная влажность, %	Напряжение, В
1	Металл-металл (нержавейка)	45	0
2		65	0,179
3		75	0,336
4		90	0,499
5	Диэлектрик-металл	45	0
6		65	0,143
7		75	0,386
8		80	0,533
9	Диэлектрик-диэлектрик	45	0
10		65	0,064
11		75	0,127
12		80	0,195

Напряжение в диаграммах выражается в дВ (децивольт)

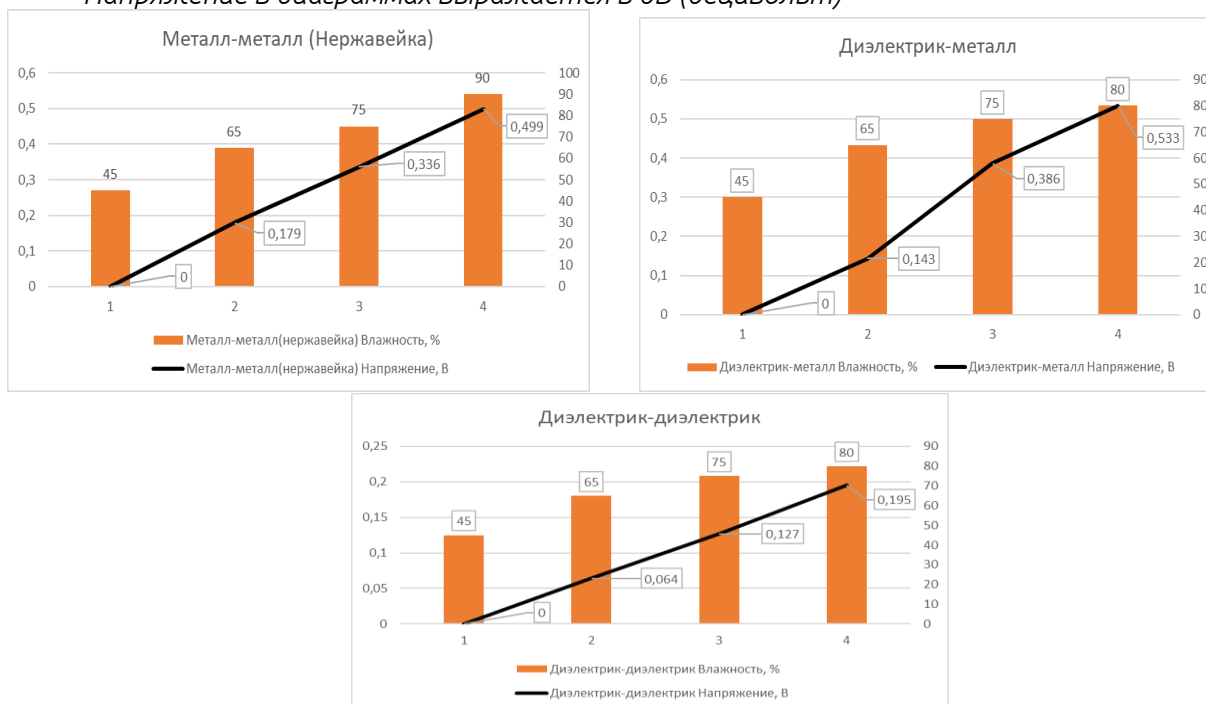


Рис.3 Диаграммы зависимости напряжения металлических пластин от количества контактирующей с ними воды

В результате проведенного эксперимента были сделаны выводы:

1. Т. к. прямого контакта капель воды с поверхностями материалов, используемых в эксперименте, не происходит, объяснить появление электричества трибоэлектрическим или баллоэлектрическим эффектом нельзя. Следовательно, предположение о энергогенерирующих свойствах воды можно считать состоятельным. Данный эффект наблюдается при влажности воздуха 60% и более.
2. Наибольшее значение напряжения было достигнуто при взаимодействии водяного пара и пары металл-диэлектрик.
3. При влажности равной 85% дальнейшее повышение напряжения в исследуемых веществах не происходит.
4. При неизменной влажности (значением более 60%) значительных колебаний напряжения не происходит

5 Выводы

1. При контакте водяных капель, за счет трибоэлектрического и баллоэлектрического эффектов, с металлическими поверхностями, происходит накопление на них электрических зарядов. При этом, значение напряжения на металлических пластинах зависит от количества «контактных» капель.
 2. Пластины, изготовленные из разных металлов, накапливают различное значение трибоэлектричества.
 3. Выяснено, что вода, содержащаяся в атмосфере в виде водяного пара, способна выступать в качестве энергогенерирующей среды при определенном пороговом значении относительной влажности воздуха. Это можно объяснить наличием у воды двойного электрического слоя в пограничной зоне вода-вторая среда.
- Баллоэлектрический и трибоэлектрический эффекты уже сейчас позволяют получать из капель воды электрический ток достаточной мощности для подзарядки переносимых электронных устройств. Дальнейшие исследования в данной области позволят создавать автономные электрогенераторы способные удовлетворять потребности человечества.

Литература

1. Zhu, G., et al. (2013). Triboelectric Nanogenerators as a New Energy Technology: From Fundamentals, Devices, to Applications. *Nano Energy*, 2(3), 491-502.
2. Vladislav Slabov, Svitlana Kopyl, Marco P. Soares dos Santos, Andrei L. Kholkin. *Natural and Eco-Friendly Materials for Triboelectric Energy Harvesting*. *Nanomicro Lett.* 2020 Dec; 12: 42. doi: 10.1007/s40820-020-0373-y
3. Chen Y, Jie Y, Wang J, Ma J, Jia X, et al. Triboelectrification on natural rose petal for harvesting environmental mechanical energy. *Nano Energy*. 2018; 50:441–447. doi: 10.1016/j.nanoen.2018.05.021
4. Kim, S., et al. (2011). Large-Scale Nanoelectronics via Directed Assembly and Massive Parallelism of Single-Digit Nanometer-Scale Nanowires Using Nanotransfer Printing. *Nature Nanotechnology*, 6(5), 296-301.
5. Lin, L., et al. (2013). High-Output Nanogenerator Based on Radial-Arranged Si Nanowire Arrays. *ACS Nano*, 7(2), 1470-1476.
6. Ammu Anna Mathew, S. Vivekanandan, Arunkumar Chandrasekhar. Chapter 7 - Polymer-based composite materials for triboelectric energy harvesting. *Engineered Polymer Nanocomposites for Energy Harvesting Applications 2022*, Pages 181-202. <https://doi.org/10.1016/B978-0-12-824155-4.00008-9>
7. Shuaihang Pan , Zhinan Zhang. Fundamental theories and basic principles of triboelectric effect: A review. *Friction* 7(1): 2–17 (2019) ISSN 2223-7690 <https://doi.org/10.1007/s40544-018-0217-7> CN 10-1237/TH
8. Kristian Tønder. Inlet roughness tribodevices: dynamic coefficients and leakage. *Tribology International*. [https://doi.org/10.1016/S0301-679X\(01\)00084-6](https://doi.org/10.1016/S0301-679X(01)00084-6). Volume 34, Issue 12, December 2001, Pages 847-852
9. Guang Zhu, Bai Peng, Jun Chen, Qingshen Jing, Zhong Lin Wang. Triboelectric nanogenerators as a new energy technology. *Triboelectric nanogenerators as a new energy technology: From fundamentals, devices, to applications*. *Nano Energy*. Volume 14, May 2015, Pages 126-138. <https://doi.org/10.1016/j.nanoen.2014.11.050>

10. Dubinin A.D. *Energy of friction and wear of machine parts. Abstract of the dissertation. for the degree of Doctor of Physico-Mathematical Sciences / Taras Shevchenko Kyiv State University.* - Kiev: [B. I.], 1964. - 28 p. (опубликовано на русском языке).
11. Tyekin, A. V. *Electrical and tribomechanical properties and triboelectric effects during friction of a composite material based on polytetrafluoroethylene // Abstract of the dissertation of the Candidate of Technical Sciences.* – Omsk: Omsk State Technical University, 2011. – 19 p. (опубликовано на русском языке).
12. Evdokimov Yu. A. *Electric phenomena and transfer during the friction of plastics on metal / Yu. A. Evdokimov, S. S. Sanchez // Electrochemical processes during friction and their use for the fight against wear: theses. All-Union. Conf. Odessa, 1973. - P. 147–149.* (опубликовано на русском языке).
13. Jain V. K. *Material Transfer in Polymer Polymer Sliding / V. K. Jain, S. Bahadur // Wear., 1978. - V. 46, № 1. - 177-178 P.*
14. Wang Z. L. *Progress in triboelectric nanogenerators as new energy technology and self-powered sensors / Z. L. Wang, J. Chen, L. Lin // Energy & Environmental Sci, 8, 2015. – P. 2250–2282.*
15. *Case-Encapsulated Triboelectric Nanogenerator for Harvesting Energy from Reciprocating Sliding Motion / Q. Jing [et al.] // ACS Nano. – 2014. – Vol. 8, № 4. – P. 3836–3842*
16. *Triboelectrification-Based Organic Film Nanogenerator for Acoustic Energy Harvesting and Self-Powered Active Acoustic Sensing / J. Yang [et al.] // ACS Nano. – 2014. – Vol. 8, № 3. – P. 2649–2657.*
17. *Dual-Mode Triboelectric Nanogenerator for Harvesting Water Energy and as a Self-Powered Ethanol Nanosensor / Zong-Hong Lin [et al.] // ACS Nano. – 2014. – Vol. 8, № 6. – P. 6440–6448.*
18. PAN S, ZHANG Z. *Fundamental theories and basic principles of triboelectric effect: A review. Friction, 2019, 7(1): 2-17. <https://doi.org/10.1007/s40544-018-0217-7>*



<https://sconferences.com>
info@sconferences.com

ISBN



9 789165 424548