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Agricultural sciences

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INHERITANCE OF BREEDING CHARACTERISTICS OF DURUM WHEAT (*TRITICUM DURUM* Desf.) DURING HYBRIDIZATION IN THE CONDITIONS OF NAKHICHEVAN AUTONOMOUS REPUBLIC OF AZERBAIJAN

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УДК 633.161

НАСЛЕДОВАНИЕ СЕЛЕКЦИОННЫХ ПРИЗНАКОВ ТВЕРДОЙ ПШЕНИЦЫ (*TRITICUM DURUM* DESF.) ПРИ ГИБРИДИЗАЦИИ В УСЛОВИЯХ НАХИЧЕВАНСКОЙ АВТОНОМНОЙ РЕСПУБЛИКИ АЗЕРБАЙДЖАНА

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Abstract

In the Nakhchivan Autonomous Republic of Azerbaijan, durum wheat (*Triticum durum* Desf.) is of particular importance among grain crops. The creation of drought-resistant and highly productive durum wheat varieties for rain-fed agriculture of the Autonomous Republic is the most important task of breeding. Research on the selection evaluation of varieties, hybrid forms and lines, and the suitability of using them as parent forms when crossing and breeding new varieties was carried out at the Institute of Bioresources. The purpose of the research was to study and identify samples of durum wheat based on a complex of economically valuable traits and to identify the most valuable of them as the starting material for breeding varieties for drought resistance. The conducted research made it possible to identify a number of hybrid forms and lines of durum wheat, recommended for use in breeding when developing new productive and drought-resistant varieties of durum wheat.

Аннотация

В Нахичеванской Автономной Республике Азербайджана среди зерновых культур особое значение имеет твердая пшеница (*Triticum durum* Desf.). Создание засухоустойчивых и высокопродуктивных сортов твердой пшеницы для богарного земледелия автономной республики является важнейшей задачей селекции. Исследования по селекционной оценке сортов, гибридных форм и линий, и пригодности использования их в качестве родительских форм при скрещивании и выведении новых сортов проводили в Институте Биоресурсов. Целью исследований было изучение и выявление образцов твердой пшеницы по комплексу хозяйственно-ценных признаков и выделение наиболее ценных из них в качестве исходного материала для селекции сортов на засухоустойчивость. Проведенные исследования позволили выделить ряд гибридных форм и линий твердой пшеницы, рекомендуемых для использования в селекции при выведении новых урожайных и засухоустойчивых сортов твердой пшеницы.

Keywords: durum wheat, varieties, hybrids, lines, crossing, selection assessment

Ключевые слова: твердая пшеница, сорта, гибриды, линии, скрещивание, селекционная оценка

Введение. Одним из важнейших путей развития и достижения высоких результатов в отрасли растениеводства являются создание и внедрение в производство качественно новых

сортов зерновых культур, обладающих высокой урожайностью в сочетании с высоким качеством зерна и устойчивостью к неблагоприятным условиям внешней среды. В Нахичеванской Автономной Республике немаловажная роль принадлежит озимой твердой пшеницы. Твердая пшеница является ведущей зерновой культурой и занимает второе место по посевным площадям и валовому сбору зерна после озимой мягкой пшеницы. В автономной республике твердая пшеница возделывается во всех почвенно-климатических зонах и выращивается как на богаре, так и на орошаемых землях.

Цель исследований - изучение и выявление образцов твердой пшеницы по комплексу хозяйственно-ценных признаков и выделение наиболее ценных из них в качестве исходного материала для селекции сортов на засухоустойчивость. В задачи исследований входило установить характер наследования важнейших селекционных признаков и получить новый исходный материал для дальнейшей работы по твердой пшеницы. Создание засухоустойчивых и высокопродуктивных сортов твердой пшеницы для богарного земледелия автономной республики является важнейшей задачей селекции, успешное решение которой невозможно без привлечения обширного генофонда мировой коллекции и правильного подбора родительских форм для скрещивания.

Материалы, методы и объекты исследований. Отобранные нами родительские формы принадлежат к различным экологическим группам. Из районированных сортов для скрещивания привлечены наиболее распространенные в автономной республике сорта Karabakh и Kehgaba. Среди образцов иностранного происхождения следует отметить Zedoni-3d56, Zatino, Carolodeskaya. Все образцы, взятые для гибридизации, являются высокоурожайными, обладают рядом положительных признаков и свойств, а также характеризуются средней и высокой засухоустойчивостью [4, с. 7-12], скрещивание было проведено в 60 комбинациях из них 10 обратных.

Посевы осуществляли вручную, по 300 всхожих семян на 1 м² в оптимальные для данной зоны сроки, т.е. в третьей декаде октября. Фенологические наблюдения, учеты и анализы элементов структуры урожая проводили, руководствуясь «Методические указания по изучению мировой коллекции пшеницы.» [1]. Степень доминирования (h_p) количественных признаков гибридами F_1 рассчитывали по формуле, предложенной Г.М.Бейлом и Р.Е.Актинсом [5, с.321-324.].

$h_p = \frac{F - m_p}{P_l - m_p}$ где h_p - степень доминирования; F - Средняя арифметическая гибрида; m_p - Средняя арифметическая обоих родителей; P_l - Средняя арифметическая Родителя с наиболее развитым признаком.

По методике Г.М. Бейла и Р.Е. Актинса дана количественная классификация. Доминирования в связи с величиной: $h_p = 0$ – доминирование отсутствует, $h_p = 1,0$ - полное доминирование, $h_p > 1,0$ – сверхдоминирование, $h_p < 1,0$ – депрессия, $-0,5 < h_p < 0,5$ - промежуточное наследование, $0,5 < h_p$ - частичное доминирование.

Истинный гетерозис ($G_{ист.}$) определяли по Д.С. Омарову [3, с. 123-128].

$$G_{ист.} \% = \frac{F_1 - P_l}{P_l} * 100\%$$

Где F_1 – средняя арифметическая гибрида, $G_{ист.}\%$ - истинный гетерозис, P_l - средняя арифметическая родителя с наиболее развитым признаком. Оценка образцов по содержанию белка и лизина проведена в лаборатории «Зерновые, бобовые и технические культуры» Института Биоресурсов (Нахичеван) Министерство Науки и Образования Азербайджанской Республики. Для определения белка в зерне твердой пшеницы использовали Инфракрасный анализатор СПЕКТРАН-119 М. Статистический анализ экспериментальных данных проводили по методике Б.А. Доспехова [2] с использованием компьютерной программы Excel 2016.

Результаты исследований. Фертильность цветков в прямых и обратных скрещиваниях в среднем колебались от 19,2 до 83,8 %. Высокая завязываемость (70,0-8,1 %) гибридных зерен наблюдалась в комбинациях Alinhca-84 x Sharq, Karabakh x Carolodeskaya, Turan x Zatino. Нами установлено что, когда в качестве материнской формы берутся местные сорта завязываемость гибридных зерен относительно выше, чем в обратных комбинациях.

Наследование селекционных признаков. Нами была изучена характер наследования основных селекционных признаков, таких как продолжительность вегетационного периода, высота растений, продуктивная кустистость, число зерен в колосе, масса 1000 зерен и масса зерна с одного растения.

Продолжительность вегетационного периода: Вегетационный период является из важнейших показателей сорта, особенно на богаре, где он в некоторой степени влияет на засухоустойчивость.

Анализ результатов 60 гибридных комбинаций показал, что раннеспелость у гибридов F₁ в большинстве случаев (75,9 %) наследуется промежуточно, 8,8 % гибридов оказалось раннеспелым или были на уровне раннеспелого родителя, 12,1 % гибриды созревали позднее, позднеспелого родителя или были на его уровне, частичное доминирование отмечалось у 5,2 % гибридов. Гибриды, полученные от комбинаций Giorgio-12571 x Yagut, Yagut x Giorgio-12571, Karabakh x Vugar, Vugar x Karabakh, Karabakh x Carolodeskaya, Carolodeskaya x Karabakh созревали одновременно со скороспелой родительской формой или оказались более скороспелыми, чем скороспелый родитель.

А гибриды комбинаций Giorgio-12571 x Zedoni-3d56, Giorgio-12571 x Karaqilhcıq были позднеспелыми, чем позднеспелая родительская форма. Полное доминирование позднеспелости отмечены у гибридов Turan x Giorgio-12571, Karaqilhcıq x Giorgio-12571, Turan x Yagut. Особый интерес представляют комбинации с участием образцов Giorgio-12571 и Yagut, у которых гибриды и обратных скрещиваниях были скороспелыми или оказались на уровне скороспелого родителя.

Гибриды от рецiproкных скрещиваний в одних случаях имели такую же длину вегетационного периода, как и скороспелая родительская форма, в других они уклонялись в сторону позднеспелой родительской формы, или же превышали их по позднеспелости и скороспелости или же занимали промежуточное положение. Во втором поколении наблюдался большой размах изменчивости этих показателей. В гибридных популяциях обнаружены как раннеспелые, так и позднеспелые формы. Однако в основном они занимали промежуточное положение. Раннеспелые формы чаще всего оказались в комбинациях с участием Yagut и Vugar, которые могут быть рекомендованы для селекции на скороспелость.

Высота растений. Высота растений – важный хозяйственно-биологический признак, обеспечивающий сохранение высокого урожая, как на богаре, так и на орошении. В наших опытах у гибридов F₁ твердая пшеница чаще всего наблюдалась сверхдоминирование (50,0 %) и промежуточное наследование (27,6%) по данному признаку. А в 10,3 % случаев гибриды были на уровне низкорослого родителя или уступали ему и 12,1 % гибриды имели частичное доминирование.

Обращает на себя внимание тот факт, что высокорослые гибриды в большинстве случаев обнаруживаются в комбинациях, где родительские формы также являются высокорослыми. К таковым можно отнести комбинации Carolodeskaya x Karabakh, Karabakh x Tartar, Tartar x Karabakh, Karabakh x Tartar.

Однако следует отметить, что в отдельных комбинациях (Turan X Giorgio-12571, Turan x k-99148, Turan X Zatino, Turan x Karaqilhcıq с участием среднерослых родительских форм благодаря гетерозиса также появляются высокорослые гибриды, низкорослые гибриды получены в комбинациях Zedoni-3d56 X Qilchigli-85, Alinhca-84 x Sharq.

В наших опытах преобладающе внимание материнской формы на наследование высоты стебля не наблюдалось, хотя в отдельных случаях (Turan X Zatino, Zatino X Turan, Karabakh x Carolodeskaya, Carolodeskaya x Karabakh, Karabakh x Tartar, Tartar x Karabakh) это явление имело место.

В F₂ в зависимости от высоты родительских форм и гибридов F₁ наблюдается сложное расщепление по высоте растений. Однако средняя высота гибридов F₂ были близки к высоте соломины родительских форм, т.е. занимали промежуточное положение. Следует отметить, что в отдельных комбинациях (Karabakh x Tartar, Tartar x Karabakh) где участвовали высокорослые сорта, средняя высота растений была выше, чем родительские формы.

Элементы продуктивности растений: В наших опытах это этот признак преимущественно (69,0%) наследовался по типу сверхдоминирования, промежуточное наследование имели 27,8 % гибридов и лишь у 3,2 % гибридов наблюдалось частичное доминирование. Наибольший гетерозисный эффект был получен в комбинациях Qilchigli-85 x Karaqilhcıq, Yagut x Qilchigli-85, Zedoni-3d56 x Bahct, Tartar x Karabakh, Qilchigli-85 x Mirbashir-50. Величина гетерозиса колебалась от 30,0 до 46,9 %. Следует отметить, что гибриды от рецiproкных комбинаций Qilchigli-85 x Turan, Turan x Qilchigli-85, Qilchigli-85 X Karaqilhcıq, Karaqilhcıq x Qilchigli-85, Karabakh x Tartar, Tartar x Karabakh сохранили высокий гетерозисный эффект.

Число зерен в колосе В наших опытах переоблачающиеся большинство гибридов число зерен в колосе (79,3 %) имели гетерозис, промежуточный тип наследование проявили 12,3 % гибриды, частичное доминирование и депрессия отмечено у 5,2 и 3,2 % гибридов соответственно. Высокая степень гетерозиса по озерненности колоса наблюдалось у гибридов F₁ полученных в комбинациях Qilchiqli-85 x Bahct, Bahct x Yagut, Yagut x Turan, Karabakh x Kehreba. Величина гетерозиса по этим комбинациям колебалась в абсолютных цифрах от 26,0 до 65,5 зерен, что соответствует их увеличению на 9,9-13,5%. В комбинациях Karaqilhciq x Turan, Alinhca-84 x Yagut гибриды уступали худшему родителю на 1,0-1,1 зерен. В наших исследованиях у большинства комбинаций (56,9 %) крупность зерна наследовалось по типу сверхдоминирования, промежуточное наследование имели 22,4 % гибридов, полное и частичное доминирование имели соответственно 5,2 и 15,5 % гибридов. Сравнительно высокий уровень гетерозиса (6,3-9,4 %) наблюдался у гибридов в комбинациях Turan x Zedoni-3d56, Turan x Zatino, Karaqilhciq x Turan, Tartar x Karabakh, Mirbashir-50 x Turan.

В рецiproкных скрещиваниях гибриды ведут себя по-разному. Так, в комбинации Qilchiqli-85 x Turan гибриды имели промежуточное наследование, а в обратном – сверхдоминирование. Такое же явление можно наблюдать в комбинациях Qilchiqli-85 X Karaqilhciq, Karaqilhciq x Qilchiqli-85, Yagut x Turan, Karabakh x Tartar, Tartar x Karabakh.

Масса зерна с одного растения является одним из главнейших признаков характеризующих селекционную ценность гибрида. В наших опытах продуктивность растений в большинстве случаев (72,4%) наследовалась по типу сверхдоминирования, в меньшей степени (3,8%) отмечается промежуточное наследование. Полное и не полное доминирование были у 6,9 и 5,2% гибридов. Наибольшим гетерозисом (40,9-52,3 %) обладают гибридные комбинации Turan x Qilchiqli-85, Qilchiqli-85 x Karaqilhciq, Turan x Barakat. Особый интерес представляют гибридные комбинации, показывающие гетерозисный эффект как в прямых, так и в обратных скрещиваниях. К таким следует отнести Qilchiqli-85 x Turan, Turan x Qilchiqli-85, Alinhca-84 x Yagut, Yagut x Turan, Karabakh x Tartar, Tartar x Karabakh.

В популяциях гибридов F₂ отмечен широкий размах по степени выраженности количественных признаков продуктивности. По средним данным наблюдается резкое падение гетерозиса в результате снижения гетерозиготности этого поколения, хотя в ряде случаев наблюдается гетерозис в связи расщеплением растений и появлением новых, более продуктивных форм.

Выделенные нами наилучшие гибридные линии по ряду хозяйственно-ценных признаков дальнейшую оценку получили в селекционном и лучшие из них в контрольном питомниках. Высокой урожайностью, засухоустойчивостью, средней рослостью и устойчивостью к полеганию характеризуются линии Giorgio-12571 x Turan, Alinhca-84 x Sharq, Karaqilhciq x Giorgio-12571. При урожае 30,9-35,0 ц/га они превысили стандарт на 40,4 – 59 %. Примечательно, что они так же созревают раньше стандарта на 3-4 дня. Линии Zatino x Turan характеризуются сравнительно высокой урожайностью и созревают на 5-6 дней раньше стандарта. По степени засухоустойчивости все линии оказались средне и высоко засухоустойчивыми. Все выделенные нами гибридные линии в настоящее время проходят дальнейшее изучение в условиях Нахичеванской Автономной Республики.

Выводы. Проведенная нами селекционная оценка различных гибридов, гибридных линий и сортов твердая пшеница как родительских форм для скрещивания позволила выделить по ряду хозяйственно-ценных признаков гибридные линии, использование которых в селекции твердой пшеницы перспективно.

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Economic sciences

COMPLIANCE AND RISK MANAGEMENT IN INTERNATIONAL HUMANITARIAN ORGANIZATIONS

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Abstract

This literature review synthesizes research on compliance and risk management in international humanitarian organizations, emphasizing the need for adaptive compliance frameworks and proactive risk management strategies. It explores the challenges of navigating complex regulatory and operational landscapes, the ethical and legal considerations in crisis contexts, and the potential of technology to enhance organizational practices. The review underscores the critical importance of these elements in ensuring the effectiveness, accountability, and sustainability of humanitarian efforts. It advocates for ongoing research into innovative strategies and technologies to support the evolving needs of the humanitarian sector.

Keywords: *Compliance, Risk Management, Humanitarian Organizations, Ethics, Legal Challenges, Technology, Sustainability*

Introduction

In the intricate and ever-evolving landscape of international humanitarian efforts, the concepts of compliance and risk management stand as critical pillars ensuring the integrity, effectiveness, and sustainability of operations. International humanitarian organizations, by their very nature, navigate through some of the world's most challenging environments. These entities strive to provide relief and support in situations marked by conflict, natural disasters, and severe socio-economic disparities. Amidst such adversity, the potential for operational, financial, legal, and reputational risks escalates, making the adherence to stringent compliance standards and the implementation of comprehensive risk management strategies not merely beneficial but essential.

The essence of compliance within these organizations transcends the mere observance of laws and regulations. It embodies a commitment to ethical principles, accountability, and transparency, ensuring that every action taken aligns with both the letter and the spirit of humanitarian values. This commitment is crucial in maintaining the trust and support of donors, beneficiaries, and the international community at large. It serves as a safeguard against the misuse of resources, ensuring that aid reaches those most in need, while also protecting the organizations from legal entanglements and ethical quandaries.

Risk management, on the other hand, involves a proactive and strategic approach to identifying, assessing, and mitigating risks. In the unpredictable realms where humanitarian organizations operate, the ability to anticipate and effectively manage risks can mean the difference between success and failure. It is about ensuring continuity and resilience, enabling these organizations to fulfill their missions even in the face of unforeseen challenges.

Together, compliance and risk management form the backbone of any successful international humanitarian operation. They ensure that organizations not only survive in a complex global landscape but thrive, making a meaningful impact on the lives of millions. As such, delving into the intricacies of these disciplines offers valuable insights into the operational excellence and ethical considerations that define the humanitarian sector today.

Theoretical Frameworks and Conceptualizations

Scholars have extensively explored the theoretical underpinnings of compliance and risk management within non-profit and humanitarian contexts. Biermann and Koops (2017) provide a comprehensive overview of the governance structures that underpin international humanitarian organizations, emphasizing the role of compliance in ensuring ethical and legal adherence amidst diverse regulatory landscapes. Meanwhile, Comfort, Boin, and Demchak (2010) delve into the complexity of risk management in crisis situations, proposing a model that integrates resilience, coordination, and adaptive capacity as key components of effective risk management strategies.

Research on compliance within humanitarian organizations often focuses on the dual challenges of adhering to international norms while also respecting local laws and customs. Betts and Orchard (2014) examine the tension between global standards and local realities, suggesting that flexible compliance frameworks that can adapt to varying contexts are essential for operational success. On the financial compliance front, studies by Othman and Rahman (2014) highlight the critical role of transparent financial reporting and accountability in maintaining donor trust and ensuring the ethical allocation of resources.

The unpredictable nature of humanitarian crises poses significant risk management challenges. Kruke and Olsen (2012) analyze the vulnerability of humanitarian operations to external shocks, advocating for a proactive approach to risk assessment and mitigation. Their findings underscore the importance of contingency planning and the development of robust logistical frameworks to ensure rapid and effective responses to emergencies.

Legal compliance and ethical considerations are intricately linked in the context of humanitarian aid. Slim (2015) discusses the ethical dilemmas faced by humanitarian organizations, particularly in conflict zones where adherence to international humanitarian law may be compromised. The study calls for a principled approach to compliance that prioritizes the protection of civilian populations. Similarly, Ferris (2011) addresses the legal challenges of operating in complex emergencies, emphasizing the need for legal expertise in navigating issues related to sovereignty, consent, and the protection of aid workers.

The role of technology in enhancing compliance and risk management practices has emerged as a significant area of interest. Wallace and Choularton (2014) explore the potential of information and communication technologies (ICTs) in improving disaster preparedness and response. They argue that technology can facilitate better risk assessment, real-time monitoring, and efficient resource allocation, thereby strengthening compliance and risk management efforts.

Analysis and Results

Analysis of Compliance Challenges

The analysis of compliance challenges within international humanitarian organizations reveals a multifaceted landscape where regulatory, ethical, and operational dimensions intersect. A critical finding from the literature is the tension between global compliance standards and local operational realities. Betts and Orchard's (2014) work highlights this tension, emphasizing the need for adaptable compliance frameworks that can be tailored to specific contexts without compromising global standards of accountability and transparency. This adaptability is crucial in ensuring that compliance efforts are both effective and culturally sensitive, thereby enhancing the legitimacy and impact of humanitarian operations.

Financial compliance emerges as another significant challenge, with Othman and Rahman (2014) pointing out the complexities of managing donor funds in accordance with both donor expectations and legal requirements. The analysis suggests that robust financial management systems, coupled with transparent reporting mechanisms, are essential in maintaining donor trust and ensuring the ethical allocation of resources.

Risk Management Strategies

The literature review underscores the importance of proactive risk management in the volatile environments where humanitarian organizations operate. Kruke and Olsen (2012) advocate for a comprehensive approach to risk management that includes contingency planning, logistical preparedness, and the development of adaptive capacities. Such an approach enables organizations to respond swiftly and effectively to unforeseen crises, minimizing the impact on vulnerable populations.

A notable finding is the potential of technology to enhance risk management practices. Wallace and Choularton (2014) explore how advancements in ICT can improve disaster preparedness, real-time monitoring, and resource allocation. The analysis indicates that leveraging technology can significantly strengthen the ability of humanitarian organizations to assess and mitigate risks, thereby improving the overall effectiveness of their operations.

Legal and Ethical Considerations

The intersection of legal compliance and ethical considerations presents a complex challenge for humanitarian organizations, particularly in conflict-affected areas. Slim's (2015) discussion on the ethical dilemmas faced by these organizations highlights the need for a principled approach to compliance that prioritizes the protection of civilian populations. The analysis suggests that navigating legal challenges requires not only legal expertise but also a deep commitment to humanitarian principles.

Ferris (2011) further elaborates on the legal complexities of operating in emergencies, emphasizing the importance of understanding issues related to sovereignty, consent, and the protection of aid

workers. The results indicate that addressing these legal challenges is critical for ensuring the safety and effectiveness of humanitarian interventions.

Conclusion

The extended analysis of compliance and risk management in international humanitarian organizations reveals a landscape marked by significant challenges and opportunities. The findings underscore the need for adaptable compliance frameworks, robust financial management, proactive risk management strategies, and a principled approach to legal and ethical considerations. Leveraging technology emerges as a promising avenue for enhancing both compliance and risk management efforts. As the humanitarian sector continues to evolve, these insights provide valuable guidance for organizations seeking to navigate the complexities of their work effectively.

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THE IMPACT OF ERP IN THE TRANSPORTATION INDUSTRY

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Abstract

The logistics and transport industry is rife with complexities, ranging from the imperative of maintaining equipment and ensuring secure operations to adeptly managing stringent shipping deadlines. Consequently, a dependable enterprise resource planning (ERP) system proves invaluable in meeting and overcoming these multifaceted demands.

Introduction

The logistics sector is making significant strides towards becoming a major player in the global economy. The rapid growth of eCommerce and the globalization of markets have fueled the expansion of the transport and logistics industries. To keep up with this growth, it has become imperative for these industries to consistently monitor their assets, manage vehicle maintenance schedules, and handle upcoming bookings, payments, and resources efficiently. However, challenges arise in tracking and scheduling maintenance, as well as managing various aspects of logistics operations, given that some data is often manually stored in files. This raises the question of how to streamline work processes in a manner that is both efficient and effective. The solution to this challenge lies in adopting Enterprise Resource Planning (ERP) systems. ERP tailored for the logistics and transportation sectors proves to be a comprehensive solution, addressing not only the aforementioned responsibilities but also providing additional functionalities, all from a unified platform. This approach ensures a seamless integration of various tasks, making the workflow more efficient and allowing for better control over the entire logistics process.

At the same time, Enterprise Resource Planning (ERP) serves as an important tool for businesses, facilitating the efficient organization and management of key operational components. Enterprises use various ERP technology software solutions to effectively implement resource planning by integrating various business functions into a single system. The primary responsibility of Enterprise Resource Planning involves the control of several processes that significantly affect the operational efficiency of a business. From a software perspective, ERP systems manage a number of functions, such as human resources, order processing, inventory management, accounting, and customer relationship management (CRM). In simpler terms, the role of ERP can be understood as a software solution that perfectly integrates various functions, integrating them into a single system. This integration, in turn, simplifies operations and facilitates the seamless distribution of critical information across the organization. [1, 457]

Additionally, Enterprise Resource Planning (ERP) solutions run on a shared database platform, acting as a connecting hub for various business functions. This platform facilitates the use of multiple features by different business units. Simply put, employees from different departments, such as accounting or sales, can depend on a single source of information tailored to their specific needs, ultimately improving overall company performance. As a result, ERP software is proving invaluable in sectors such as transportation and logistics due to the many benefits it brings.

In essence, a transport and logistics company has the capability to oversee crucial business operations, including enhancing customer satisfaction, efficiently managing logistics, optimizing resources, and streamlining processes for maximal efficiency. The integration of ERP software becomes instrumental in achieving these objectives, fostering client retention, and ultimately driving profitability.

Contents of the study

The logistics and transport industry operates within a dynamic landscape, where successful navigation from one point to another involves managing a multitude of interconnected components. Providing reliable transportation services adds another layer of complexity to the operational puzzle. In this ever-evolving environment, expertise and adept implementation of strategies become crucial. The ability to seamlessly integrate material handling processes, optimize packaging techniques, and maintain precise control over inventory is essential. Furthermore, the effective utilization of warehouse solutions is pivotal for streamlining operations and meeting the demands of a dynamic market. Transportation services, a cornerstone of the industry, require not only timeliness but also efficiency. Navigating through the challenges of fluctuating fuel prices, regulatory changes, and global events demands a strategic approach to ensure the uninterrupted movement of goods from point A to point B. In essence, the logistics and transport sector is a multifaceted industry where success hinges on the meticulous coordination of various moving parts. Adapting to change,

embracing technological advancements, and employing innovative solutions are key elements for businesses seeking to thrive in this complex operational landscape.

Effectively managing the myriad aspects of a logistics and transport business can pose significant challenges. To address this, the integration of logistics software emerges as a crucial solution. An ERP system proves invaluable for companies in this sector, offering a range of benefits. Enterprise Resource Planning (ERP) software plays a pivotal role in enhancing logistics across various domains, such as:

- ERP software facilitates enhanced inventory management by providing real-time insights into stock levels, order processing, and demand forecasting. This ensures that businesses maintain optimal inventory levels, reducing the risk of stockouts or excess holdings.

- With its integrated approach, ERP assists in streamlining supply chain management by connecting various elements of the production and distribution processes. This coordination enhances overall efficiency, reduces delays, and minimizes the chances of errors in the supply chain.

- ERP systems offer modules for transportation management, allowing companies to optimize routes, track shipments in real time, and manage logistics partners effectively. This leads to improved efficiency in transportation and shipping operations, reducing costs and delivery times.

- One of the significant advantages of ERP in logistics lies in its ability to provide accurate and timely financial reporting. By consolidating data from different business functions, the software enables better financial analysis and decision-making, fostering a more transparent and accountable financial environment.

The implementation of a robust ERP system becomes a strategic move, enabling companies to identify opportunities for efficiency improvements while mitigating errors that might incur substantial costs over time. This approach not only enhances operational efficiency but also positions the company for a competitive edge within the sector.

ERP systems play an important role in optimizing your logistics operations and bring high efficiency. Take for example the scenario of monitoring a fleet of trucks. With the implementation of the ERP system, it is possible to track the location of each truck in real time. This enables a strategic overview of available trucks and facilitates accurate dispatch based on current positions. Improving business efficiency isn't just limited to truck driving; an ERP system extends its benefits to various areas of your operations. In addition to real-time tracking, an ERP system allows you to simplify inventory management, organize seamless order processing, and easily create shipping labels. Together, these functions contribute to a more efficient and well-coordinated business ecosystem. The versatility of an ERP system lies in its ability to optimize various aspects of your business processes and foster an environment where operational efficiency becomes a defining feature. [2, 984]

Employing an ERP system offers the added advantage of cost reduction. Consider the scenario where you rely on an Excel spreadsheet for inventory management, introducing the potential for errors that may incur financial losses. By implementing an ERP system, real-time inventory tracking becomes feasible, preventing situations of overstocking or understocking. This proactive approach aids in cost savings and enhances overall operational efficiency. Moreover, the automation capabilities of an ERP system extend to tasks like billing and invoicing, further streamlining processes and contributing to financial efficiency.

Another advantage of implementing ERP in logistics lies in its ability to elevate customer service standards. This system facilitates improved communication, efficient resource scheduling, and enhanced material tracking through the automation of routine tasks and the optimization of various processes. The integration of an ERP system empowers businesses to swiftly pinpoint areas that require refinement in their customer service initiatives. Additionally, it furnishes a comprehensive pool of visible data that can be strategically utilized to enhance overall operational efficiency. By offering real-time insights into customer needs, an ERP system enables businesses to craft tailored solutions that cater to individual preferences. This proactive approach not only boosts customer satisfaction but also ensures that every interaction with the company is characterized by top-notch service quality. The utilization of ERP in this context transforms data into actionable intelligence, enabling businesses to consistently meet and exceed customer expectations in a personalized manner.

In the absence of an ERP system, the transport and logistics sector grapples with a myriad of challenges. Timely deliveries become a struggle, and operational costs escalate due to the pitfalls of manual coordination errors. In order to enhance overall efficiency, organizations within this industry must relentlessly pursue automation solutions. Implementing proper automation not only streamlines processes but also addresses issues such as delivery delays and financial burdens associated with manual errors, paving the way for a more effective and cost-efficient operation in the transport and logistics landscape.

1. *Ineffective Transactions*

In the absence of a robust ERP (Enterprise Resource Planning) system, transport and logistics companies frequently grapple with operational inefficiencies, giving rise to a cascade of issues. These challenges encompass elevated operational costs, protracted delivery timelines, and ultimately, customer dissatisfaction. The integration of an ERP system is imperative for streamlining and optimizing various facets of the logistics workflow, facilitating smoother coordination between disparate departments, and enhancing overall operational efficiency. By leveraging advanced technologies and data-driven insights, companies can mitigate inefficiencies, improve cost-effectiveness, and cultivate a more responsive and customer-centric approach in the dynamic realm of transport and logistics.

2. *Difficulty Tracking Inventory*

In the absence of an efficient Enterprise Resource Planning (ERP) system, the transport and logistics sector encounters a notable challenge in effectively monitoring inventory. The absence of an integrated ERP system poses difficulties in tracking shipments, overseeing inventory levels, and efficiently managing customer orders. The repercussions of this deficiency are evident in potential delays and instances of lost goods, ultimately contributing to adverse effects on the financial aspects of the industry. The implementation of a robust ERP system becomes imperative to streamline operations, enhance visibility, and mitigate the risks associated with inadequate inventory tracking within the transport and logistics domains.

3. *Inaccurate statistics*

A well-functioning and robust Enterprise Resource Planning (ERP) system is essential for the optimal functioning of transport and logistics companies. The absence of such a system can lead to fragmented and inaccurate data, hindering daily operations and impeding the ability to make informed decisions regarding customers and suppliers. An adept ERP system offers automation that transforms raw data into actionable intelligence, allowing leaders in the transport and logistics sectors to address identified issues proactively. This not only provides valuable insights to executives but also ensures a consistent flow of accurate information, a capability inherent in modern ERP technology.

By showing these reasons as the main problem, we can better understand the role of erp in the field of transportation. Considering all the issues mentioned above, we consider the implementation of erp in the logistics sector as a priority step.

Result

An ERP system offers many benefits for a logistics and transportation business. It delivers a comprehensive set of integrated, customizable tools that can help you better manage complex processes related to supply chains and logistics. With actionable data from a correctly implemented ERP, you'll be able to streamline and optimize any process within your infrastructure. This increased visibility will diminish the risk factors commonly caused by a disjointed system, allowing you to save time and money whilst scaling your business. The smart integration of components increases total operational knowledge with detailed reporting capabilities, enabling optimum results. 3 Key Traffic Management Features of an Erp system are mentioned below:

1. Vehicle tracking is a crucial component of any effective transportation management system, offering real-time insights that prove instrumental in optimizing various aspects of the logistics process. The capability to monitor vehicles in real-time not only facilitates route optimization but also ensures the efficient utilization of transportation resources. Beyond that, it serves as a valuable tool for overseeing and enhancing driver behavior. In addition to the operational advantages, real-time tracking data plays a pivotal role in elevating customer service standards. By harnessing this information, businesses can provide accurate estimated arrival times for deliveries, thereby enhancing customer satisfaction. The ability to offer precise delivery timelines contributes to a more transparent and reliable service, fostering positive relationships with customers. In essence, the dynamic tracking feature in transportation management systems goes beyond its fundamental purpose of route optimization. It emerges as a multifaceted tool that positively impacts operational efficiency, driver conduct, and the customer experience. As businesses increasingly recognize the significance of real-time vehicle tracking, they stand to benefit not only in terms of streamlined logistics but also in the cultivation of a customer-centric and reliable reputation in the market.

2. Efficient load planning is a crucial component of a well-rounded transportation management system, ensuring the secure and safe transport of items to their destinations. The system must adeptly strategize the loading process, prioritizing the arrangement of items on vehicles to enhance stability during transit. Moreover, the optimization of vehicle utilization is a key goal, maximizing cargo capacity for each journey. By carefully planning and organizing loads, a transportation management system

contributes to both the safety of transported goods and the overall cost-effectiveness of the logistics process.

3. A comprehensive transportation management system must encompass robust reporting and analytics functionalities to enhance operational efficiency. By harnessing data insights, organizations can pinpoint trends and areas that require improvement within their transportation operations. The integration of reporting and analytics tools also facilitates the measurement of driver and vehicle performance, offering a holistic view of the overall transportation system. This data-driven approach empowers businesses to make informed decisions, optimize resource allocation, and continually refine their logistics strategies for enhanced effectiveness and competitiveness in the ever-evolving transportation landscape.

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Medical sciences

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PALLIATIVE CARE FOR CANCER PATIENTS AND THE CRITERION OF QUALITY OF LIFE

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Abstract

This work highlights modern approaches to the study of quality of life in palliative oncology. The basic principles for assessing clinical symptoms in cancer patients with advanced forms of malignant tumors and their impact on the quality of life of these patients are presented. Aspects of studying quality of life in clinical research and clinical practice are described. It has been shown that the method of assessing the quality of life, being a simple and reliable way to determine the impact of the disease on the patient's condition, can increase the effectiveness of palliative treatment.

Keywords: *palliative care, quality of life, questionnaire.*

Palliative medicine is a system of comprehensive care for incurable patients, the main goal of which is to achieve the best quality of life for patients, control pain and other symptoms that aggravate their condition, as well as solve psychological and social problems. Dynamic monitoring of quality of life allows for full monitoring of the condition of an oncology patient and adequate correction of symptomatic and supportive therapy programs [1,2].

Today, the problem of high morbidity and mortality from cancer is a worldwide problem. At the same time, it is known that the main burden of therapeutic and moral responsibility for patients with advanced forms of malignant neoplasms, who make up clinical group IV and for whom only supportive (palliative) treatment is carried out primarily at diagnosis or in the process of treatment as the disease progresses, lies with district oncologists, general practitioners, general practitioners at local clinics and doctors at palliative care centers (hospice). At the same time, it is often difficult to adequately assess the patient's true condition, which is associated with many objective and subjective factors (such as, for example, individual pain threshold, etc.).

The characteristics and degree of influence of various symptoms on the quality of life in modern palliative care practice are based on the patient's perception and are carried out using special tools. The main requirements for questionnaires used in palliative medicine are fully applicable to questionnaires for assessing symptoms. At the same time, accurate assessment and measurement of symptom intensity in clinical trials allows us to study the mechanisms of symptom formation and compare the effectiveness of treatment methods. Assessment of quality of life is widely used in clinical practice, because here, as in clinical studies, an accurate and adequate assessment of the patient's condition, his response to

treatment, palliative care programs and symptomatic therapy is necessary. In clinical practice, this method makes it possible to monitor the dynamics of symptoms, investigate the cause and mechanisms of their occurrence, develop an adequate treatment plan, and also determine the effectiveness of the treatment measures taken. Symptom assessment tools include both questionnaires for assessing individual and main symptoms, and single scales (verbal rating scales, visual analogue and digital rating scales). The most commonly used symptom assessment questionnaire in palliative care is the Edmonton Symptom Assessment System - ESAS, which allows assessing the manifestation of 9 leading symptoms found in cancer patients: fatigue, pain, nausea, depression, anxiety, loss of appetite, drowsiness, shortness of breath and general impairment. well-being [3,4].

Assessing quality of life in palliative medicine in general and in palliative oncology in particular has its own characteristics. First of all, this concerns the choice of an instrument for assessing quality of life. Such questionnaires are developed taking into account the following characteristics: the presence of problems associated with the symptoms of the disease, the characteristics of the physical and psychological status of patients and the patients' limited ability to concentrate. In this regard, tools for assessing quality of life in palliative medicine should be simple, concise and easy to fill out. The patient fills out the questionnaire himself (self-assessment) and only if this is not possible - with the help of relatives or medical personnel (proxy assessment). But it must be taken into account that the latter option for assessing symptoms has low reliability. The most common and frequently used questionnaires in palliative oncology include the EORTC QLQ-C15-PAL (European Organization for Research and Treatment of Cancer Palliative Care Questionnaire) [5,6] and FACT (Functional Assessment of Cancer Therapy) [7,8].

The great potential of the method for assessing the quality of life lies both in determining the severity of pathological symptoms and in the method of individual monitoring of the condition of an oncological patient (assessment of the overall quality of life and various functional indicators over a long period of observation). At the same time, the basic principles for assessing leading symptoms are as follows: 1) assessment of the symptom(s) obtained with the help of the patient; 2) use of special tools for assessing symptoms (scales and questionnaires); 3) assessment of the symptom(s) over time; 4) documenting all stages of symptom assessment.

The method of assessing the quality of life in clinical practice allows for timely correction of palliative treatment in order to increase its effectiveness, thereby ensuring adequate psychological and social assistance and the highest possible level of quality of life for the doomed patient during the entire observation period.

It should be especially noted that quality of life indicators have independent prognostic significance in determining the possible response to palliative treatment and patient survival. There is indicative data on the relationship between quality of life and survival of cancer patients. At the same time, it has been proven that high quality of life indicators lead to improved survival rates for cancer patients who undergo maintenance therapy. The resulting quality of life indicators can be used to determine an individual prognosis for a particular patient for various nosological forms of malignant tumors. When developing rehabilitation programs for psychological and social support, the parameters of the quality of life of cancer patients must be taken into account.

Thus, assessing quality of life in palliative oncology is a simple and reliable method for determining the impact of the disease on the patient's condition, including his physical, psychological and emotional status. This comprehensive approach to assessing the patient's condition makes it possible to develop individual palliative care programs that make it possible to maximally cover the required amount of medical and social support for each patient with cancer.

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HEARING FUNCTION IN CHILDREN AFTER THE IMPACT OF CORONAVIRUS INFECTION (COVID-19)

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Abstract

Information about the hearing status of patients who have suffered coronavirus infection caused by the SARS-CoV-2 virus is currently varied and sporadic. There are no results from studies conducted among the pediatric population.

Aim. *To assess the state of hearing function in children who have had coronavirus infection.*

Material and methods. *In the city of Dushanbe, Republic of Tajikistan, 87 children aged from 3 to 17 years old who have had coronavirus infection. Audiological examination depending on age included: otoscopy, registration of delayed evoked otoacoustic emissions (DEOAE), otoacoustic emissions at the frequency of the distortion product (DAEPI), short-latency auditory evoked potentials (SAEP), impedance measurement, tone threshold audiometry, speech audiometry in silence and noise. According to the indications, the condition of the central parts of the auditory analyzer was assessed.*

Results. *In 80 (92%) children, no pathology was detected during otoscopy. A type "A" tympanogram was recorded in all children. The acoustic reflex was recorded in 49 (56%) children, was not recorded at 1-2 frequencies in 27 (31%) children, was recorded only at 1 frequency or was not recorded in 11 (13%) children. Otoacoustic emissions recorded in 83 (95%) children. Pure-tone threshold audiometry data for all children were normal. Speech intelligibility in quiet and noise was also within the normal range for most children.*

Conclusion. *There were no cases of hearing loss or signs of central auditory disorders in children who had a new coronavirus infection. Due to the diversity of the clinical presentation and long-term consequences of COVID-19, further study of the hearing status in such patients is required.*

Keywords: *Sensorineural hearing loss, coronavirus infection, SARS-CoV-2, COVID-19, hearing.*

Introduction. *Since 2020, an epidemic of a new coronavirus infection (COVID-19) began in many countries of the world, including the Republic of Tajikistan. The epidemic caused by the SARS-CoV-2 virus has been declared a public health emergency of international concern by the World Health Organization.*

The new coronavirus is an RNA virus belonging to pathogenicity group II. The source of infection is a sick person. The entrance gate is the epithelium of the upper respiratory tract and gastrointestinal tract, transmission routes are airborne droplets, airborne dust and contact. SARS-CoV-2 is capable of infecting various organs and tissues, but its primary target is type II alveolar lung cells [1]. The neurotropic effect is associated with the ability of the virus to penetrate cells that have ACE2 receptors, which include cells of the brain and pituitary gland. Entry of SARS-CoV-2 hematogenously or through the ethmoid bone plate can lead to brain damage. Anosmia is considered as evidence of the neurotropism of the virus [2].

Symptoms of the disease are similar to those of an acute respiratory viral infection: hyperthermia, cough, shortness of breath, fatigue, chest congestion, sore throat, hyposmia and anosmia. The disease can have varying degrees of severity: from mild (upper respiratory tract damage) to extremely severe (pneumonia, sepsis, DIC, shock), with up to 50% of those infected experiencing the disease asymptotically. Children get sick less often and have less severe clinical symptoms [3].

It has been proven that many types of both viral and bacterial infections can cause hearing loss. However, previously known coronaviruses, such as SARS (severe acute respiratory syndrome) or MERS (Middle East respiratory syndrome), did not cause hearing impairment. Due to the high spread of the new

coronavirus infection, which has caused a global pandemic, the question arises whether it could be the cause of pathology of the auditory analyzer.

In June 2020, several young Iranian patients (22 to 40 years old) experienced hearing loss, tinnitus, and dizziness due to mild COVID-19 [4]. In October 2020, the medical journal BMJ Case Reports published a case report of a 45-year-old British man who developed tinnitus and sudden hearing loss in one ear after severe COVID-19. After a course of hormone therapy, hearing was partially restored [5]. It is impossible to prove that COVID-19 directly caused this patient's hearing loss, but the study authors suggest it is likely because he did not receive any medications with potential ototoxic effects during treatment.

C. Degen et al. (2020) presented a clinical case of acute hearing loss (deafness on one side and severe hearing loss on the other side), which occurred against the background of pneumonia in a 60-year-old patient with coronavirus infection. In addition to hearing problems, the patient complained of severe bilateral ear noise. Magnetic resonance imaging of the temporal bones showed a pronounced accumulation of contrast in the area of the cochlea, which experts associated with the presence of a bilateral acute inflammatory process in the inner ear. Due to the high risk of cochlear obliteration, the patient immediately underwent cochlear implantation surgery [6].

There have been cases of unilateral hearing loss that occurred against the background of a new coronavirus infection [7, 8]. At the same time, a course of corticosteroids in some patients provided partial restoration of hearing [5, 7], but in other situations it was ineffective [8].

The virus was detected in the middle ear ossicles during autopsy of the temporal bones in two out of three patients with COVID-19 [9].

The results of a survey of patients who suffered a new coronavirus infection, conducted in the UK, cannot be ignored. It turned out that about 13% of patients reported problems with hearing and/or the presence of tinnitus. At the moment, not all of these patients have undergone full audiological testing due to the difficult epidemic situation. Therefore, the final results of assessing the hearing status of patients in this group are still unknown [10].

Two studies analyzed not only the presence/absence of hearing pathology after COVID-19 infection, but also audiometric parameters of hearing status, such as tone hearing thresholds, otoacoustic emission (OAE) characteristics, and impedance measurements [11, 12]. Both studies compared the hearing status of patients with coronavirus infection with the hearing status of healthy control group participants. A statistically significant difference was revealed in the characteristics of otoacoustic emission (OAE) at high frequencies between the two groups, while the OAE amplitude was worse in patients of the main group. M. Mustafa also notes a statistically significant increase in the hearing threshold in patients of the main group at frequencies of 4000 Hz, 25 dBnHL compared with the average threshold in control patients of approximately 15 dBnHL. Disadvantages of the design of this study include the lack of baseline testing, non-randomization of groups, and lack of adjustments for age and gender [11].

In general, it should be recognized that in the literature, reports on the state of hearing after COVID-19 infection are still scattered and isolated. Some review articles devoted to this problem emphasize the paucity of information on the occurrence of hearing loss after the disease, as well as the paucity of audiological data [13]. At the same time, despite the extensive experience gained in treating patients with a new coronavirus infection, we still do not know much about the pathogen. One of those unknowns is the potential long-term health consequences for people who survive the disease. More research is needed both to examine the acute effects of COVID-19 and to understand the long-term risk to auditory and vestibular function. The available data on the impact of the new coronavirus infection on hearing is mainly obtained for adults. There are currently no results from similar studies conducted among the pediatric population.

The purpose of the study is to assess the state of hearing function in children who have suffered a new coronavirus infection.

Material and methods. The study was conducted in the city of Dushanbe (on the basis of the ENT clinic of the National Medical Center "Shifobakhsh").

A total of 87 children aged from 3 to 17 years, 44 boys and 43 girls, who had a laboratory-confirmed new coronavirus infection, were examined. Children are distributed by age groups as follows: 3 years - 18 children; 4-6 years old - 12 children; over 7 years old - 57 children. At the time of the study, all children had a negative PCR test result and did not present complaints characteristic of an upper respiratory tract infection; There were no complaints of hearing loss either during or after the disease.

Clinical variants of the course of COVID-19 were distributed as follows: 21 (24%) children were asymptomatic (7 children under 3 years old, 2 children 4-6 years old, 12 children over 7 years old), 61 (70%) children had infection manifested itself in the form of acute nasopharyngitis (9 children under 3 years old, 11 children 4-6 years old, 41 children over 7 years old), 5 (6%) children over 7 years old had pneumonia without respiratory failure. In 83 children the disease was mild (18 children under 3 years old, 12 children 4-6 years old, 53 children over 7 years old), 4 children over 7 years old had a condition of moderate severity. Additional neurological and general symptoms of the disease were headache (in 14 cases); weakness, apathy (in 7 cases); pain in the back and legs (in 2 cases); confusion (in 1 case); loss of appetite (in 1 case). 9 (10%) children had anosmia during the disease. The duration of the disease was less than 1 week in 4 (5%) children; in 29 (33%) children - 1-2 weeks; in 31 (36%) children - 2-3 weeks; in 23 (26%) children - more than 3 weeks. Azithromycin was received by 6 children, of which 1 child with pneumonia additionally received amikacin (drugs with a potential ototoxic effect).

The period that elapsed from the moment of recovery from COVID-19 to the time of audiological examination was less than 1 month in 23 (27%) children; 1-2 months - in 21 (24%) children; 2-3 months - in 16 (18%) children; 3-4 months - in 14 (16%) children; 4-6 months - in 13 (15%) children.

All children underwent registration of delayed evoked otoacoustic emission (DEOAE), otoacoustic emission at the frequency of the distortion product with a stimulation intensity of 65/55 dB SPL (DAEPI), tympanometry (in children under 6 months a probing tone of 1000 Hz was used, over 6 months - a tone of 226 Hz), children over 6 months of age underwent acoustic reflexometry. Registration of short-latency auditory evoked potentials (SLEPs) with determination of the detection threshold of the V peak, assessment of the morphology of the response, latent periods of SSEPs, and interpeak intervals was performed in 5 young patients in a state of natural sleep. The results of objective tests were supplemented by behavioral audiometry data: for children over 5 years of age, the study was carried out using a standard method, for children aged 2 to 5 years - in the format of play audiometry, for children under 2 years of age, audiometry with visual reinforcement was performed.

In 17 young children (under 3 years of age), auditory-verbal development was assessed using the LittleEARS (Early Child Hearing Behavior Assessment) and PEACH (Parents' Evaluation of Aural/Oral Performance of Children) questionnaires, which were completed by parents [14, 15]. The condition of the central parts of the auditory analyzer was assessed 50 patients over 4 years of age: parents filled out the Fisher screening questionnaire to identify central auditory disorders, and speech audiometry was also performed in the format of monaural testing. The study was carried out with headphones at a comfortable volume level using speech tables of one- and two-syllable words depending on age; When testing in noise, equal intensities of speech and noise signals were used. Speech intelligibility of 80% or higher was considered normal speech testing performance. Normative data from the Fisher questionnaire vary depending on the age of the child. For all age groups, the lower limit of the norm for the Fisher questionnaire is 67.8 points [16].

Children suspected of having central auditory disorders (low speech intelligibility and/or low scores on the Fisher Questionnaire) underwent additional testing of the functional state of the central parts of the auditory system. This testing included several tests: a binaural interaction assessment, a dichotic number test, a pause detection test, and a speech study against the background of ipsilateral interference. Binaural interaction assessment was performed using binaurally alternating speech (BIS). As speech material, tables of 10 monosyllabic words corresponding to the child's age were presented. Binaural intelligibility was assessed by alternating presentation of the signal: the first part of the word was presented to one ear, and the second part to the other ear. Normally, the intelligibility of monosyllabic words presented in the BBR format is at least 80%. When performing the dichotic number test, one number was simultaneously presented to each ear (single-digit numerals were used for children 4-6 years old, double-digit numerals were used for children over 6 years old); The child's task is to repeat both numbers in any order. We used two tracks of 10 pairs of numbers each (the first was training; the second was testing). Correct reproduction of at least 80% of pairs was taken as the norm [17]. Low-redundancy monaural speech testing was carried out in the format of the Russian matrix phrase test (RuMatrix - Russian Matrix Sentence Test) in silence and against the background of ipsilateral noise using the full (for children over 10 years old) or simplified (for children under 10 years old) version [18, 19]. Normally, 50% noise intelligibility in the RuMatrix test is -8.8 ± 0.8 dB SNR. For the simplified version, the standard indicators depend on age and are: -7.4 ± 1.7 dB SNR in children 5-6 years old; -8.7 ± 1.7 dB SNR in children 7-8 years old; -9.2 ± 0.9 dB SNR in children 9-10 years old. Temporal characteristics of hearing were assessed using the pause detection test modified by R. Keith (2000) (Random Gap Detection Test). During the test, tonal stimuli were presented at frequencies from 500 to 4000 Hz, into which pauses

lasting from 2 to 40 ms were inserted. The patient determined whether the stimulus sounded like one sound (without a pause) or two sounds. Normally, the pause detection threshold does not exceed 20 ms.

Results. For 49 (56%) children, the medical records contained data on a negative result of universal audiological screening of newborns (UAE registered), 5 (6%) children did not undergo screening, and 33 (38%) children had no data on screening. There were no children with a positive result of audiological screening (OAE not registered), as well as children with verified hearing loss before the onset of the new coronavirus infection in the study sample.

According to otoscopy: one child had mild hyperemia of the eardrum on one side; in 6 children - retraction of the eardrum; Another child has scars on the membrane. In 80 children, otoscopy did not reveal pathological features.

A type "A" tympanogram was recorded in all children. The acoustic reflex during ipsilateral stimulation was recorded in the range of 500–4000 Hz on both sides in 49 (56%) children, not registered at 1–2 frequencies in 27 (31%) children, recorded only at 1 frequency or not recorded at all in 11 (13%) children. The period since recovery in children with an unregistered acoustic reflex averaged 6.8 ± 5.9 weeks, and in children with a registered reflex - 10.2 ± 5.5 weeks.

TEOAE was not registered on one side in 2 children, in 85 children it was registered on both sides. In one child, TEOAE was not recorded in both ears, in another child - in one ear (in these children, TEOAE was recorded on both sides, and the audiogram thresholds were within normal values). In 85 children, OAPEI was recorded on both sides.

Pure-tone threshold audiometry data for all children corresponded to the norm; hearing thresholds did not exceed 25 dB HL at frequencies of 250–8000 Hz.

Based on the results of recording ABR in 5 children, visual detection thresholds for the V peak were obtained within the range of 10–20 dB nHL, while the interpeak intervals and absolute latencies of the peaks corresponded to normative values, and the peaks themselves had a typical morphology.

The results of speech testing showed that speech intelligibility in quiet and noise, on average for the group, corresponded to the norm. At the same time, 10 children had speech intelligibility rates below the norm (less than 80%).

Discussion. The data from pure-tone threshold audiometry, as well as registration of CVEP, confirmed the preservation of hearing thresholds throughout the entire frequency range studied in all children. The results of registration of otoacoustic emissions also indicate the absence of damage to the auditory receptors of the cochlea, namely the outer hair cells. When examining hearing in adults who had coronavirus infection, there was an increase in hearing thresholds at frequencies of 4-8 kHz [11] and a statistically significant decrease in the amplitude of TEOAE at high frequencies compared to this indicator in participants in the control group [12]. In our study, children did not reveal statistically significant differences between hearing thresholds at different frequencies; OAE registration also did not reveal any peculiarities in the frequency characteristics of either OAPEI or TEOAE. There are currently no results of hearing measurements in children who have had COVID-19 in the literature.

4 children were identified for whom OAE was not registered: 2 children did not have TEOAE, and 2 others had OAEI. At the same time, in children with the absence of one type of OAE, another type of OAE was registered and the hearing thresholds corresponded to the norm, which confirms the absence of pathology of the auditory analyzer. One of the hypotheses that may explain this clinical finding is middle ear dysfunction after a previous illness, which is not detected by tympanometry, but affects the registration of OAE. The same hypothesis can be taken into account when analyzing the absence of normal results of recording the ipsilateral acoustic reflex, which was noted in 13% of cases. It is noteworthy that in these cases less time passed from the moment of recovery compared to children in whom the reflex was recorded. Another possible explanation for the acoustic reflexometry data is the effect of the new coronavirus infection on the central nervous system. This assumption requires prolonged observation of these patients. However, it is important to note that all children had normal speech intelligibility, which does not confirm the hypothesis of viral damage to the central parts of the auditory system.

Thus, our examination did not reveal any impairment of auditory function, either peripheral or central, in children who had suffered a new coronavirus infection. Taking into account the currently available literature data on hearing disorders occurring after COVID-19 in adults, and the lack of such information in children, it can be assumed that the damaging neurotropic effect of the SARS-CoV-2 virus in children is compensated by mechanisms of increased neuroplasticity characteristic for children [20].

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EARLY REHABILITATION MEASURES AFTER ISCHEMIC STROKE IN HOSPITAL**Izbassarova Akmaral Shaimerdenovna**

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Abstract

We studied and analyzed data on the prevalence of ischemic stroke in Almaty (stroke center of the clinic) from January 2022 to January 2023. During this period, 423 patients with a clinical diagnosis of "Acute cerebrovascular accident" applied to the stroke center, of which 126 patients were diagnosed with cerebral infarction. We selected 78 cases where ischemic stroke developed. The Rankin, Ashworth, Rivermead scale involves the use of data obtained as a result of examining the neurological status of a patient with a stroke using the NIHSS scale. Early recovery of movement disorders depends on the correct and consistent initiation of such measures as positional treatment, passive and active therapeutic exercises, and verticalization. Rehabilitation specialists, relatives and friends can help restore impaired functions after an ischemic stroke and adapt to social activity.

Relevance

Stroke still remains the most important cause of morbidity and mortality in the population. According to expert estimates from the World Health Organization (WHO), stroke is the second leading cause of death in the world. Every year, cerebral stroke affects 5.6 to 6.6 million people and claims 4.6 million lives. In addition to its absolute medical and social significance, stroke also causes significant economic damage, developing in people of working age. Disability due to stroke ranks first among all causes of primary disability. The medical and social significance is significantly increasing due to a clear trend towards the aging of the population and an increase in the proportion of elderly people, in whom the frequency of chronic progressive forms of cerebrovascular accident (CVA). primarily ischemic. is increasing [1].

Disability due to stroke ranks first among all causes of primary disability. According to WHO expert estimates, the creation of an adequate system of care for patients with stroke will make it possible in the coming years to reduce mortality during the 1st month of the disease by 20% and ensure independence in everyday life after 3 months. after its initiation in at least 70% of surviving patients [2]. The quality of life in ischemic stroke (IS) depends on the severity and course of the stroke, the duration and complexity of the stages of rehabilitation treatment. To improve the quality of life of patients with IS, assessment of lost functions is necessary [3]. Stroke is a medical and social problem, which is why real efforts to organize effective preventive measures and improve the system of providing medical care to patients with a stroke are so significant and important.

Keywords: *ischemic stroke, rehabilitation measures, early stage of rehabilitation, disability, rating scales.*

Purpose of the study

To study effective rehabilitation measures at an early stage after ischemic stroke.

Research methods

We studied the materials of the stroke center of a multidisciplinary clinic in Almaty (Kazakhstan) for 2022 - 2023. 234 medical records of an inpatient with a diagnosis of "Cerebral infarction (I63)" were processed. The study included 78 patients (46 men and 32 women). The average age of the patients was 70.8±6.8 (from 50 years to 80 years). The diagnosis was made based on the patient's complaints, clinical and neurological data on the NIHSS scales , changes identified by the results of CT (computed tomography) / MRI (magnetic resonance imaging) of the brain, ECG (electrocardiography), EchoCG (echocardiography), laboratory data and examination by doctors from a multidisciplinary team. Early recovery of movement disorders was assessed using the following scales : Ashworth spasticity, Rivermead Mobility Index, and Rankin Activities of Daily Living Index .

Patients stayed in the stroke center for 9-15 days. Received drug and syndromic therapy. Informed consent to participate in the study was obtained from all patients. Statistical processing of the research results was carried out using parametric and non-parametric statistics methods. Standard methods of descriptive statistics were used (calculation of means, standard deviations, standard errors, rank statistics, etc., as well as well-known significance tests χ^2 , Student's t -tests, etc.).

Research results

According to the Ashworth muscle spasticity assessment, movement disorders in patients with ischemic stroke revealed severe/severe hemiplegia – in 77.4%; mild/moderate hemiparesis – in 22.6%. The Rivermead index was detected in the examined patients with ischemic stroke - 5 points in 33.4%, 6 points in 41.6% and 7 points in 25%. Barthel Activities of Daily Living Index – 50 points for 32 (41.0%), 65 points for 28 (35.9%), 80 points for (23.1%).

From the first day of admission, all patients received positional treatment. From the third day, in order to reduce spasticity, patients were given passive therapeutic gymnastics, and active gymnastics and verticalization - from the 4-5th day of hospitalization.

Upon the start of early rehabilitation, patients showed significant improvement - in 42.9±4.0%, moderate improvements - in 34.0±3.8% of patients, and in 23.1±1.51% of patients no positive improvements were identified. changes.

Discussion

From the first days after the stroke, early rehabilitation was carried out, i.e. treatment by position in order to prevent the formation of stable pathological systems (contractures, pathological postures). To maintain movement in the joints and prevent contracture, passive gymnastics was performed in them. When the condition improved, the patients were given breathing exercises in combination with active exercises in the limbs and verticalization. Subsequently, patients were taught to eat and dress independently.

Conclusion

Based on the identified data from clinical diagnostic studies, a clinical diagnosis was made in the first days of the disease. Using neurological examination, motor syndromes were identified. Along with drug therapy, patients with acute cerebrovascular accident started treatment from the first days. The main task of early rehabilitation is to return the patient's ability to assume a vertical position earlier.

After all, this is necessary to prevent pneumonia and bedsores. The joint efforts of rehabilitation specialists, family and friends make it possible to restore impaired functions and social activity after a stroke.

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OUR FIRST EXPERIENCE OF USING THE DEVELOPED ROBOTIC DEVICE FOR CORE BIOPSY OF PANCREATIC NEOPLASMS

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Introduction. Pancreatic diseases often cause a number of difficulties in diagnosis by radiation imaging methods, which is explained by the complex topography of the organ. For example, ultrasound imaging can be difficult due to the presence of gas in the stomach or intestinal loops. Due to the difficulties discussed above in the diagnosis of pancreatic diseases, it should be concluded that computed tomography is relevant and that a puncture biopsy under the control of computed tomography of the site of the pathological process is necessary to verify the diagnosis [1]. Core-biopsy, which allows obtaining a full-fledged neoplasm tissue for histological examination and enzyme immunoassay, is the most accurate diagnostic method [2]. Currently, it is carried out most often under the control of the "free hand" method, when both the patient and the interventionist, despite various types of protection, receive a high radiation exposure [3]. To solve these problems, various mechanical and electronic robotic systems have recently been developed [4]. Their disadvantage is the high cost, large size, and sometimes incompatibility with the available CT scanner. A robotic device for biopsy of tumors of parenchymal organs was created on the basis of the Department of Hospital Surgery of the Belgorod National Research University. In this article, we want to present our first experience of using this device for biopsy of solid tumors of the pancreas.

Material and methods. The device we have developed is an arc-shaped bracket mounted on a frame, which can rotate together with a clip for attaching a biopsy needle. The device is equipped with an electric drive to ensure the movement of the entire system in various directions. The radius of the holder frame corresponds to the average radius of the patient's body. There are brackets on the outer circumference of the frame for attaching straps and fixing them to the patient's body. The described system allows the entire device to be securely attached to the patient's body and ensures fast and accurate needle entry into the area of interest. The puncture of the gland was performed by percutaneous access, preferably along a straight trajectory. In cases where the structures of the abdominal cavity prevented direct access to the lesion, indirect (transgastric or transhepatic) access or techniques of hydrodissection and/or pneumodissection were used. To do this, a coaxial needle was used to inject saline solution (hydrodissection) or 50-100 ml of ambient air to displace neighboring structures from the trajectory of the needle. The choice between these methods depended on the position of the patient in which the procedure was performed and the structures involved, since the injected air tends to concentrate in the uppermost parts of the abdominal cavity.

Results. A total of 26 punctures were performed in 26 patients using a robotic device. The average age of the patients was 64.8 ± 6.7 years, body weight was 78.5 ± 6.7 kg. Of these, 50% (13/26) were women, 23.1% (6/26) had a previous history of primary tumors, most often lung cancer (4). The majority (16/26, 61.5%) of the lesions were localized in the head; 26.9.2% (7/26) were in the body; and 11.6% (3/26) were in the tail of the pancreas. The average size of pancreatic lesion was 45.5 ± 9.2 mm (range: 15-195 mm). Based on imaging criteria, 76.9% (20/26) of lesions were inoperable; 5 (19.2%) were resectable and 1 (3.9%) was a borderline case. Serious suspicions of the presence of pancreatic neoplasms were in 7.6% (2/26) of patients: 1 of them with localization in the head and 1 in the body of the gland, who underwent a fine needle biopsy under ultrasound control with negative results before core biopsy.

The majority (18/26; 69.2%) of the procedures were performed through direct anterior access.

In 3 cases, punctures were performed using hydrodissection. Due to the location of the intestine in the supine position, blocking access to the gland, the anterior access was considered difficult, so the posterior access was used.

In 2 patients, a biopsy was performed using pneumodissection. Anterior access was classified as difficult due to the location of the intestinal loops in the supine position. It was decided to use posterior access.

Indirect anterior transhepatic access was performed in 2 patients due to their inability to be in the prone position during the procedure.

Anterior transgastric access to the pancreas was used in 1 patient.

Histological analyses of all biopsies were performed. According to the results of the study, diagnoses were verified in 92% (24/26) of cases and were distributed as follows:

- 7.6% (2/26) of tumors are benign;

- 94.2% (24/26) are malignant,

of which:

- 69.2% (18/26) are adenocarcinoma,

- 7.7% (2/26) - metastatic,

- 3.8% (1/26) - neuroendocrine tumors,

- 3.8% (1/26) - primary leiomyosarcoma.

- 7.6% (2/26) – not verified.

Of the patients with tumors metastasizing to the pancreas, two had lung adenocarcinoma, one had esophageal cancer. In only two cases, the biopsy results were inconclusive, and a second biopsy was required, according to the results of which adenocarcinoma was verified in one case, and leiomyosarcoma in the other, which corresponded to the clinical course of the disease in both cases.

The average duration of manipulation was 25.7 ± 4.8 minutes.

There were no serious complications associated with the biopsy procedure. Minor complications were noted in 23.1% (6/26) of patients who resolved themselves: 2 retroperitoneal hematomas, 1 subcapsular hematoma of the liver occurred immediately after biopsy without continued bleeding; three had asymptomatic pancreatitis. Complications were more often associated with biopsies of lesions located in the head of the gland and did not differ depending on the biopsy technique. With indirect anterior access through the liver, subcapsular hematomas were noted in both groups, but it was used in exceptional cases when direct access was impossible. Otherwise, the frequency of complications did not depend on the type of access (anterior or posterior). Also, in this series of biopsies, we did not notice any suspicious cases of implantation of tumor cells along the trajectory of the biopsy channel.

As noted above, only 2 biopsies out of 26 were not histologically confirmed against the background of a malignancy clinic. Repeated biopsy confirmed the malignant processes. In total, we got 24 true positive results and 2 false negative results. Calculations have shown that the sensitivity of the method is 92.3%, specificity is 100%, and accuracy is 92.3%.

Conclusion. Thus, a CT-controlled puncture core biopsy using a robotic device developed by us has proven itself well for obtaining samples from various neoplasms of the pancreas and has made it possible to replace the biopsy with a "free hand" method, which eliminates the effects of ionizing radiation on an interventionist doctor.

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Pedagogical sciences

GAMIFICATION IN THE ESL CLASSROOM

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Abstract

The idea of gamification has gained popularity as an attractive educational element, especially as a way of learning a language in ESL classrooms. Through the addition of game elements, such as points, badges and quests to non-game contexts, the gamification process can make learning more exciting, motivational, and effective. This article presents the definition of gamification and its usage in ESL classes and also discusses the advantages and drawbacks of its implementation. In Duolingo and Kahoot utilized as models, the importance of gamification in language learning effectiveness is highlighted. Moreover, the article highlights the advantages of gamification as comprise of building the teamwork, adapt learning style to different people, and bridging the gap between class and real-life application. While the benefits of technology are highlighted, the article has also focused on some limitations like distraction, shallow engagement, and using tools that assess and maintain motivation. Summing up, gamification constitutes an outstanding medium for teachers to make a diverse and participatory learning space and give every learner a chance to progress on the road to bilingualism.

Keywords: *Gamification, language learning, ESL classrooms, motivation, engagement, challenges, Duolingo, Kahoot.*

The atmosphere of teaching ESL is always evolving, and only new techniques that result in improved participation and efficiency among learners are considered appropriate. Gamification, a strategy that combines learning objectives with game characteristics, is becoming increasingly popular. Even though traditional pedagogy is defined by regular studying and bookwork, captivating factors in education entice students with characteristics that include pleasure and competitiveness. The hands-on method fosters pupil involvement while also accommodating various styles of learning.

Gamification has shown to be an essential component of the educational atmosphere, and this is unquestionably true. This makes it a great instrument that can compete with the attributes of the most addicting activities with the goal to render instructional lessons easier in regard to outcomes. Think about learning an unfamiliar tongue because you find yourself constrained by hefty texts and workouts, but rather love each second of it. This appears to be the sweet spot for gamification in ESL lessons.

Now, what does gamification mean? In essence, it means borrowing some elements from games such as point systems, leader boards, badges and challenges and applying them to non-game contexts, say, education. This strategy has been demonstrated to lead to motivation increase and good learning outcomes (Anisa, et al., 2020).

The gamification objective is to attract and retain people, inspire action, deliver learning, and solve challenges (Kapp, 2012). Learning with the use of games improves learners' adaptability to the process of learning. Moreover, it boosts the self-teaching competencies and prepares students for their careers in future (Altun and Yassin, 2022). Consequently, gamification is the process through which non-game contexts are infused with the game design components (Deterding et al., 2011). Other educational strategies include play elements, but are not the same as gamification, for example, game-based learning or serious games. Games of various types (online, digital video games, table games, outdoor games, etc.) or educational games are used to achieve a particular learning goal. Although the large amount of digital examples demonstrating gamification currently exist, the term should not be limited to digital technology (Deterding et al., 2011).

Keeping the point in mind that we have been beforehand, gamification in the ESL classes provides an engaging way of language learning as compared with the boring systems of the traditional methods. The students being rewarded by the introduction of elements of competition makes them excitedly participate, and also motivates their persistency in the language learning process.

In general, gamification is what transforms learning process into a thrilling experience so that each milestone reached is accompanied by feelings of accomplishment. Imagine an example of learners being rewarded with tokens for successfully learning specific language skills, rising up the leaderboard by doing tasks, and getting virtual prizes to continue. Out of the blue, learning English becomes not self-torture, but a thrilling adventure.

However, what separates gamification from simply eye candy is its ability to create a sense of community and cooperation among students. Apart from teacher-student activities, student learns from co-students during team assignments and in collaborative activities. This helps in creating a support network where everyone can achieve the highest level of learning (Azar & Tan, 2020).

The malleability of gamification permits educators to learn and demonstrate different student learning styles and preferences. This flexibility is more crucial in ESL classroom when the students are from different social and linguistic ethnicities.

Such digital platforms as language learning apps are interactive activities that allow you to learn information at the rate appropriate for your capabilities while implementing the preferred methods. As an instance, some students can be the fast learners via the flashcard studies, whereas the other students display their leading abilities in the competitive environment by challenging the other students (Kayimbaşoğlu & Hacı, 2016).

Nevertheless, engaging games and role games application grants students chances to study practically and practice the new language in real situations. Whether they are practically talking in English-speaking environments or having in-depth cultural experiences by the means of virtual reality, these exercises provide a connection between what is learned in the classroom and how it can be practically applied in the real world.

Thus, gamification helps to use the old stuff easily with the current curriculum and teaching methods. The teachers can integrate gamification tools to boost students' acquisition of appropriate vocabulary, the application of grammar rules and ability to pronounce the languages correctly without compromising educational standards and achieving the set objectives.

Through using different gamifications utilities and tools, educators could produce an interesting platform for learning in which all individuals can succeed without any exception. Through online platforms, interactive games or educational activities even role-playing, it is possible to make the process of learning more humanised and to make educators' task easier.

Duolingo as a part of gamification.

The Duolingo language learning app, widely popular, is an exemplification of using a game in the learning process. Leveraging its platform of gamified user interface and will of adaptive learning system Duolingo has changed the scene of learning to the millions people all over the world. Language learning is no longer only about words and grammar. Thanks to Duolingo's powerful elements such as streaks, experience points, and skill levels, it has become a game to pass time pleasantly (Lee & Hammer, 2011).

Finally, Duolingo also builds substantial areas that utilize vocabulary and grammar. It merges fake situations and environmental pictures into its exercises thus help learners relate to the relevant features of the language of the new environment. Accordingly, visitors are enabled to buy meals in a digital coffee shop like place and maintain dialogues with a local guy who has settled nearby in the virtual space.

Duolingo gamified app is enough to pull people and puts them in a kind of group. Competition with friends or joining groups is one way of giving support and sharing the progress on the road to accomplish the goal. This social side of gaming is the most engrossing feature about it, therefore, it makes users to try to surpass each other and go up the ranking table.

It is the Duolingo's ability that combines learning and entertainment in the process of learning through "edutainment" is what makes it stand from the rest in the learning software industry. The users of Duolingo will have the impression of learning something new is not boring; but they are all playing a game.

Research indicates that Duolingo-like language learning apps with gamification features are as efficient as traditional methods. In an analysis by Lee and Hammer (2011), it was revealed that Duolingo users reported to have observed significant improvement in their language proficiency, compared with the more traditional classroom techniques. This reflects the possibility of the gamification contributing to an enhancement of language learning outcomes and modification of the language learning environment, which could be used by a broad audience. Actually, Duolingo is just one of the things that shows that by gamifying language learning it can be turned into an interesting and lively process.

Kahoot as a part of gamification.

Another one of the most perfect learning gamification platform in the world- Kahoot! It is a gamified digital teaching tool that has taken the educational world by storm. It is a helpful tool that enables educators to do their job using a fun and interactive way to engage students in learning activities. The Kahoot platform makes it easy for teachers to design quizzes, polls, and discussions that students take part in using their smartphones, tablets, or computers.

The platform is very adjustable, with the teachers having the opportunity to make Kahoot games in order meet learning goals and target students' needs. Whether it be for testing vocabulary, checking comprehension or reinforcing ideas, Kahoot offers a number of customizable features to make learning more interesting and beneficial.

Competition is an integral component of the Kahoot. The students are made to contest against each other by answering correctly and by acquiring points in the course of this process which will be stimulating and motivating. The ranking factor adds an extra factor of competition, therefore students do their best to come first and be the leader of the rank.

Nevertheless Kahoot does not only revolve around the competition; the game supports interaction and team work. Many of the video games appeal to a team-play, which promotes intercourse and collaborative problem-solving in order to set and reach certain goals. Such a team-oriented approach helps to develop effective communication skills and a beneficial peer learning environment making Kahoot a perfect means to accomplish this community goal.

The other plus of Kahoot is its ability to be accessed by everyone. The site is easy to use and can be accessed on any device that has internet, and teachers can use this to supplement any kind of lessons. What is more, Kahoot has a great collection of ready-made games which are made by educators around the globe, giving teachers the opportunity to have more time and strength for their planning of lessons.

Besides Kahoot's educational advantages, it includes the analytics category, which enables teachers to keep track of student development and pinpoint potential difficulties. Such an approach to education that relies on data enables educators to capitalize on the effectiveness of their teaching methods in order to satisfy the needs of their pupils who in a result have better academic achievements.

Benefits of Gamification in Language Classrooms

Through the games of gamification, we have experienced that it has a great impact for language development, stimulating the development of many skill sets in the language classrooms. The foremost advantage of these applications are that these can be very powerful in boosting language motivation and inclusive participation. By gamifying the language-learning activities through the addition objectives such as points, badges and rewards, the students will start admiring and enjoying the learning process (Hanus & Luke, 2015). The flaming desire for better results cause students to be diligent and participate very actively in language learning activities.

Plus, it should be mentioned that gamification is not only a key factor in making the vocabulary learning process more effective, but also that tackling lexical assemblages is aided by the utilization of this strategy. In the research for the use of a game based learning tool named the "Classcraft" by Botmart (2019) posted positive results with improved vocabulary retention in flipped learning environment compared to traditional methods. The engaging character of the vocabulary-related activities in language gamification improves students' ability to learn new words by experiencing them in significant situations; hence, these words can be retained and used when needed.

Along with the boost of a vocabulary, gamification is a solid puzzle for turning the communication and interaction development in language learners. collaborative and dialogical language learning tasks in tons of themed gaming activities for students. In the case of two-players' language games, speaking a target language to reach a goal is expected and allows the performance of the actual communicative and interpersonal skills (Murray & Fujishima, 2013).

Besides, gamification is efficiently utilized in improving listening and reading comprehension skills. Language games use audio and video resources which establish possible chances for the students to work on their listening and reading skills. The immersion of students into the interactive games with compelling plots, as is the case of Ho (2020), makes them follow the instructions, to decode the dialogues and then to interpret the signs and symbols, all of which lead to improvement of their receptive language skills.

Another noteworthy element is the fact that gamification leads to a significant increase in speaking proficiency. There are gamified activities consisting of role-playing, simulation, and interactive discussions in which students can make opportunities to develop their speaking skills in a relaxed way.

Language learning platforms, such as those with conversational bots or virtual language exchanges, for instance, provide students possibilities to hone their speaking skills with confidence.

Also, gamification's writing skill enrichment is another meaningful benefit. The process of telling stories and creative writing games prompt students to write which promotes their self-expression. Through finishing missions or quests, students have an opportunity to present their writing in the target language and are encouraged to improve writing proficiency (Thorne, Fischer, & Lu, 2012).

Drawbacks of Gamification in Language Classrooms

Although gamification has many goals, one needs to remember that it may also contribute to the creation of some undesirable aspects. Here are some areas for improvement in the implementation of gamification: Here are some areas for improvement in the implementation of gamification:

Potential for distraction: On certain occasions, gamification feature may divert learners from the concept of intended objectives and also it might be frustrating for users. Here are some instances: too much eye-catching graphics, sound effects and competitive elements will steal attention from the main content and, therefore cause the garble of lecture and lower understanding.

Risk of superficial engagement: Nevertheless, there is a possibility that the gamification in the process of learning can result in superficial engagement, in which learners' attention is strongly drawn to winning new rewards and competition rather than to learning the material at hand. It might result in surface learning that, in turn, may not become as deep and as meaningful as we desire for the students.

Uniform Approach: While gamification approaches can be effective for certain learning types and styles, it might be inappropriate in the case of some learners. Some students may indeed be successful learners in game-based education, while other students may face serious difficulties with it or may simply not be interested in this kind of learning. Teachers should be aware of person-to-person variability and modify gaming activities so that they are adaptable for all learners and are not exclusive.

Dependence on technology: Numerous gamification models base their functioning on the applications of digital technologies which, unfortunately, are not always affordable or available to all students and this may be attributed to factors such as cost, poor infrastructure or low technology literacy. Such dependence on technology can enhance the existing gaps and deepen the rift in terms of digital accessibility between the students from varied near-to wealth groups.

Difficulties in assessing learning outcomes: There are difficulties associated with the measurement of the effectiveness of gamification based on learning output. Although gamified apps may evaluate parameters like test scores and numbers of the lessons accomplished, these parameters might not always be aligned to the intellectual and skill development of learners. Teachers should be employing both kinds of data: quantitative and qualitative to be able to see the results in the whole.

The challenge of maintaining motivation: While keeping learners interested and motivated can be somewhat tricky in the initial stage using gamification, it can be done with time. After the initial excitement has passed or students become accustomed to the reward mechanism, their motivation to learn can decline and in turn they may quit learning. Teachers can only stay ahead of the game by constantly renewing and fitting in, gamification activities to give them a new tune.

Conclusion

Finally, it is clear that gamification has a capability to change the ESL language learning, it provides with a modern and interactive substitute to the traditional methods. Besides that, its limitations should be considered and tackled properly to realize it successfully; as it is obvious, it improves work motivation, learners' engagement and level of skill. Identifying the risks of frivolous interaction, together with the difficulties of assessing the learning connection and the sustainability of motivation over a long period of time would be the leading factors. Teachers dealing with gamification can successfully counter its complexities by adopting and pursuing modern and considerate practices that result in diverse, dynamic and vibrant learning settings where each student finds a pleasurable rhythm in his or her language studies. The purpose of the educational language gaming is to assimilate these approaches into educators' confidence and competence of teaching languages. Gamification can virtually transform language learning and make learning and practising English a pleasurable and exciting trip to learners of all skills and proficiency levels by using creative addition and regular innovativeness.

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METHODS OF USING ELECTRONIC RESOURCES IN THE PREPARATION OF A BIOLOGY TEACHER**Kuanali Gulina***1st year Master's degree student of Abai Kazakh National Pedagogical University, Almaty, Kazakhstan***Zhaksybayev Murat Bodinovich***Scientific supervisor: community.Prof., candidate of Biological Sciences, Almaty, Kazakhstan***Abstract**

The article discusses the current state of the use of electronic resources in the system of modern biological education. In today's digital age, electronic resources have become an important pillar in the field of education, providing students with a wide variety of learning resources and learning methods. From online platforms to distance learning, the use of electronic resources is gradually changing the face of traditional biology education. The article discusses the results of research on the current state of the use of electronic resources in modern biology education and its role in education, tasks and directions of future development.

With the continuous development of technology, the field of education is also undergoing major changes. In the field of biology, the use of electronic resources has become an indispensable part of teaching. Through online classes, virtual experiments, students can intuitively understand biological concepts and improve learning efficiency.

In this era full of opportunities, an in-depth discussion of the current state of the use of electronic resources in modern biology education will not only help to better understand the dynamics of educational development, but also contribute to the disclosure of their effectiveness in education.

Keywords: *biology, education, electronic resource, students, learning, multimedia educational materials, visual learning, cell division.*

Currently, in order to ensure the high quality of education, students actively use electronic resources in the educational process. The use of digital resources in education increases the activity of students and develops the ability to think.

Current level of development of knowledge and technology helps each student to obtain high-quality and in-depth knowledge. The XXI century is an information digital age. Since modern times are the time of scientific and Information Technologies, the approach to education should correspond to it[1].

One of the main conditions for the use of information and communication technologies in vocational training is to ensure full access of students to the necessary educational materials. On the way to these goals, there is a need for such software products as electronic textbooks, Business games, educational programs.

In general education schools throughout the Republic of Kazakhstan, all electronic technologies are covered. Thanks to the use of these resources, conditions are created for conducting the educational process at the highest level. In the course of e-learning, the following types of educational activities are used: video lessons, practical classes, virtual laboratories, feedback, reflections.

The goals of using electronic resources in the educational process are: formation of qualifications and improvement of skills, motivation to acquire knowledge, control over the lesson process, as well as the development of the ability to information search.

I will show the state of large-scale and comprehensive development of the use of electronic resources in the system of modern biological education. With the continuous development of Science and technology, the education sector is also actively introducing innovative technologies to improve the quality and effectiveness of biological education. For example:

1. widespread use of online textbooks and e-books[2]:

With the development of technology and the internet, students gradually moved from traditional paper textbooks to online textbooks and e-books. Through e-books, students have access to the educational materials they need at any time and anywhere to make personal progress in their studies,

and this also reduces the workload in educational institutions and reduces paper consumption. Ways to use this resource include :

- Personalized learning path: students can freely choose online learning materials according to their academic performance and interests to form a personalized learning path.

- Reading anytime and anywhere: the use of e-books allows students to access educational materials anytime and anywhere, adapt to different learning environments, and improve the comfort of reading[3].

- Use interactive features: some online tutorials offer interactive learning features such as online tests, discussion forums, etc., with which students can strengthen knowledge and improve their understanding of the topic.

2. widespread use of multimedia educational materials :

Multimedia educational materials are widely used in biology. Multimedia elements such as images, video clips, and animations help to visualize biological concepts. This combination of sight and hearing improves the effect of understanding the subject and plays a positive role in the learning process of students. Virtual video recordings help students understand a complex topic. Ways to use these resources:

- Visual learning: students can better understand abstract concepts such as cell division and gene transfer by watching videos and animations related to biology.

- Hearing exercises: multimedia materials with audio explanations help students better understand and remember educational moments through auditory channels.

- Interactive learning: some multimedia resources provide interactive features and students can participate in the actual study of subjects by increasing the depth of learning.

3. new experience of working in a virtual laboratory :

Virtual laboratories offer a new way to conduct biological experiments. Students can conduct experiments using computer simulations without the need for real laboratory equipment. This not only reduces the cost of experiments, but also solves the shortage of experimental materials and equipment. The virtual laboratory also allows students to experiment freely in a controlled environment, enhancing their practical abilities. Methods of using this resource include :

- Pre-experiment preparation: students can familiarize themselves with the stages of the experiment in a virtual laboratory before starting a real experiment and get to know the experimental devices and processes in advance[4].

- Safety issues: in some experiments, taking into account safety factors, students can conduct an experiment in virtual laboratories to avoid possible experimental risks.

- Experimental data analysis: the virtual laboratory provides experimental data recording and analysis functions to help students better understand the results of the experiment.

4. the emergence of online learning platforms :

One of the survey questions is aimed at determining the value of multimedia teaching tools in the process of teaching biology. University teachers showed the values of using ICT tools:

- development of educational motivation and interest in the subject-42%;

- formation and development of knowledge in biology-25%;

- development of universal educational activities-20%;

- helps teachers to see students in an unconventional form of education-8%.

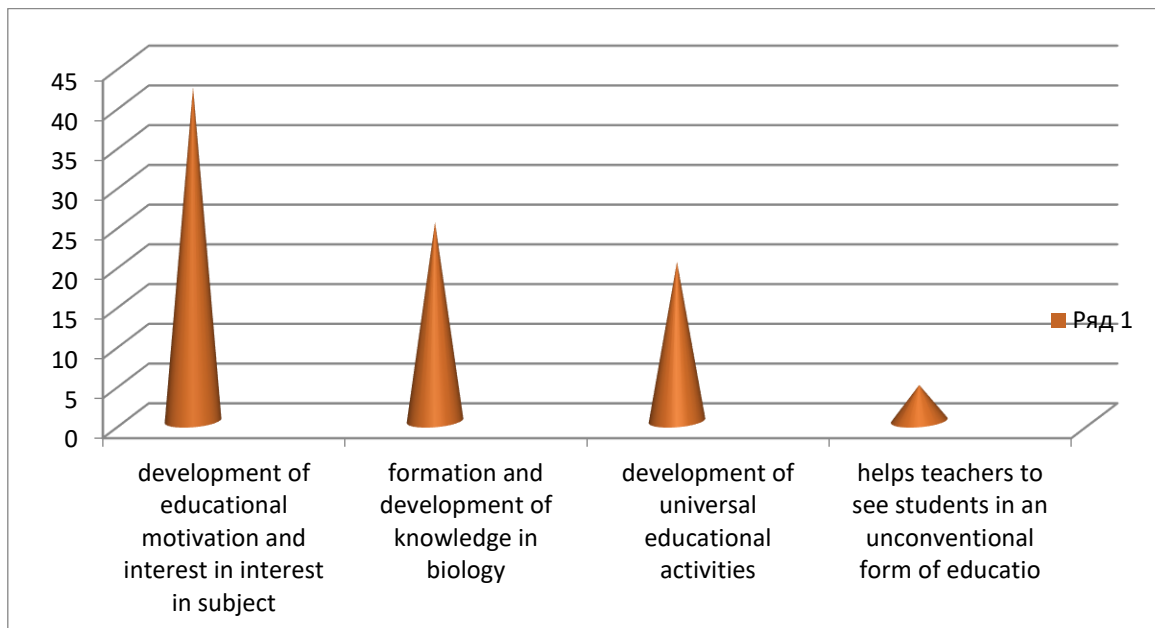


Figure 1: Teachers' answers towards the value of multimedia teaching tools in the process of teaching biology

All these resources allow us to diversify the learning process, make it more visual. In addition, the use of such ICTs helps students to get much more opportunities for independent study of the material, organizing research activities in the form of laboratory work in combination with a computer at home and a real experiment at school, planning and analyzing those experiments that are not feasible in real life in school laboratories, but are possible in virtual reality. In addition, do not forget about the expediency of using ICT for the development of students' personality and their preparation for independent production activities in the conditions of modern information society.

The online learning platform provides a convenient interactive space for students and teachers. Students can use these platforms to participate in discussions, share learning resources with classmates, complete online assignments, and more. Such interaction not only promotes cooperation between students, but also allows teachers to better control the learning process of students. Some platforms also offer real-time feedback and personalized learning suggestions to help students better understand and assimilate knowledge. Methods of using these platforms include[5]:

- Lesson discussion: students can participate in lesson discussion through online platforms, share their ideas, interact with classmates, and expand their understanding of biological concepts.
- Online homework: teachers can publish their homework through an online platform, and students can complete it for a certain period of time to improve their ability to apply the topic in practice.
- Resource sharing: students can share biology learning resources on online platforms to promote the exchange and dissemination of knowledge.

5. problems and opportunities of Distance Education :

The widespread use of electronic resources has contributed to the development of distance education. Students do not need to attend school and can take biology courses on a global scale through the internet and online platforms. This provides more opportunities for students with special needs, working people, and international students. However, distance education will have some issues, such as ensuring student participation and solving network problems. Ways to use these resources :

- Convenient study Time: Distance Education provides convenient study time and students can plan their own leisure time.
- Access to global resources: students can acquire various subject resources in Biology on a global scale to increase the level of subject knowledge.
- Remote experiments: for students studying remotely, some virtual laboratories offer online simulation of the experiment so that they can participate in a practical study of the subject.

In the context of the active promotion of electronic resources, the modern biological education system is undergoing a digital transformation. This change provides students with a flexible and personalized way of teaching, as well as promoting the innovation and development of teaching. It is necessary to seriously think about how to balance the benefits of digital education and traditional education and how to ensure the effective use of electronic education.

In the modern biological education system, the use of electronic resources in many respects has shown a wide development, which has had a deep impact on teaching and teaching methods. The popularity of online educational materials and e-books has increased the convenience of reading, and the widespread use of multimedia educational materials has increased the depth of understanding of the subject. The introduction of virtual laboratories has opened up new opportunities for practical learning, while online learning platforms and interactive learning tools have enriched teaching methods.

These changes not only contributed to the innovation of teaching, but also allowed students to gain knowledge and develop practical skills. However, there are still issues with distance education and it is necessary to continue to focus on improving student participation and ensuring the quality of teaching.

In the future, we believe in integrating more technologies and introducing innovative applications in biological education, in addition, we must continue to focus on issues such as equality in education and the digital gap. The continued development of electronic resources continues to determine the future of biological education, offering students a diverse learning experience.

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AN ANALYSIS OF TESTING AND ASSESSMENT ACTIVITIES OF STUDENTS' LEARNING RESULTS: A CASE STUDY AT THE HIGH SCHOOL OF CAN THO UNIVERSITY

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Abstract

Testing and assessment activities are an inseparable part of the teaching and learning process and a driving force to promote innovation and improve the quality of general education. Practical teaching activities of social sciences at the high school - Can Tho University over the past decade since its establishment has been achieving many great achievements. However, with the changes in the new situation, especially the process of access and deeper integration of international education, there are still many inadequacies in actual educational activities when the 2018 General Education program of the Ministry of Education and Training is implemented. This research is approached to practice the situation and orient appropriate solutions for activities of testing and evaluating students' learning outcomes at High School - CTU. The results of the study contribute to summarizing useful values and objective assessments of the situation of testing and evaluating students' learning outcomes in social science subjects at the school, and at the same time propose solutions to bring suitable strategies in the constantly evolving context of domestic and international education.

Keywords: test activities, assessment activities, social sciences, general education program, the High School - CTU

I. INTRODUCTION

Testing - assessment in teaching is a systematic process to determine the level of achievement of knowledge and skills of learners. In addition, testing and assessment is also a comparison between the level of knowledge, skills and attitudes formed in learners with the defined requirements of program objectives and teaching objectives. Testing and assessment activities in general education can be said to be an important link, both meaningful in "weighing" the level of achievement of the goals of teaching activities, and meaningful in providing evidence to influence and adjust contents, programs, teaching plans as well as methods and forms of teaching organization... In particular, in the current context, in order to implement the basic, comprehensive and effective reform of the General Education Program in 2018 at the request of the Ministry of Education and Training, one of the key "links" needs to focus, make the most efforts, invest a lot of time and money, the most intellectual is the stage of assessing the current situation and innovating the assessment of students' learning activities.

From the fact that teaching activities at the High School - Can Tho University over the past decade since its establishment have been achieving great achievements and positive signals in teaching in general as well as in testing and evaluating students' learning results in particular. However, in the face of the change of the current situation, especially the process of approaching and deepening the integration of international education, along with that is the implementation of the world

The General Education Program in 2018 issued by the Ministry of Education and Training still exists and arises many inadequacies in the reality of teaching activities as well as in the examination and evaluation of social science subjects in the new program, which are not logical and consistent between the theory and practice of the school. From the current situation of testing and assessing the learning results of Social Science subjects of the students of the High School - Can Tho University, it has brought about the need to be evaluated and oriented appropriate solutions to adjust and improve in each period on the basis of acquiring measurement and evaluation science, experience in conducting examination and evaluation of advanced education systems in the world, taking into account factors suitable to the school's practice and in accordance with the provisions of the Vietnam Education Law in terms of human resources, forms, methods and quality of this activity.

II. MATERIALS AND METHOD

Literature review

Since the mid-80s of the twentieth century, the world has exploded a revolution in testing and assessment in education with many radical changes in both philosophies, views, methods and practical activities. Changes in the trend of testing and assessing learning outcomes have contributed to clearly reflecting new perspectives on education and the learning process, and creating a theoretical system of testing and assessment in teaching in the world with many studies approached in different aspects:

Rowntree, D. (1987) for his study "Assessing students: How shall we know them?" introduced the interaction model between teaching and assessment, which focuses on the main features: Learning assessment must be based on information provided by the teaching process. Teaching quality regularly developed on the basis of processing information from the learning outcome assessment process and the factors affecting therefrom. Grading of student performance should be based on the results of the series of assessments. Therefore, Rowntree's research emphasizes the importance and critical role of testing and assessment in the quality of the teaching process.

A research by Black, P., and Wiliam, D. (1998b) with the theme "Inside the black box: Raising standars throught classroom assessmen. Phi delta Kappan 80(2): pp. 139-148" presented the theory of testing as activities that include teacher observation, exchange, discussion inside and outside of class between teachers and students, analysis of assignments, tests, etc. to assess the level of lesson acquisition and forecast student learning outcomes in order to improve students' achievement and improve the quality of teaching.

Williaam Wiersma & Stephen G. Jurs (1990) in "Educational measurement and testing" deals with the skills and techniques of the teaching process, which is both artistic and scientific. In particular, the issue of testing - assessment is an important step that needs to be built on reliability, authenticity, standardized assessment and criteria assessment not only to grade students but also to encourage progress and adjustment in students' learning process.

In Vietnam, research on the current situation and solutions to improve the efficiency of testing and assessing learning results of high school students is reflected in a number of research works:

Hoanh, T. B. (1997) in "Assessment in Education" clearly analyzed testing to help provide data and information as a basis for assessing students' learning outcomes. Accordingly, assessment has many different forms such as regular assessment, periodic assessment, summative assessment with different advantages and disadvantages. This is really a useful scientific theory for study about testing and evaluation in education.

Thiep, L. Q. (2012)'s research in "Measuring and evaluating learning outcomes in schools" has contributed to distinguishing assessment methods applied in education from other types of classification of conventional assessment methods. In particular, this study focuses on analyzing the values, advantages and disadvantages of two groups of objective and essay methods, to propose orientations for using these groups of methods in accordance with teaching practice.

The presentation of Anh, V. T. P.'s scientific conference (2006) on "Assessment for learning: new trends of the world and lessons for Vietnam" highlighted new trends in testing and evaluating learning outcomes of countries around the world. Accordingly, testing and assessment as a tool to support the teaching process of upper secondary school in order to move from comprehensive education to intensive education and propose some basic solutions to improve testing and assessment of students' learning outcomes in upper secondary schools in order to contribute to the successful implementation of the education reform of the country.

An analysis by Anh, H. S. (2013) in "Understanding about testing, assessing students and innovating testing and assessing students in the direction of competency approach" concluded that testing and evaluating students is very important stages in the teaching and learning process. The article has mentioned some theoretical and practical issues on testing and assessment activities in some countries around the world and Vietnam, and proposed some solutions to innovate testing and assessment in the direction of approaching student capacity.

A study by Ninh, N. V. (2016) on "Renovating testing and assessment in the direction of approaching students' competencies in the process of teaching History in Nguyen Tat Thanh Secondary & High School" published in Education magazine, analyzed many forms of testing - evaluating learner results with a variety of testing tools. The study has contributed to sharing practical experiences on the issue of innovation of testing and assessing learners' ability towards capacity development.

Previous research results on testing and assessing students's learning outcomes contribute to creating an important foundation for the research team to refer to and solve some of the problems posed in the paper.

Research methods

This study was conducted in 2 main ways:

Theoretical research is conducted on the basis of reading and analyzing domestic and foreign research papers on testing and assessment methods for learning results of high school students in order to create a scientific basis for filtering and establishing the theoretical system of the research topic.

Practical research is carried out through methods such as statistics, comparison, meta-analysis to provide a comprehensive, thorough view and objective comment and assessment of the situation of testing - assessment activities learning results in social science subjects of students at the High School - Can Tho University.

III. RESEARCH RESULTS AND DISCUSSION

Theory of testing and assessment activities in education

Assessment activities

According to Nguyen Phuc Chau's research: "Assessment is the performance of the management function of educational management activities to review all activities or an aspect of educational activity of the institution and individuals in that institution, then to discover the positive side to promote and the inadequacies to adjust or handle" (Chau, N. P. (2006)

According to Phe, H. (2016)'s research: "Testing is to consider the actual situation to evaluate and comment" (Phe, H., 2016)

Basically, in teaching activities, testing is understood as an inevitable step and an integral part of the teaching process in order to obtain information about the state and learning results of students about the underlying causes of that situation to find solutions to overcome gaps, at the same time, strengthen and continue to improve the effectiveness of teaching activities. Thus, in education, testing is a term that refers to the measurement and information gathering to make judgments and determine how each learner after learning has gained knowledge, skills, attitudes or competencies, and get feedback to improve the teaching process.

Assessment activities

The concept of "evaluation" is approached by various studies, in which Kiem, T. (2004) stated: "Evaluation in educational management is to consider whether the activities of individuals and groups are suitable for the set tasks, consider the advantages, shortcomings and corresponding causes to promptly adjust management decisions" (Kiem, T., 2004).

According to Hoanh's research: "Evaluation is the process of forming judgments about the results of work based on analyzing the obtained information, comparing with the set goals and standards, proposing appropriate decisions to improve the performance, adjusting and improving the quality and efficiency of work" (Hoanh, T. B., 1997)

Chau's research has shown that: "Assessment in educational administration is a systematic process of operation to determine the level of achievement of management subjects according to the standards contained in the set management objectives. It includes the qualitative and quantitative description of management results through comparative observations with management objectives" (Chau, N. P., 2006)

Chien's research stated: "Assessment is the basic task of educators, the unifying aspect of learning and teaching curriculum preparation, creating a mutual relationship between factors: educational objectives, learning content and assessment methods in an educational program to determine the learners' proficiency level" (Chien, N. D., 1995)

Although there are many different approaches to this concept, learning outcome assessment is basically a comparison and contrast of knowledge, skills, and practical attitudes that learners have gained to diagnose before, during, or after the learning process with the expected outcomes defined in teaching objectives.

The role of testing and evaluating students' learning results in high school:

- Assessment and validation function: is the basis for confirming the learning results of students and the class collective, on the basis of which it creates favorable conditions for students to develop self-assessment skills, helping students realize their own progress and develop better in learning.

- Inadequacy detection and adjustment function: It is a practical basis to help teachers and students detect both their own strengths and shortcomings in the teaching process in order to orient continuous improvement of teaching quality and to improve the quality of effective teaching.

- *Orientation function: It is the basis for creating a foundation for recognizing the current situation, adjusting and orienting teaching activities in a more effective way in accordance with educational and social practices.*

- *Support function: testing and evaluation activities allow to establish a close relationship between the teaching process and teaching results, to establish a support base in the teaching process to help students improve the learning process and teachers to adjust the teaching process to suit each learning object.*

** Principles in testing and evaluating students' learning results*

Objectivity: is one of the important principles of testing and evaluating learning results to ensure openness and transparency in the process of testing and evaluating students. This principle will contribute to preventing negative and dishonest behaviors in the learning process as well as the process of testing and evaluating students' learning results.

Comprehensiveness: the contents of examination and assessment should be comprehensive, and methods and means of conducting testing and assessment activities should be rich and diverse in order to fully collect all aspects of the learning process of students. Thereby, the results of testing and assessment will fully and comprehensively reflect the learning progress and learning quality of students.

Systematic: testing and evaluation activities should be carried out regularly, periodically and according to the set teaching plan to ensure the scientific value and effectiveness of this activity, on the basis of which to better adjust and improve the non-progressive aspects of students.

Forms of testing - assessment organization of students' learning results

Test form	Forms of assessment
<ul style="list-style-type: none"> - Written tests in the classroom - Written tests prepared at home - Testing students' presentation ability in the classroom - Checking students' homework practice - Checking through group discussion - Checking through the project product... 	<ul style="list-style-type: none"> - Diagnostic assessment: takes place before the learning activity - Evaluation process: during the learning process - Summative assessment: after the learning activity

Practical testing and assessment of social science subjects at the High School - Can Tho University

Process of conducting testing and assessment activities at the High School - Can Tho University

Defining testing and assessment objectives: Teachers need to clearly define their objectives before conducting testing-assessment activities: Is testing and assessing to determine learning ability at the beginning of the school year or before starting a new learning topic? Is testing and assessment intended to guide the teacher's teaching or student learning? Is testing - assessment to determine the level of achievement or failure to achieve the goals after the end of the lesson or learning topic? On the basis of defining the objectives of testing and evaluation, the teacher will develop a plan for the organization and implementation of this activity.

Develop an testing and assessment plan:

- *Contents: Based on the testing - assessment item and the teaching plan in the school year as prescribed by the Ministry of Education and Training, teachers shall develop plans for testing and evaluating students' learning results each semester, according to each lesson topic with the basic content of determining the capacity to receive and apply the knowledge and skills of the lesson into practice.*

- *Criteria: assessing students' learning abilities such as calculation capacity, ability to use knowledge, ability to use language, ability to practice lessons.*

- *Methods: teachers choose many different testing and assessment methods depending on the objectives, learning content and test - assessment criteria of learning results: written test methods, observation methods, question-and-answer methods, methods of assessing portfolio, and methods of evaluating students' learning products...*

Implementation organization:

- *Form: depending on the objectives of testing - evaluation, teachers will choose appropriate forms of testing - assessment: regular, periodic, or process testing and assessment.*

- *Test-assessment information: Teachers inform students about competency standards and criteria for testing and assessing learning results.*

- *Collecting evidence of activities and exercises, material and instrument making, results of tests, practice reports through the forms including observation, self-assessment and peer assessment in groups.*

- Teachers process test and assessment information based on the evidence collected, determining the level of learning capacity of students achieved in the process of conducting the testing- assessment.

- Students perform testing and assessment activities under the guidance of the teacher.

Analysis and processing of results: Teachers analyze and process the results of students' learning results and compare them with set goals, create archives of test results - evaluate students' learning results according to the implementation progress. This is a very important step to help teachers have data to analyze the test results, the basis for processing results such as analysis, grade distribution, calculation of standard deviation, mean value and reliability of testing - assessment.

Feedback on results: teachers need to carry out the process of commenting on students' products after the dynamic inspection process while highlighting the advantages and shortcomings and limitations of the typical class that need to learn from the experience for the next testing- assessment.

Results of testing and evaluating the learning results of social science subjects of the High - Can Tho University

Starting from the school year 2021 - 2022 up to now, all high schools in Vietnam in general and the High School of Can Tho University in particular have implemented teaching under the new general education program of the Ministry of Education and Training. Accordingly, the examination and evaluation of learning results in social science subjects are carried out in accordance with the established process and plan, in which the learning results of students (including semester I, study II) through the school years are shown as follows:

Table 1. Results of the examination of the academic results of social science subjects in the first semester of the academic year 2021-2022

Subject	Year Groups	Amount students	8.0-10		6.5-7.9		5.0-6.4		3.5-4.9		0-3.4	
			SL	Ratio %	SL	Ratio %	SL	Ratio %	SL	Ratio %	SL	Ratio %
SUBJECTS Social Science	Year 10	208	18 2	87.5	26	12.5	0	0	-	-	-	-
	Year 11	227	18 3	80.6 2	41	18.0 6	3	1.32	-	-	-	-
	Year 12	192	17 3	90.1	17	8.85	2	1.04	-	-	-	-
SUM		627	53 8	85.8 1	84	13.4	5	0.8	-	-	-	-

[Source: Office of the High School - Can Tho University]

Table 2. Test results of social science subjects in the second semester of the academic year 2021-2022

Subject	Year Groups	Amount students	8.0-10		6.5-7.9		5.0-6.4		3.5-4.9		0-3.4	
			SL	Ratio %	SL	Ratio %	SL	Ratio %	SL	Ratio %	SL	Ratio %
SUBJECTS Social Science	Year 10	211	10 6	50.24	79	37.44	19	9	7	3.32	0	0
	Year 11	227	71	31.28	88	38.77	47	20.7	19	8.37	2	0.88
	Year 12	192	46	23.96	55	28.65	62	32.2 9	25	13.0 2	4	2.08
SUM		630	22 3	35.4	222	35.24	128	20.3 2	51	8.1	6	0.95

[Source: Office of the High School - Can Tho University]

Tables 1 and 2 showed that there is a large disparity in the academic results of social science subjects between semester I and semester II of the academic year 2021-2022. Accordingly, in the first semester of the 2021-2022 school year, the test results of students in all 3 grades 10, 11 and 12 achieved from 5 - 10 points and no score less than 5, of which more than 80% of students achieved test results from 8-10 points, 10-20% of students achieved test results from 6.5 - 7.9 and only a few students achieved score 5-6.4.

Meanwhile, the test results of social science subjects in the second semester of the academic year 2021-2022 are fully distributed at different levels. Accordingly, the 8-10 score bracket is only achieved by about 35% of students, this rate is down about 2.5 times compared to the first semester; The 6.5-7.9 bracket also about 35% of students achieved this result, an increase of about 2.5 times compared to the first semester; bracket 5-6.4 the number of students increased by about 20% compared to the first semester; especially the 0-5 score bracket increased by about 10% compared to the first semester.

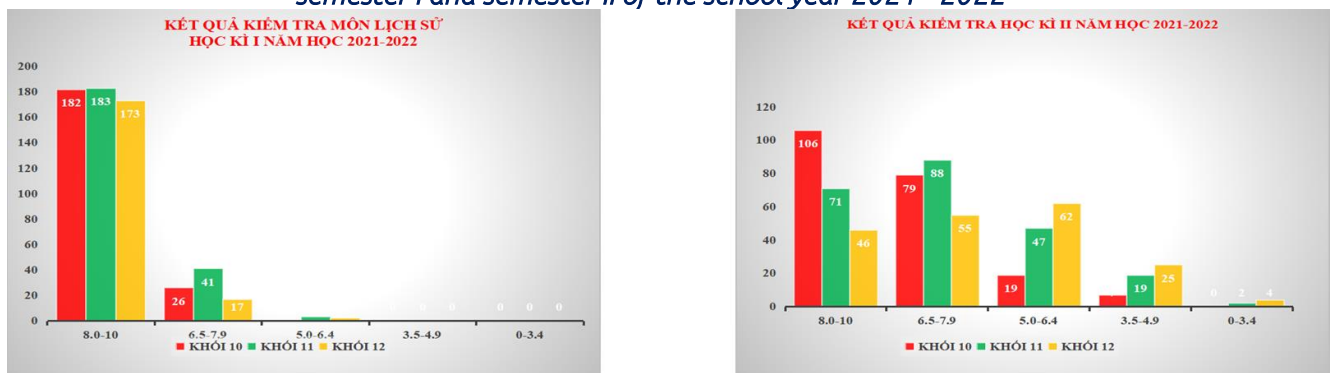
The disparity in the results of social science subject tests between the two semesters in the same academic year 2021-2022 stems from various reasons:

- The school year 2021-2022 is the first school year to implement the new general education program promulgated by the Ministry of Education and Training of Vietnam, however, "the implementation of the new general education program still has many shortcomings and limitations, especially in issues related to textbooks, the teaching staff, the facilities" (<https://baomoi.com>). These limitations have a very significant impact on the teaching process of teachers and the process of learning new knowledge of students, which led to the results of testing and evaluating social science subjects of students with high differentiation in the score brackets.

- Stemming from the inconsistent implementation of the new general education program when "a part of general education teachers in general and teachers teaching social science subjects in particular have not yet escaped the old teaching methods, have not been sensitive and adaptable to the situations and requirements of the new general education program" (Giao, N. L., 2018)

- On the other hand, the first semester of the 2021-2022 school year was taught and tested and evaluated online learning results due to the impact of the Covid-19 pandemic raging globally and Vietnam is no exception, which has changed the way of life, work, learning and human connection in society, including the mode of learning from face-to-face learning to online learning. Meanwhile, the organization of online testing and assessment was also affected by many inadequacies and inconsistencies such as computer infrastructure system, internet connection does not meet the large number of simultaneous access, the objective impact of the environment around students and the dishonesty in the process of examining subjects Social Science... has contributed to distorting the results of students' assessment of academic ability. Therefore, for the second semester of the 2021-2022 school year, which has organized teaching and testing and assessment in direct mode due to the control of the Covid-19 pandemic, the results of students' social science tests are more deeply divided than in semester I, In particular, the score ratio of 8-10 dropped sharply, while increasing much for the remaining score brackets. This actual result has contributed to reflecting the actual capacity of students in the learning process, which is shown in 2 comparison charts as follows:

Figure 1. The chart shows the results of social science tests of students in 3 year groups in semester I and semester II of the school year 2021 - 2022



[Source: Bui Hoang Tan]

In the next school year 2022-2023, all learning activities of high schools in Vietnam will take place normally in face-to-face form because the Covid-19 pandemic has been completely controlled. Accordingly, the examination and evaluation of the learning results of social science subjects of students in the High School are organized according to the strict process from the teaching organization plan set out at the beginning of the school year and the students' achievements through the first and second semesters are shown as follows:

Table 3. Results of the examination of the academic results of social science subjects in the first semester of the academic year 2022-2023

Subject	Year Groups	Amount students	8.0-10		6.5-7.9		5.0-6.4		3.5-4.9		0-3.4	
			SL	Ratio %	SL	Ratio %	SL	Ratio %	SL	Ratio %	SL	Ratio %
SUBJECTS Social Science	Year 10	236	142	60.17	71	30.08	21	8.9	2	0.85	0	0
	Year 11	228	127	55.7	79	34.65	17	7.46	5	2.19	0	0
	Year 12	225	54	24	98	43.56	56	24.89	15	6.67	2	0.89
SUM		689	323	46.88	248	35.99	94	13.64	22	3.19	2	0.29

[Source: Office of the High School - Can Tho University]

Table 4. Results of the examination of the academic results of social science subjects in the second semester of the academic year 2022-2023

Subject	Year Groups	Amount students	8.0-10		6.5-7.9		5.0-6.4		3.5-4.9		0-3.4	
			SL	Ratio %	SL	Ratio %	SL	Ratio %	SL	Ratio %	SL	Ratio %
SUBJECTS Social Science	Year 10	236	166	70.34	56	23.73	11	4.66	2	0.85	1	0.42
	Year 11	228	166	72.81	48	21.05	7	3.07	5	2.19	2	0.88
	Year 12	223	40	17.94	92	41.26	56	25.11	28	12.56	7	3.14
SUM		687	372	54.15	196	28.53	74	10.77	35	5.09	10	1.46

[Source: Office of the High School - Can Tho University]

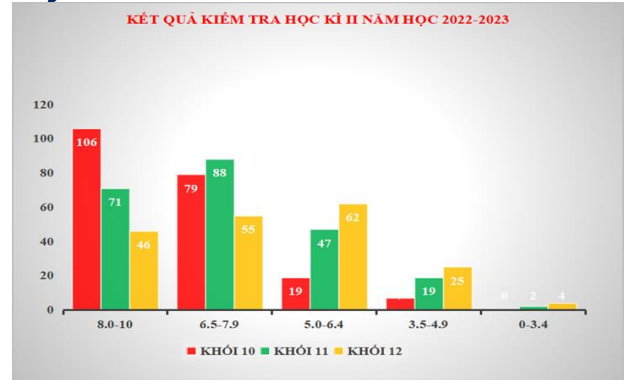
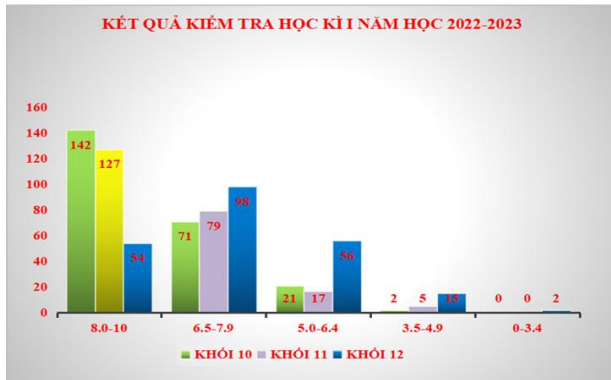
Tables 3 & 4 indicated the results of social science tests of students in 3 grades at the High School - Can Tho University in the school year 2022 – 2023. There is a full differentiation in the grade brackets of both semesters.

In the first semester of the 2022-2023 school year, 323 students achieved scores of 8-10, accounting for 46.88%; at the score of 6.5-7.9, 248 students achieved, accounting for 35.99%; Scores 5-6.4 have 94 students achieving this result, accounting for 13.64%, while the score below 5 has 24 students accounting for about 4%.

In the second semester of the 2022-2023 school year, 372 students achieved in the 8-10 grade bracket, accounting for an increase of 54.15% compared to the first semester; The score bracket 6.5-7.9 had 196 students passing, accounting for a decrease of 28.53% compared to the first semester; The 5-6.4 bracket has 74 students, accounting for 10.77%, down from semester I, but in the bracket below 5, there are 45 students, accounting for about 7%, 2 times higher than in semester I.

Common points in test results in both semesters: students in years 10 & 11 tend to rise higher in the 8-10 bracket and gradually decrease in lower brackets, reflecting students' efforts in the learning process and the relatively equal distribution of student learning capacity across Social Science subjects. However, in grade 12 there is the opposite trend as the number and proportion of students is decreasing for the 8-10 bracket and increasing much in the remaining brackets, which is explained by the skewed divergence in students' learning capacity. On the other hand, the choice of university professions and university examination complexes has a great impact on students in grade 12, most students of High School - Can Tho University tend to choose university majors and corresponding exam blocks belonging to Natural Science; only a few choose social science majors, so there has been a situation of academic orders for all subjects in the general education curriculum and social science is no exception. The difference between year groups and between two semesters is clearly shown through the two charts as follows:

Figure 2. The chart shows the results of social science tests of students in 3 year groups in semester I and semester II of the school year 2022 - 2023



[Source: Bui Hoang Tan]

Some comments

Advantages

The High School of Can Tho University has over 10 years of establishment and development (2011 to now) has constantly improved, gradually affirming the position of a high school in the city and the Mekong Delta region. That educational quality result is clearly reflected in the quality of entrance enrollment, learning conditions at the school and the outcomes of students through the courses. It has contributed to affirming in-depth knowledge and learning capacity, self-study skills, thinking skills and learning problem solving, and transforming knowledge resources into valuable knowledge capital in life. Therefore, the awareness and capacity of students in all 3 grades have contributed significantly to the teaching process and testing and assessment activities in social science subjects at the school.

Testing and assessment activities are conducted regularly in accordance with the plan and principles because this is the main activity and an important link of the teaching process for high school students in general and Can Tho University High School in particular. Teaching staff are always aware of the importance of testing and assessment activities for the process of improving the quality of teaching for students, so in addition to the prescribed tests and assessments, teachers regularly organize this activity associated with lessons through theoretical exchanges, hands-on thematic learning. On that basis, teaching activities and testing and assessment activities are integrated and have a mutual relationship, contributing to improving and enhancing the quality of learning for students at the school.

The professional competence of the teaching staff at High School - Can Tho University is of high quality. Accordingly, the teaching staff including high school teachers and university lecturers are 100% qualified above professional standards (of which 100% of teachers have master's degrees or higher). The teachers are always dedicated, love the profession, have a high sense of responsibility and master the pedagogical profession as well as effectively apply scientific and educational achievements to teaching activities. In addition, the teaching staff of the school are constantly fostered professionally and regularly updated effective teaching methods from Vietnamese and international practices to apply to the teaching process. That has contributed to gradually affirming the quality of education of High School - Can Tho University over the past decade, and the quality of education of the school has contributed to affirming the prestige and building trust for parents and students in the country in general and the Mekong Delta region in particular.

Some existing problems

Although High School - Can Tho University is constantly improving synchronously the educational process to adapt to the development of the educational situation in the new era, there are still some problems that need to be overcome. Typically, the methods of testing and evaluating students' learning results for social science subjects are not rich and diverse in both forms and contents. This comes from the regulations of the Ministry of Education and Training of Vietnam and the School of Education and Training of Can Tho City on principles, organization and content of testing and evaluation of learning results of high school students throughout the city. Therefore, the examination and evaluation of learning results in social science subjects at High School - Can Tho University also depends on this general plan.

According to the new general education program carried out by the Ministry of Education and Training of Vietnam in 2018, it is built according to career orientation, from which students need to

choose according to the Department of Social Science or Social Science right from the beginning of high school. It is the career orientation following that trend that has a great impact on learning activities and testing and assessment activities for social science subjects. Students after selecting the division will focus intensely on the study program of the selected division while reducing the attention and motivation to study for the other division, including social science subjects. In fact, this situation has had a great impact on the teaching process of teachers, as well as students' motivation for learning social science subjects, leading to disparities and many inadequacies in testing and evaluating these subjects at High School - Can Tho University.

In addition, the inadequacies of learning materials, exam pressure, and uneven learning capacity of students have profoundly affected the testing and assessment of learning results for social science subjects. In fact, high school education is being implemented in Vietnam according to the trend: an educational program but many textbooks, so it has caused many difficulties for teachers, students and parents to choose learning materials that are synchronous and unified among year groups, between subjects. In addition, although the current educational program has had many changes in both the content and form of teaching and assessment activities, the amount of knowledge is still "quite heavy" compared to the age of students along with too high expectations from families and schools, contributing to the pressure of exams and overload for students with students.

Suggested solutions

Regularly implement testing and assessment methods in the direction of approaching students' competencies in both forms and contents. Because the regular renewal of testing and assessment of students' learning results in general and social science subjects plays an important role, creating motivation to innovate teaching methods and encouraging the development of students' learning capacity while contributing to improving quality, ensure Vietnamese educational goals. Accordingly, the renewal of testing and assessment of learning results in social science subjects in the direction of approaching students' competencies needs to focus on new orientations in line with reality: shifting from assessing knowledge and skills to assessing learners' abilities in order to apply gained knowledge to solve real-life problems. At the same time, the methods of testing and evaluating the learning results of social science subjects should focus on closely following the objectives of each subject in terms of knowledge, skills and attitudes of students on the basis of a variety of forms of regular assessment, periodic assessment after each topic, each chapter aims to respond to adjustments to the teaching process (process assessment).

Exploit and use a variety of tools to test and evaluate students' learning outcomes for social science subjects. In the current development of digital technology, testing and evaluation of students' learning results need to be researched and strengthened to exploit and use ICT in testing and evaluation activities such as: using software that integrates measurement characteristics of assessment tools (reliability, difficulty, distinction, value) and using combined face-to-face and online testing and assessment models in testing and evaluation methods to achieve actual educational results as a basis for timely and highly effective adjustment of the teaching process.

Strengthen the cohesion between lecturers of the School of Education and teachers of the High School - Can Tho University in fostering activities, professional exchange and teaching methods. In fact, in addition to core teachers, the school also has professional teaching support from lecturers of the School of Education - CTU because these two education and training units are under CTU. However, in the face of the development of the new educational situation, especially the process of implementing the new general education program of the Ministry of Education and Training, it is inevitable to strengthen the deeper and closer relationship between the School of Education and the High School - Can Tho University in teaching students, in fostering, professional training and modern teaching methods. Strengthening the cohesion between these two units will be important in creating a better sharing, collaborative and mutually supportive working environment in teaching. On the other hand, the process of cohesion through fostering, training and professional sharing activities between lecturers and teachers will make an important contribution to the sustainable general education development of CTU in particular and general education in the Mekong Delta in general.

IV. CONCLUSION

On the basis of theoretical research, it has been affirmed that testing and assessing students' learning outcomes in general, especially for social science subjects in particular, is an inseparable part of the teaching process, as well as a driving force to promote innovation, improve the quality of education of students in upper secondary schools. Stemming from the practice of teaching social science subjects at High School - Can Tho University for more than a decade, there have been great achievements in the

quality of student education, contributing to improving the prestige and position of the school in the general education system in Vietnam. However, in the face of the change in the new education situation, especially when approaching the new general education program promulgated by the Ministry of Education and Training of Vietnam, many inadequacies in teaching practice have arisen, which has had a great impact on testing and assessing activities, in the learning results of social science subjects both in terms of content and form. Therefore, this issue should be studied in the direction of an approach to the practice the situation and orient appropriate solutions for the testing and assessment of social science subjects at the High School - Can Tho University on the basis of flexible and appropriate application of feasible solutions to the actual conditions of the High School - Can Tho University in order to promote the superiority of the solutions and contribute to improving the quality of general education in the new context.

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THE CURRENT STATE AND PROSPECTS FOR THE DEVELOPMENT OF FUNCTIONAL LITERACY OF SCHOOLCHILDREN IN BIOLOGICAL EDUCATION

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Abstract

Over the past decade, the world has changed incredibly and is changing at a very fast pace. The integration of educational content can become one of the effective tools for solving this problem. Functional literacy is currently the most important principle of the development of the modern education system, closely related to the principle of differentiation. Big changes are currently taking place in Kazakhstan. A developing society needs educated, moral, initiative people in modern conditions who can make decisions of their choice, anticipate their possible consequences, are capable of cooperation, are mobile, dynamic, constructive and feel responsible for the fate of the country. Education is becoming a powerful driving force for economic growth. The integration of sciences, the desire to accurately reflect the overall picture of the world is a characteristic feature of modernity.

Keywords: functional literacy, integration, biology, technology, integrity, textbook, general secondary school, innovation.

Modern life requires replacing the formula "education for life" with the formula "education for life". The main object is to determine the effectiveness of interdisciplinary connections in the process of teaching interdisciplinary integration in biology lessons. Comprehensive teaching methods the purpose of helping students: to teach them to learn; to teach them to do; to learn to live together; to learn to live in harmony with themselves. Such learning goals lead to the formation of children's not critical, but in the sense of choosing the optimal solution from a set of solutions. Now, when time demands from us and our children more interesting and non-standard solutions in order not to get lost in this world, to find our place in life, critical thinking is unlike any other[1].

Any teacher, using any technology, method, is looking for the most beneficial one for the child. The student studies theory to improve his knowledge in the lessons of natural science, physics, geography, etc.

Integrated learning implies not only the interconnection of knowledge in different subjects in one lesson, but also the unification of various technologies, methods and forms of one subject and even within one lesson. Integrated classes can be conducted throughout the school day using a variety of methods[2]. A number of classes can be held within the framework of a single topic. Classes are conducted by 2-3 teachers. 60-80% of the study time is devoted to the creativity of students, various methods of influencing the student, multimedia support are used. Integrated lessons have many advantages because they not only solve common educational problems, allowing students to form a more holistic view of the world. A great opportunity to use various technologies, methods, and forms in integrated lessons — in the conditions of our school — allows us to solve another important task - this is a health-saving approach to learning. The use of integration methods in the organization of the educational process contributes to the creation of conditions of psychological comfort, assuming the presence of an atmosphere. creativity, cooperation and mutual assistance, opportunities for self-expression and self-realization, successful personal development and preservation of children's health.

The effectiveness of integrated education depends on the correct, pedagogically sound choice of forms of educational organization, provided by a deep and comprehensive analysis of the educational, developmental, and educational capabilities of each of them. Integration between subjects is possible only with a healthy and healthy climate in the teaching staff, their fruitful cooperation based on mutual understanding and respect. promotes the formation of consistency and integrity of knowledge, skills and abilities of students, their views on the world, culture and its values[3]. In turn, to conduct an integrated

lesson, the following conditions must be taken into account: first of all, the teacher must choose the object of study in the lesson and carefully analyze the content of the lesson.

During the implementation of the lesson, it is necessary to think over the technology of independent educational activities of students. The teacher should use problem-based teaching methods, as this activates the mental activity of students at all stages of the lesson. A thoughtful combination of individual and group forms of work is also an integral part of the integrated lesson. Of course, one should not forget to take into account the age-related psychological characteristics of students and their orientation towards a healthy lifestyle. An integrated lesson also cannot be implemented without knowledge of its types and forms. Such classes give the best results, teachers find different tasks, sort them according to their connections with different subjects. The number of embedded stems should not be large. On average, 2 classes per month will be optimal, so the method will not interfere with the assimilation of new material. The most successful in my practice are the following forms of integrated classes: research, excursions, travel. And methods are a lesson in learning skills and a lesson in repetition [4]. Integration as a means of learning contributes to the formation of consistency and integrity of knowledge, skills, skills of students, their attitude to the world, culture and its values. The greatest happiness of a teacher is to look at the joy of children from the small discoveries they have made in our built-in lessons.

The importance of biological education based on the improvement of the educational system space is currently possible with the use of technology. Based on the research problem, methods of theoretical literature analysis, research, survey, comparison, analysis, induction, synthesis, observation were used [5].

The survey questions were mainly intended to determine which technology could be used to develop a higher quality of knowledge. The vast majority of teachers, i.e. 75%, are integration technologies.

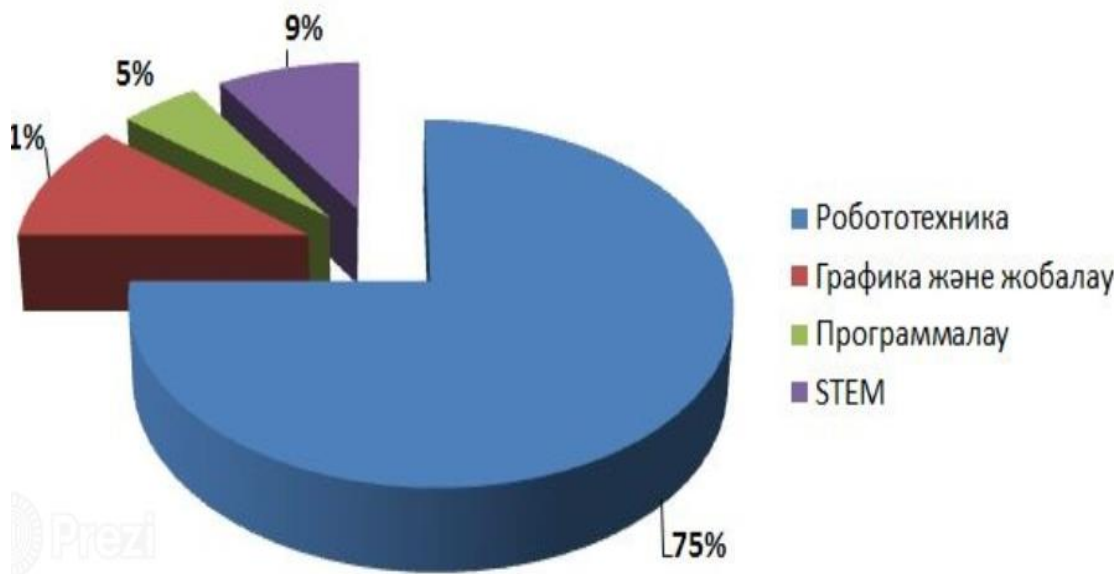


Figure 1: Ways to integrate biological content in general education schools

Integration technology is an integrated approach to learning, i.e. it develops the student's skills of applying knowledge gained in theory in practice. We can say that STEM is a laboratory of modern innovative projects. After all, STEM is rapidly developing in modern foreign countries. As these countries develop, a competitive generation is also developing. In Kazakhstan, the education of a competitive generation is the task of every teacher. Thus, it is aimed at increasing interest in science.

1 American bacteriologist R. Colwell at a biology lesson, interdisciplinary communication, in turn, stimulates the student, develops a systemic need for an object of knowledge, forms skills for comparison, analysis of complex processes and phenomena of objective reality.

2 Kazakh encyclopedia in an integrated lesson, a skill is formed, thinking, memory, imagination are developed

The main objectives of the "integration technology" are:

1) Familiarization with the integrated system "integration technology duties

2) to consider global trends and experience of integration technologies in the countries of the world;

3) study and evaluation of the advantages of integration technologies in the modern education system;

The main forms of improvement and development of education in biology are the ability to apply and demonstrate effective teaching methods and techniques in biology lessons in the process of developing cognitive, biological literacy of adolescents, defining its tasks and goals.

To present examples of educational projects implementing technologies in biological education as an integrated system. That is, when creating this object, for example, whether it is a small constructor, a small single hydraulic crane, he does it by combining the knowledge that he was able to calculate using chemistry, physics, mathematics, geometry. Thus, the student thinks that I am applying knowledge. That's how, working on techniques in biology class, the ability to apply it in life is very important for a children.

Elements of technologies used in biology lessons:



Figure 3.4: Elements of technologies used in biology lessons

Conclusion

60-80% of the study time is devoted to the creativity of students, various methods of influencing the student, multimedia support are used. Integrated lessons have many advantages because they not only solve common educational problems, allowing students to form a more holistic view of the world. A great opportunity to use various technologies, methods, and forms in integrated lessons — in the conditions of our school — allows us to solve another important task - this is a health-saving approach to learning. The use of integration methods in the organization of the educational process contributes to the creation of conditions of psychological comfort, assuming the presence of an atmosphere.

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Philological sciences

MANIFESTATION OF ETHNO-CULTURAL SPECIFICITY IN COMPARISONS WITH PRECEDENT NAMES

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Abstract

The article is devoted to the role of precedent names in explicating key cultural qualities by using them in comparisons. More than 500 comparisons of Russian, Belarusian, English and Turkish with the component "precedent name" were analyzed. The results obtained make it possible to describe thematic groups of described qualities by means of comparisons, as well as to reveal ethno-cultural specificity in the use of precedent names to describe this or that quality of a person. It is established that the sources of formation of images of precedent names used in comparisons are the images of heroes of literary works; images from folklore; images of historical figures; images of outstanding scientists and educators; images of writers. Four large thematic groups of descriptions of qualities were identified: human appearance, physical data, character traits, and mental abilities.

Keywords: *quality, culture, comparisons, cultural identity, image, ethnos, language, precedent name.*

The interconnection between language, culture and society.

Language does not exist outside of society, just as there is no society without language. And in order to understand how language works, it is necessary to study it in close connection with the society that uses it. There are several points of view, for what reason language arises and is used in society. Y. S. Stepanov emphasizes the simultaneity of language emergence with the process of consciousness formation, in connection with the labor activity of society's representatives [8, p.162]. A. A. Potebnaya is convinced that the emergence of language is connected with the inner need to express a thought [169]. According to W. von Humboldt, "the worldview, system of cultural values and principles of understanding the world around a certain nation are concentrated in its spirit, and language is the result of the activity of the people's spirit; an organ that forms a thought" [5]. According to E. Benevist, language is a multidimensional phenomenon that represents both human activity and the product of this activity; it is a spontaneously developing phenomenon and an ordered self-regulating phenomenon; it is "arbitrary and produced" [2]. Thus, language is a way of expressing human thought, the result of labor activity. It serves as a reflection of key notions and concepts of a certain nation.

Moreover, there is a close connection between the life of a society and the language it speaks. This connection is manifested in material culture and in social rituals, as well as reflected in the values, ideals, attitudes of people and in what they think about the world and their life in this world [3]. Culture, like language, reflects a person's worldview.

To sum it up, all key concepts and values of culture are reflected in the language spoken by a particular ethnos.

Aim and materials of the study

In order to identify and describe the ethnocultural specificity of using certain images in comparisons that describe human qualities, we analyzed 500 comparisons with the component "precedent name". The material for the analysis was a sample from the national corpora of Russian, Belarusian, English and Turkish (the main subcorpus). The aim of the study is to identify, describe in a comparative aspect comparisons with the component "precedent name" that describe the qualities of a human being in Russian, Belarusian, English and Turkish languages.

Precedent names in comparisons

A precedent name is characterized by informativeness, cognitive and emotional value for a native speaker, invariance and symbolism. Concluding the meaning in a concentrated form, the precedent onym is able to designate the appearance of a person (Uncle Stepa), the type of his character (Oblomov), the model of behavior (Othello), social status (Abramovich) [7, p.232].

Among the key sources of formation of images of precedent names, which are used in rhetorical ways of expressing quality, stand out:

- 1) images of heroes of literary works;
- 2) images from folklore;
- 3) images of historical figures;
- 4) images of outstanding scientists and enlighteners;
- 5) images of writers.

In Russian, among the precedent names used in describing qualities, the names of heroes of literary works are predominantly used (43.9%); in Belarusian, the images of outstanding scientists and enlighteners take the first place (31%); in English, as well as in Russian, the images of heroes of literary works prevail (36.4%). In Turkish there are used images of historical figures (30.7%).

The analyzed comparisons allow us to identify **4 groups of described qualities** with the component "Precedent Name":

1) **human appearance** (Varvara the Beauty, Anna Karenina, Old Woman Isergil, Babya Yaga, Alyosha Popovich, Karakura);

2) **strength, physical data** (Uncle Stepa, Koschei the Immortal, Alyosha Popovich, Ilya Muromets, the Giant);

3) **character traits** (Plyushkin, Fox Patrykeevna, Ilya Muromets, Stalin, Lenin, Zoya Kosmodemyanskaya, Dev, Margaret Thatcher, Mary Poppins, Hamlet, Othello);

4) **mental abilities** (Hashiwat, Karagez, Nasreddin Khoja, Sherlock Holmes).

The results of the study have shown that in comparison with the other languages being compared, in Russian the images of onyms prevail in the quantitative ratio. When analyzing onyms used as components of comparison, we introduce the concept of "unit". A unit is understood as an image that is used in various combinations in comparisons or metaphors when describing a quality. For example, the images of Pushkin, Margaret Thatcher, Vitovt, Kemal Ataturk. It should be noted that not all units have unambiguity. Thus, the image of Stakhanov as a unit is used only when describing high labor capacity: Russian. a real Stakhanovite; Stakhanov's labor; he was always among the first strikers at the plant, among the first Stakhanovites [6]. In this case we are talking about the unambiguity of the image. However, there are a number of precedent names that can describe both positive and negative qualities. That is, these images do not possess unambiguity. For example, the image of V. I. Lenin. With the help of one such unit such qualities as intelligence, self-interest, eloquence, diligence, and strong lisp are described. Thus, one and the same unit, depending on the context, gives both positive and negative assessment of the described quality: rus. worked like Lenin, at nights and weekends; to be like Lenin fearless in battle and ruthless to the enemies of the people; in the ratio of sizes, like Lenin with a log on a subbotnik [6].

In total, there are 42 units in Russian, 20 units in Belarusian, 21 units in English, and 17 units in Turkish. The analyzed comparisons allow us to say that the mentioning of a certain image in a comparison or metaphor reflects the most significant values of culture. Images from mythology, literature and history are used in describing the degree of quality in modern sources and nowadays. They do not lose their relevance. Since each image used in speech has cultural significance, the qualities explicated with the help of this element are culturally significant.

The key qualities of a culture described in comparisons

Russian culture emphasizes such qualities as **patriotism** and **diligence** (Z. Kosmodemyanskaya, N.F. Gastello, A.G. Stakhanov). The qualities opposite to patriotism and diligence are described with the help of such images as Pavlik Morozov (betrayal): Russian denunciation of the new "Pavlik Morozov" against his parents and teachers; and if your dad kills your mom, will you also shout about it on every corner and demand that the folder be put against the wall? I am not Pavlik Morozov; that you lie on the stove all the time like Ivan the fool [6]. As in any culture, Russian culture values **female beauty** and **intelligence**. First of all, these qualities are explicated with the help of images from fairy tales: Varvara the Beauty, Vasilisa the Beautiful, Vasilisa the Wise. Thus, the classic beautiful Russian woman is a woman with long hair, possessing intelligence. The **qualities of a leader** are reflected in the images of Lenin and Stalin. However, as noted earlier, with the help of these images can be expressed as positive and negative qualities. Moreover, they not only characterize an individual as a leader, but also point out, depending on the context, the shortcomings: Russian. Volodya suddenly began to lisp like Lenin; Nikolai Vasilyevich for Dikanka (sorry) as Lenin for Ulyanovsk; I spoke in front of them like Lenin, only without the armored car; Zyuganov is like Stalin on stage; as Stalin destroys people who do not suit him [6]. Thus, in order to interpret the statement, it is necessary to know what this or that person is noted for.

In the Belarusian culture, based on the analyzed precedent names, such key qualities as **courage** (the image of Ragneda), **observance of the commandments** (the image of Mindovg) are highlighted. In the national corpus of the Belarusian language there are examples of comparisons that use the image of Ilya Muromets. However, unlike the Russian language and culture, this image is associated not with strength or masculine beauty, but with the defender of one's country: bel. pastaits for radzima, like Illa Muromets [1]. The love for one's Motherland is also explicated with the help of such images as Tadeusz Kosciuszko, Kastus Kalinowski. These people are the national heroes of Belarus, therefore, when comparing them to these historical figures, such qualities as contribution to the development of their homeland, struggle for independence are expressed: "You are a hero for us like Kastus Kalinowski / Tadeusz Kasciuszka" [1].

In English culture, among the key qualities are **intelligence**, **shrewdness** and **good manners**. These qualities are expressed through the images of Sherlock Holmes, Miss Marple, Mary Poppins, Inspector Moore: as clever as Miss Marple, she is well brought up, a real Mary Poppins. **Strong character**, **sociability** and **productivity** are contained in the images of W. Churchill and M. Thatcher: Eng. the man of ideas like Churchill, know your words like Churchill, try to develop a wide vocabulary, people like Thatcher and the Royals could solve the Ethiopian problem within ten seconds [4].

In Turkish culture such qualities as **wit** and **intelligence** play an important role. These qualities are expressed through the images of Hodja Nasreddin, Karagöz and Hacivat: tur. Nasreddin Hoca gibi anlayışlı 'has natural ingenuity like Hacivat' [210]. As in Russian, Belarusian and English, Turkish has a number of writers who act as a measure of writing talent. First of all, these are the images of Yunus Emre, Mevlana and Hadji Bektaş: tur. Mevlana, Yunus Emre, Hacı Bektaş gibi düşüncelerin birleşimine kaynaklık etmiştir 'he was the source of combinations of thoughts like Yunus Emre, Mevlana and Hacı Bektaş' [9].

Conclusion

The analyzed material allows us to conclude that comparisons with the component "precedent name" represent the manifestation of ethno-cultural specificity due to two important factors:

1. the analyzed comparisons use unique onyms that are not typical for other languages and cultures. In order to understand what quality is expressed with the help of this or that onym it is necessary to know about the role of this character in history or in a literary work, for example.
2. analyzing comparisons with the component "precedent name" it is possible to describe key cultural qualities.

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STUDY OF SELF-ESTEEM OF HIGHER EDUCATION ACQUIRES

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ДОСЛІДЖЕННЯ САМОПОВАГИ ЗДОБУВАЧІВ ВИЩОЇ ОСВІТИ

Вавринів Олена Степанівна
Львівський державний університет внутрішніх справ

Швидкі зміни в соціально-економічному, політичному та культурному житті України ставлять перед викладачами нові виклики, вимагаючи від них високої якості роботи, професійності та компетентності, а також креативного підходу до своєї праці. Вчителі, які постійно працюють над покращенням своїх навичок і мають здібність до саморозвитку, найкраще відповідають цим вимогам. Дослідження в галузі педагогіки показують, що випускники педагогічних вищих навчальних закладів часто виявляються не готовими до самостійного професійного розвитку, що сповільнює їхній професійний прогрес і позначається на якості навчального процесу.

Самоповага — це почуття власної цінності, поваги до себе. Самоповага включає в себе самоприйняття, самоцінність та вміння ставити межі в стосунках з іншими. Люди з високим рівнем самоповаги зазвичай відчувають внутрішній спокій, впевненість у собі та власних силах, мають позитивне ставлення до себе та здатні адекватно реагувати на критику. Вони можуть встановлювати здорові межі в стосунках та відстоювати власні інтереси, не дозволяючи іншим ображати себе чи знецінювати свої досягнення. Навпаки, низька самоповага може призводити до невпевненості у собі, залежності від думки інших, трудно у встановленні та підтриманні здорових стосунків, і, як наслідок, до психологічних проблем.

Самоповага здобувачів вищої освіти безліч важливих характеристик, які відображають їхній внутрішній стан та поведінку в академічному та соціальному середовищі. Студенти, які мають високий рівень самоповаги, частіше мають чітке уявлення про свої цілі, інтереси та пріоритети [1]. Вони знають, чого хочуть від життя та освіти, і активно працюють над досягненням своїх цілей. Такі студенти вірять у свої здібності та потенціал. Вони схильні сприймати академічні виклики як можливості для розвитку та навчання, а не як загрози своїй самооцінці.

З метою визначення особливостей самоповаги здобувачів вищої освіти нами було проведено дослідження. За допомогою шкали самоповаги М. Розенберга. На основі проведеного дослідження нами було встановлено, що у 16% досліджуваних надмірно високий рівень самоповаги, у 25% виявлено високий рівень самоповаги, у 19% середній, у 20% - низький, та у 20% досліджуваних здобувачів вищої освіти зафіксовано вкрай низький рівень самоповаги.

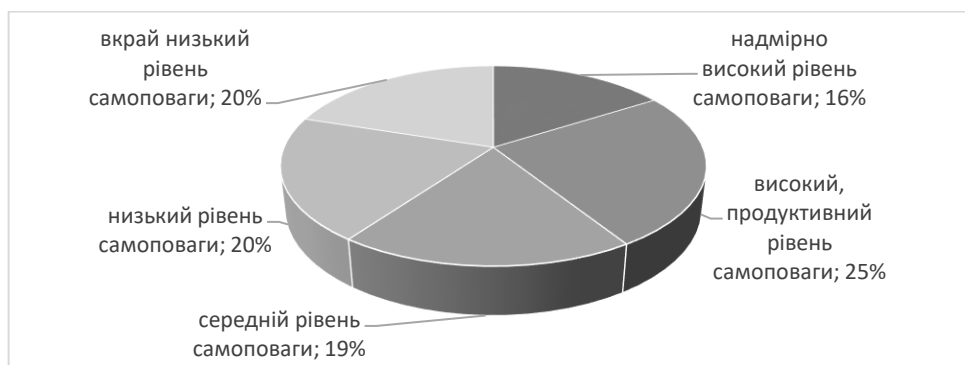


Рисунок 1 – результати дослідження самоповаги здобувачів вищої освіти

Висока самоповага допомагає студентам адекватно реагувати на помилки та невдачі. Вони бачать в них не підставу для самокритики, а лекцію для майбутнього росту та вдосконалення. Здобувачі вищої освіти з високою самоповагою мають схильність до самостійного мислення та прийняття рішень. Вони менш схильні піддаватися груповому тиску

або сліпо слідувати авторитетам. Висока самоповага сприяє розвитку позитивних соціальних навичок, таких як здатність до ефективної комунікації, емпатії, встановлення здорових меж у стосунках з іншими. Студенти з високою самоповагою зазвичай більш мотивовані до навчання, активно беруть участь у навчальному процесі та шукають додаткові ресурси для особистісного та професійного розвитку. Вони краще адаптуються до змін і нових обставин, що є ключовим аспектом успішного проходження академічного шляху та вступу в доросле життя. Висока самоповага дозволяє студентам адекватно оцінювати власні досягнення та працювати над власними недоліками, не переходячи при цьому до самообвинувачення.

Рівень самоповаги має значний вплив на навчальну діяльність здобувачів вищої освіти, визначаючи не тільки їхній академічний успіх, але й загальне ставлення до навчання та розвитку. Студенти з високою самоповагою зазвичай мають внутрішню мотивацію до навчання. Вони вважають, що заслуговують на успіх і готові докладати зусиль для його досягнення. Така мотивація сприяє активній участі в навчальному процесі та прагненню до самовдосконалення. Студенти з високим рівнем самоповаги сприймають невдачі як частину навчального процесу, а не як відображення їхньої некомпетентності. Вони з більшою ймовірністю аналізують причини невдач і використовують отриманий досвід для поліпшення майбутніх результатів. Висока самоповага сприяє розвитку позитивних соціальних навичок, таких як комунікація і взаємодія з одногрупниками та викладачами. Такі студенти з більшою ймовірністю беруть участь в групових проєктах, дискусіях і академічних спільнотах. Студенти з високою самоповагою краще справляються зі стресом та тиском, що часто супроводжують навчальний процес. Вони ефективніше управляють своїм часом і ресурсами, не дозволяючи тимчасовим труднощам негативно впливати на їхнє навчання. Студенти, які поважають себе, здатні адекватно сприймати критику, розглядаючи її як можливість для розвитку, а не як особисту атаку. Вони відкриті до зворотного зв'язку та готові працювати над своїми слабкими сторонами.

Розвиток самоповаги у здобувачів вищої освіти важливий не тільки для їхнього академічного успіху, але й для загального емоційного та соціального благополуччя. Висока самоповага пов'язана з більшою відповідальністю за власне навчання. Такі студенти розуміють, що їхній освітній шлях та успіх залежать від їхніх власних зусиль і рішень. Оскільки самоповага сприяє загальному емоційному благополуччю, студенти з позитивним самоствердженням менш схильні до навчальної тривоги, депресії та інших емоційних проблем, які можуть заважати навчанню.

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Philosophical sciences

THE ESSENCE AND FORM: NEW RELIGIOUS MOVEMENTS IN THE USA AND THE USSR AT THE END OF THE 20TH CENTURY

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СУШТИНА И ФОРМА: НОВИ РЕЛИГИЈСКИ ПОКРЕТИ У САД И СССР КРАЈЕМ 20. ВЕКА

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Abstract

Distinguishing essence from form opens the door to a better understanding of religion as a phenomenon. One phenomenon is the basis of all the forms we call religions. An example of the new religious movements in the United States and the Soviet Union is a paradigm that makes religion a phenomenon that must not be viewed unilaterally, but studied multidisciplinary. Legal and social circumstances can be fertile ground for the accelerated spread of such movements, but this does not necessarily mean that such circumstances are the reason for their appearance. This short text presents the relationship between the essential and the formal in the emergence of new religious movements.

Сажетак

Разликовање суштине од форме отвара врата бољем разумевању религије као феномена. Један феномен је база свим формама које називамо религијама. Пример нових религијских покрета у Сједињеним Државама и Совјетском Савезу је парадигма која религију чини феноменом који се не сме посматрати једнострано, већ изучавати мултидисциплинарно. Правне и друштвене околности могу бити плодно тло убрзаног ширења оваквих покрета, али то не мора да значи да су такве околности и разлог њиховог појављивања. У овом кратком тексту представљен је однос суштинског и формалног у појави нових религиозних покрета.

Keywords: *religion, phenomenon, essence, form, new religious movements (NRMs), the United States, the Soviet Union*

Кључне речи: *религија, феномен, суштина, форма, нови религијски покрети (НРП), Сједињене Државе, Совјетски Савез*

На први поглед делује као контрадикторност да именицу религија употребљавамо искључиво у једнини, пошто постоји више од једне деноминације. Још убедљивији разлог да се ова тврдња посматра као контрадикторна јесте стално појављивање нових религијских група. Ипак, то не значи да се религија умножава. Њене форме могу бити различите, али религија је једна – феномен који се може различито манифестовати у зависности од околности. Дакле, када говоримо о религијама, ми заправо говоримо о њеним формама. Зато је можда тачније користити именицу религија (у Азији, Африци, Америци) уместо присвојног придева азијске, афричке, америчке (религије). Тој тврдњи доприноси и стална појава нових религиозних покрета (у даљем тексту НРП) и проблема њихове типологије. Разликовање суштине од физичке форме или типа, помаже у разумевању идеје да је форма, заправо, резултат адаптације човека као призме на околности. Другим речима, уникалност форме религиозности, а самим тим и религије, зависи пре свега од њеног носиоца. Пример на коме ћемо покушати да разграничимо два религијска сегмента јесте истовремено ширење поменутих покрета у Сједињеним Државама и Совјетском Савезу.

Између две, по много чему, водеће државе света постоји ривалитет кроз скоро цео двадесети век. Њихова сличност се огледа у настојањима да превазиђу оног другог – да буду лидери међу лидерима (политички, војно, економски...). Оно што их чини коренито различитим јесте друштвено уређење, које је стајало на различитим филозофским и социјалним темељима.

Положај религије у ова два државна система је зависио од тих темеља. Случај Сједињених Држава оставља утисак да је настанак НРП проузрокован позитивним ставом владе према верском плурализму и слободи говора и штампе загарантованих Првим амандманом. Истовремено, ова појава у Совјетском Савезу оповргава наведену тезу. Зашто? Подршка верском плурализму кроз законе и званичну политику свакако је разлог стварања друштвене климе за несметано ширење НРП (који се не сматрају нужно непријатељима друштва), али став државне власти Совјетског Савеза није био такав. Он је, за разлику од америчког примера, обликовао друштвени дискурс који се супротстављао, и директно, и индиректно, свему што се сматрало религиозним, у смислу веровања у духовно, метафизичко и апстрактно за ограничену, материјалистичку логику људског ума. Негативно расположење није било усмерено само на поменуто веровање, већ и на упражњавање верских обичаја и обреда. Чак и у таквом окружењу верске заједнице нису нестале. Напротив, поред традиционалних конфесија и „старих“ нових религиозних покрета, континуирано су се појављивале нове верске групе. Постоје различите тврдње за разлоге њиховог појављивања, о којима се, наравно, може дискутовати, али без обзира на намеру иницијатора, ниједна верска група није верска без оних који су поверовали.

Околности у којима су верски плурализам и слобода говора заштићени законом и представљају основне вредности друштва нису разлог за настанак, већ разлог бржег ширења НРП. Разлог настанка, долази изнутра, из дилеме, несигурности, искуства страха, из жеље да се схвати смисао, из кризе непремостивих ситуација, неслагања са матичном верском групом, уверења следбеника у изабраност религијског лидера, и тако даље. Ако то што долази изнутра разумемо као суштински узрок, онда можда није грешка закључити да такав узрок изазива формалну појаву, односно друштвено отелотворење НРП. Према томе, тренутак у коме су потенцијални следбеници поверовали је одговор који завршава круг појаве НРП као друштвене стварности. Само кроз следбенике потенцијални верски лидери добијају друштвени легитимитет. Оно што тим покретима даје форму јесте друштво.

At first glance, it seems like a contradiction to use the noun religion exclusively in the singular, since there is more than one denomination. An even more compelling reason to view this claim as contradictory is the constant emergence of new religious groups. However, this does not mean that religion is multiplying. Its forms may be different, but religion is one – a phenomenon that can manifest differently depending on the circumstances. So, when we talk about religions, we are actually talking about its forms. Therefore, it may be more accurate to use the noun religion (in Asia, Africa, America) instead of the possessive adjective Asian, African, American (religions). The constant appearance of new religious movements (hereinafter referred to as NRMs) and the problems of their typology also contribute to that claim. Distinguishing essence from physical form or type helps in understanding the idea that form is actually the result of human's adaptation as a prism to circumstances. In other words, the uniqueness of the form of religiosity, and therefore of religion, depends primarily on its bearer. An example on which we will try to demarcate two religious segments is the simultaneous spread of the aforementioned movements in the United States and the Soviet Union.

Between the two, in many respects, the world's leading countries, there was a rivalry throughout almost the entire twentieth century. Their similarity is reflected in their efforts to overcome the other – to be leaders among leaders (politically, militarily, economically...). What makes them radically different is the social order, which stood on different philosophical and social foundations. The position of religion in these two state systems depended on those foundations. The case of the United States gives the impression that the emergence of the NRMs was caused by the government's positive attitude towards religious pluralism and the freedom of speech and press guaranteed by the First Amendment. At the same time, this phenomenon in the Soviet Union refutes the stated thesis. Why? Support for religious pluralism through laws and official policy is certainly the reason for creating a social climate for the unhindered expansion of the NRMs (which are not necessarily considered enemies of society), but the attitude of the state authorities of the Soviet Union was not like that. It, unlike the American example, shaped a social discourse that opposed, both directly and indirectly, everything that was considered religious, in the sense of believing in the spiritual, metaphysical and abstract for the limited, materialistic logic of the human mind. The negative disposition was not only aimed at the aforementioned belief, but also at the practice of religious customs and rituals. Even in such an environment, religious communities did not disappear. On the contrary, in addition to traditional confessions and "old" new religious movements, new religious groups appeared continuously. There are various claims for the reasons for their appearance, which can

of course be debated, but regardless of the intention of the initiators, no religious group is religious without those who have believed.

Circumstances in which religious pluralism and freedom of speech are protected by law and represent the basic values of society are not the reason for the emergence, but the reason for the faster spread of NRMs. The reason for its emergence comes from within, from a dilemma, insecurity, the experience of fear, from the desire to understand the meaning, from the crisis of insurmountable situations, disagreement with the parent religious group, the followers' belief in the chosenness of the religious leader, and so on. If we understand what comes from within as an essential cause, then perhaps it is not a mistake to conclude that such a cause causes the formal appearance, that is, the social embodiment of NRMs. Therefore, the moment in which potential followers believed is the response that completes the circle of emergence of NRMs as a social reality. It is only through followers that potential religious leaders gain social legitimacy. What gives shape to these movements is society.

Technical sciences

MODELS OF A SUGENO TYPE FUZZY LOGICAL SYSTEM IN THE PRESENCE OF A LIMITED VOLUME OF DATA

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Abstract

This paper discusses the construction of a model of a fuzzy logic system of the Sugeno type in the presence of a limited amount of data. The Sugeno model is a fuzzy logic method that allows nonlinear and complex systems to be approximated based on a set of rules expressed in linguistic form. The main advantage of the Sugeno model is the ability to create a transparent output system that is easily interpreted by humans.

This paper explores the application of the Sugeno model to solve classification, regression or control problems with a limited amount of data. Instead of traditional supervised learning, which requires a large amount of labeled data, a technique is used to build a model based on expert knowledge and a limited amount of data. This allows you to effectively use existing data and create models that can be applied in settings with limited access to data or small samples. The purpose of the work is to study the capabilities of the Sugeno model in conditions of a limited amount of data and to identify its applicability for solving practical problems. The study will examine the construction of the model, the definition of linguistic variables and inference rules, and the evaluation of its performance on small data. The results of this study may be useful for practitioners in the field of machine learning and artificial intelligence, as well as for developers of control and decision-making systems who need to work with a limited amount of data.

Keywords: *Sugeno model, classification, accuracy, small data set, fuzzy logic method, results.*

1. Introduction. *With the advancement of technology and access to large amounts of data, machine learning has become an integral part of many areas of science and industry. However, in real-world situations there are often situations where access to large amounts of data is limited or difficult, which poses challenges to traditional machine learning methods. Research into the possibilities of building machine learning models with a limited amount of data becomes relevant in light of the need for effective algorithms for analyzing information and making decisions. In this context, the Sugeno type fuzzy logic model is a promising approach that allows the creation of transparent and interpretable models based on limited data and expert knowledge. The purpose of this work is to study the applicability of the Sugeno model for small amounts of data and evaluate its effectiveness in solving practical classification or regression problems. This study will examine the construction of the Sugeno model based on a small data set, as well as analyze its results and compare it with other machine learning methods [1].*

This research has important practical significance for various fields, including industry, medicine, finance and others, where access to data is limited, but the construction of effective models for data analysis and decision-making is required. The relevance of this work lies in the fact that in real conditions there are many situations where access to a large amount of data is limited, for example, due to the high costs of collecting it or the unavailability of information. In such cases, using traditional machine learning training methods, which require large amounts of labeled data, becomes difficult or impossible. However, even with limited data, it is necessary to be able to build machine learning models to solve various problems such as classification, regression or control. In this context, the use of a Sugeno-type fuzzy logic model is a promising approach because it allows efficient use of available data and expert knowledge to create transparent and interpretable models [2].

Thus, the relevance of this work lies in the study of the capabilities of the Sugeno model in the presence of a limited amount of data and its applicability for solving practical problems in conditions of limited access to data or small samples. The results obtained can be useful for developers of control systems, decision making and other areas where work with a limited amount of data is required. In addition, conducting research on building the Sugeno model based on a small amount of data is relevant from the point of view of increasing the interpretability of machine learning models. A Sugeno-type model has the property of interpretability, which makes it easy to understand the principles of its operation and explain the adoption of specific decisions. This is especially important in areas where model decisions are required to be explainable, such as medicine or finance. Thus, studying the applicability of the Sugeno model with a limited amount of data has not only theoretical but also practical significance, opening up new prospects for the application of machine learning methods in conditions of limited data availability [3].

2. Materials and methods.

To build the Sugeno-type model with a small amount of data, it is necessary to use machine learning methods that can effectively work with a limited number of training examples. In the context of this study, various algorithms can be used, such as data clustering allows you to select similar objects into groups, which can be useful when analyzing small data sets. Examples of such methods are k-means, DBSCAN, and hierarchical clustering. Regression models predict numerical values based on input features. In the context of the Sugeno model, models can be used to estimate the parameters of fuzzy rules [4,5].

Given the limited data, it is important to select the most informative features for building a model. Feature selection methods such as principal component analysis (PCA) or importance-based feature selection methods can be useful. To increase the diversity of training examples, data augmentation methods can be used. This allows you to create new training examples based on existing ones by modifying them, for example by distorting images or adding noise.

In addition to choosing methods, it is important to correctly preprocess the data, analyze it, and assess the quality of the model. This includes steps such as cleaning the data from outliers and missing values, scaling features, splitting the data into training and testing sets, and assessing the quality of the model using appropriate metrics. Thus, to build a Sugeno model with a small amount of data, it is necessary to choose methods that can work effectively with a limited number of training examples, and to correctly preprocess the data and assess the quality of the model.

3. Results.

The results of a study to build a Sugeno type model with a small amount of data may include the following aspects:

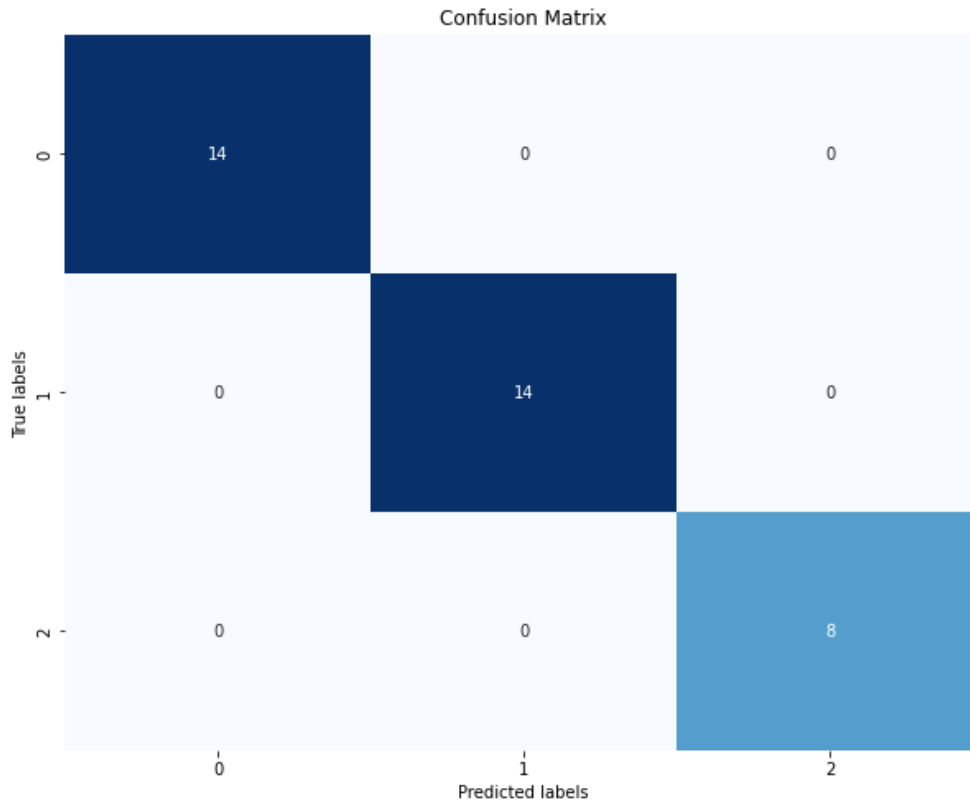
Model quality assessment includes various metrics such as accuracy, recall, F1-measure and accuracy. These metrics help you understand how well a model is able to classify or predict values based on input data. Analysis of the importance of features allows you to determine which of them have the greatest impact on the results of the model. This can be useful information for understanding the model's decision-making process. It is important to be able to generalize the results obtained and draw conclusions about the applicability of the model in real conditions. This may include assessing its effectiveness against new data and identifying its strengths and weaknesses.

Thus, the results of a study on building a Sugeno model with a small amount of data may include assessing the quality of the model, the importance of features, generalizing the results and comparing with other models.

Classification accuracy: 1.0

Classification Report:

	precision	recall	f1-score	support
0	1.00	1.00	1.00	14
1	1.00	1.00	1.00	14
2	1.00	1.00	1.00	8
accuracy			1.00	36
macro avg	1.00	1.00	1.00	36
weighted avg	1.00	1.00	1.00	36



The results obtained demonstrate a classification accuracy of 1.0. This means that the model correctly classified all samples in the data set. Each class has a recall, precision, and F1-score of 1.0, indicating that the model did not make any errors in any of the classes. The confusion matrix also confirms this as there are non-zero values on the main diagonal and all off-diagonal elements are zero, indicating no classification errors. These results indicate the high efficiency of the model on this data set.

4. Conclusion. The constructed classification model based on the Sugeno method showed effectiveness in solving the classification problem on a small data set. The results show perfect classification accuracy for all classes, confirming the model's high ability to correctly identify objects. Such results indicate the potential practical applicability of the model in classification problems, especially in cases where high accuracy is required and the data set is small. However, additional testing and analysis is needed to generalize the findings to a wider range of data. Based on the results obtained, we can conclude that the Sugeno model has been successful in solving classification problems on small data sets, which can be useful in various fields that require accurate identification of objects across several classes.

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STUDIES OF LOW-WASTE CATIONISATION SCHEMES FOR CHEMICAL DESALINATION AND WATER SOFTENING PROCESSES

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Abstract

Low-waste ion exchange technologies based on two-stage regeneration of cationite are proposed. Both regeneration stages are closed-loop. The first regeneration stage is short-circuited to the source water clarifier. The second regeneration stage is closed to the waste water settling tank of ion-exchange filters, where the reagent-free recovery of the spent solution and its additional reinforcement takes place. The scheme is not low-waste, but waste-free, as it is characterised by the absence of effluents and provides separate production of two products - CaSO_4 and CaCO_3 .

Keywords: Thermal power plants, heating networks, reverse cooling systems, chemical desalination.

As a result of water treatment for technological purposes at TPP, a large amount of salt wastes of different composition is generated, the utilization of which is an urgent technical problem. One of the ways to solve this issue is the development of low-waste water treatment schemes.

The main principles of the developed low-waste schemes are: reduction of reagent consumption for filter regeneration; reagent recovery; production of waste in the form of environmentally friendly precipitates of poorly soluble salts, stored or used as building materials; maximum use of components of initial natural water, spent solutions and precipitates by their extraction and processing to produce reagents with regenerating or precipitating properties; use of combustion products of organic fuels; use of the following components of raw water, spent solutions and precipitates.

A low-waste technology was developed for the combined production of deep softened water to supply medium pressure steam generators and evaporators, as well as make-up water for the heating network (TM) and the recirculating cooling system (RCS). The technology includes interaction of all elements of the scheme with each other and provides creation of closed cycles on utilization of lime, flue gases of boilers, spent regeneration solutions of ion-exchange water treatment processes and cationite. At the same time Na-cationic filters of water softening plant after depletion are converted into exclusively Ca-form by passing of $\text{Ca}(\text{HCO}_3)_2$ solution. This creates favourable conditions for subsequent regeneration of Ca-cationite by Na_2SO_4 solution with obtaining precipitate in the form of CaSO_4 (marketable product) and using Na_2SO_4 solution for cationite regeneration in stoichiometric quantity. The spent solution of the process of cationite conversion into Ca-form is utilised in the clarifier of water treatment for make-up of TM and RCS.

The considered combined scheme of two-stage softening (boilers, evaporators, TM, RCS) can be easily transformed into a scheme of softening of only TM make-up water [1]. According to the known developments it is often impossible to do only with liming and acidification when treating water in TM. Thus, for water of type III according to the generally accepted classification, for which the sum of cations equal to the sum of anions is $\sim 12 \text{ mg-eq/l}$, it is obligatory to use 100% Na-cationisation. This technology allows to significantly reduce the number of Na-filters, passing through them only a part of water, as shown in Fig. 1.

This possibility is provided by deep reduction of calcium hardness in the clarifier, and, consequently, increasing the share of water supplied to the TM directly after the clarifier (line 1), reducing the load on Na-filters (line 2). In addition to reducing the number of filters, we achieve complete elimination of effluent.

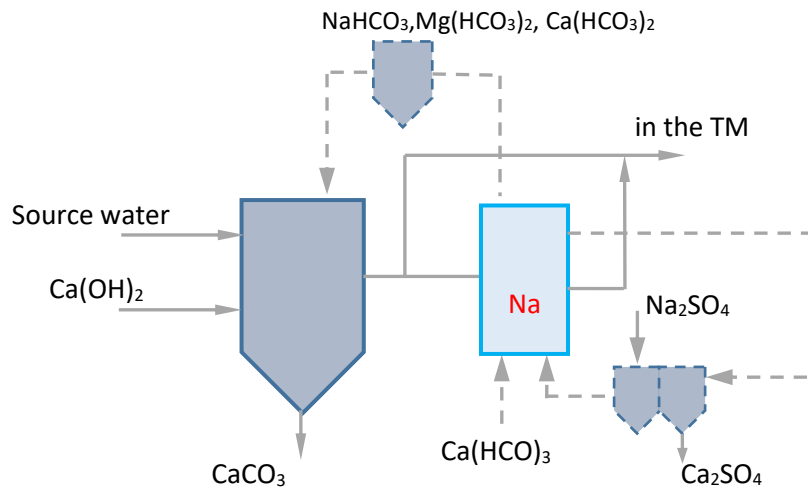


Fig. 1. Scheme of water treatment in the TM

Fig.2 shows the I stage of H-cationic regeneration in the scheme of chemical demineralization. In order to use the previously discussed method of cationite regeneration in the scheme of chemical demineralization it is necessary to fulfil one condition: presence of two-case H-cationic filters in the scheme (H_{pr} -loading polyfunctional cationite - the first case; H_1 -loading strongly acidic cationite KU-2-8 - the second case). Before passing the $Ca(HCO_3)_2$ solution through H_{pr} , the depleted cationite should not contain H-ions. Therefore, sorption is finished at the moment of obtaining the filtrate alkalinity, equal to the alkalinity of water limed in the clarifier. It is possible to slightly and overexhaust H_{pr} , displacing Na-ions from the first case into the second. In this case switching off for regeneration of H_{pr} is carried out by slip of magnesium ions.

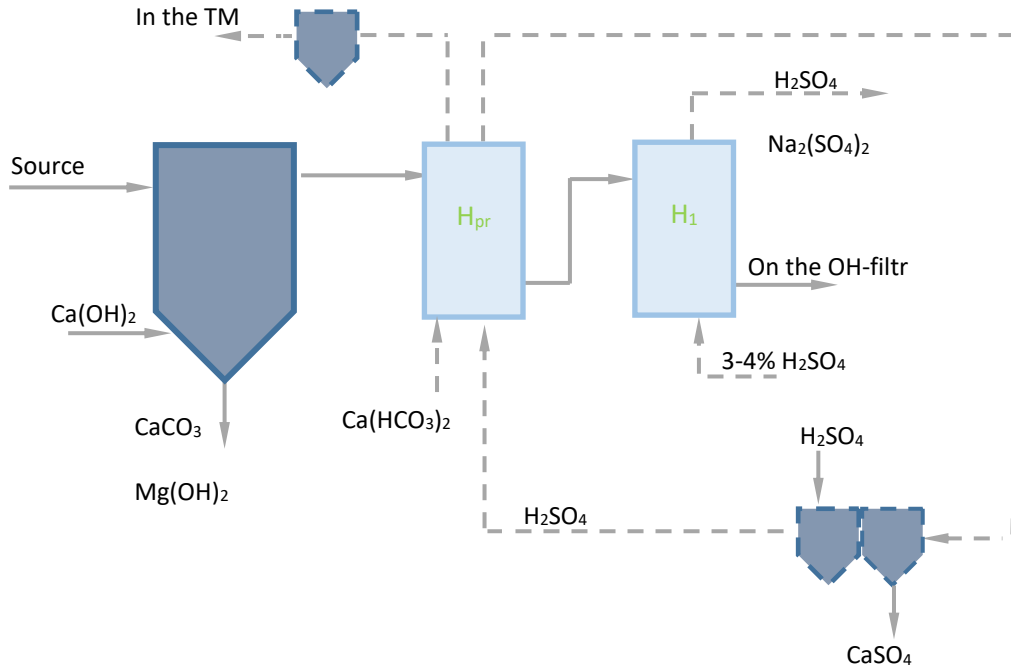


Fig.2. Schematic diagram of I-stage H-cationization of chemical demineralization plant.

After passing the $Ca(HCO_3)_2$ solution, the cationite in the H-filter is practically in homogeneous calcium form. It is washed with a part of washing water of H-filter and acid solution is passed from bottom to top through a closed circuit: H_{pr} - settling tank (reactor), where calcium sulphate precipitation takes place. The recovered solution is reinforced with H_2SO_4 and repeatedly used for regeneration, at that the consumption of H_2SO_4 for reinforcement is stoichiometric to the calcium displaced from the loading. The $Ca(HCO_3)_2$ solution containing $Mg(HCO_3)_2$ and $NaHCO_3$ used at the preliminary stage is sent

to the clarifier TM (in winter; in summer the same clarifier is used for treatment of make-up water of the RSC).

In case of magnesium over-depletion of N_{pr} , the spent $\text{Ca}(\text{HCO}_3)_2$ regeneration solution contains mainly $\text{Mg}(\text{HCO}_3)_2$ and it can be fed to the clarifier of the chemo-besalting scheme without increasing the sodium load. Since the excess acid is not removed from the cycle, but is fully realized in the process of repeated circulation through the cationic filter, the proposed method achieves the maximum possible degree of cationite regeneration by the regenerated solution.

If softened water is supplied to the H_{pr} (i.e., when both H-filter vessels operate only on sodium), another method of two-stage regeneration is possible with the use of $\text{Ca}(\text{OH})_2$ lime solution instead of $\text{Ca}(\text{HCO}_3)_2$ solution at the first stage. In this case, the spent lime solution will contain only NaOH and $\text{Ca}(\text{OH})_2$, i.e. sodium ions delayed during H-cationisation will be returned to the clarifier in the composition of sodium hydroxides, which promotes deep precipitation of calcium. At the same time, the anionic composition of water in the clarifier does not deteriorate and the total salt content of treated water does not increase from the return of effluent. The anionic component of the solution fed into the clarifier is reactive and is maximally realised in the process of sedimentation. The lime consumption is considerably reduced - below that required for carbonate precipitation mode (due to NaOH in the composition of $\text{Ca}(\text{OH})_2$). The obtained precipitate has a homogeneous carbonate composition, which after calcination is used to convert depleted H-cationite into a homogeneous calcium form (the general principle is preserved, so we do not describe the stage of regeneration of H_{pr} by acid).

The considered cyclic process (at the first stage of regeneration) determines reagentless water softening in the clarifier TS, the efficiency of which exceeds reagent water softening with commercial $\text{Ca}(\text{OH})_2$ and Na_2CO_3 . So residual calcium hardness of treated water of composition, (mg-eq/l): Ca-3,5; Mg-2,0; Na-0,9; SO_4 - 1,5; Cl- 1,1; HCO_3 -3,9 in the proposed method is 0.2-0.3 mg-eq/l against 0.6 mg-eq/l in case of soda-lime treatment. This is achieved by co-treating the water with a mixture of Ca and Na hydroxides obtained by passing $\text{Ca}(\text{OH})_2$ through the first body of the H-filter. Sodium content in clarified water is also lower than in case of soda-lime treatment: ~ 1.4 mg-eq/l versus 3.7 due to elimination of soda consumption for sedimentation.

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ANALYTICAL RESEARCHES OF REACTION CONDITIONS OF STEPWISE MANGANESE REDUCTION FROM ITS DIOXIDE BY CO GAS FROM THE POSITION OF THERMODYNAMICS

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АНАЛИТИЧЕСКИЕ ИССЛЕДОВАНИЯ УСЛОВИЙ ПРОТЕКАНИЯ РЕАКЦИЙ СТУПЕНЧАТОГО ВОССТАНОВЛЕНИЯ МАРГАНЦА ИЗ ЕГО ДИОКСИДА ГАЗОМ СО С ПОЗИЦИЙ ТЕРМОДИНАМИКИ

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Abstract

The article presents the results of a thermodynamic analysis of the possibility of chemical reactions of stepwise manganese reduction from its dioxide by the reducing gas CO, as well as the Bell-Boudoir chemical reaction. Using expressions existing in the literature, numerical values of boundary temperatures were obtained, which made it possible to establish temperature ranges for each of the reactions of stepwise manganese reduction from its dioxide by CO gas and gasification of solid carbon according to the Bell-Boudoir reaction.

Аннотация

В статье приведены результаты термодинамического анализа возможности протекания химических реакций ступенчатого восстановления марганца из его диоксида газом-восстановителем CO, а также химической реакции Белла-Будуара. С помощью выражений, существующих в литературе, получены численные значения граничных температур, которые позволили установить диапазоны температур протекания для каждой из реакций ступенчатого восстановления марганца из его диоксида газом CO и газификации твёрдого углерода по реакции Белла-Будуара.

Keywords: reduction, manganese dioxide, carbon monoxide, chemical reaction, carbon gasification, enthalpy, entropy, Gibbs energy, boundary temperature, thermodynamics, Bell-Boudoir reaction.

Ключевые слова: восстановление, диоксид марганца, монооксид углерода, химическая реакция, газификация углерода, энтальпия, энтропия, энергия Гиббса, граничная температура, термодинамика, реакция Белла-Будуара.

Введение

Почти во всех железных рудах и в агломератах присутствует марганец (Mn) в виде его оксидов в различных концентрациях. Термодинамика процессов термического восстановления металлического Mn из его оксидов различными восстановителями представляет значительный практический интерес при разработке и внедрении технологий восстановления из железосодержащего сырья железа – жидкого чугуна или его альтернативного аналога (железа DRI, HBI и LRI), а также, что более предпочтительнее, непосредственно стали (чего до настоящего времени не было достигнуто). Это важно для повышения степени ресурсосбережения технологий прямого получения железа за счёт увеличения в нём содержания марганца, позволяя снижать при этом расход марганецсодержащих ферросплавов и материалов.

Указанные процессы восстановления марганца (так же, как железа и некоторых других металлов) относятся к числу сложных гетерогенных физико-химических процессов, в которых участвуют вещества в твёрдых, жидких и газообразных состояниях. В качестве восстановителей марганца из его оксидов (руды, агломерата, окатышей и др.) обычно

используют вещества, обладающие более высокой степенью химического сродства к кислороду [1], нежели марганец и его оксиды.

Известно [2], что при высоких температурах процесс восстановления марганца из его оксидов протекает ступенчато – в соответствии с принципом последовательных превращений, т.е. путём последовательного перехода от высшего оксида к более низшему и в самом конце – от самого низшего оксида к металлическому марганцу:



В результате взаимодействия оксидов марганца с твёрдым углеродом С кокса в доменной печи или древесного угля в сыродутных печах (т.е. при температурах выше 570°C), а также с образующимися восстановительными газами CO и H₂ (если последний присутствует) происходит указанное выше последовательное восстановление марганца из его оксидов, которое называется прямым в первом случае и косвенным (или непрямым) во вторых двух случаях [3].

Актуальность работы

Установлено, что при проведении исследований процесса ступенчатого восстановления Mn из его оксидов, а именно: твёрдым углеродом С, газами CO и H₂ с последующим анализом полученных данных и формулировкой теоретических выводов и положений предварительный термодинамический анализ условий протекания всех реакций восстановления Mn по схеме (A) не проводился. Однако он необходим, так как позволяет определять диапазон температур протекания каждой реакции процесса восстановления Mn, что с позиций второго начала термодинамики позволило бы с уверенностью констатировать о возможности их существования при температурах реального процесса, выяснив при этом, что же будет выступать восстановителем на каждом этапе, и определив численные значения граничных температур T_{гр} (пояснение см. ниже), выше или ниже которых возможны восстановительные процессы в каждой стадии схемы (A), а также выяснить условия протекания процесса газификация твёрдого углерода С по реакции Белла–Будуара.

Цель работы

Поэтому целью данной работы является нахождение граничных температур T_{гр}, ниже или выше численных значений которых термодинамически возможно протекание всех химических реакций ступенчатого восстановления марганца из его диоксида газом CO и химической реакции Белла–Будуара.

Материалы и методы

В ходе выполнения работы были использованы имеющиеся в различных литературных источниках выражения для расчёта численных значений свободной энергии Гиббса ΔG_T⁰ в зависимости от температуры T, для осуществления вычислений и обработки полученных результатов применялось компьютерное приложение MS Excel 2013.

Состояние вопроса

Ввиду наличия в шахтных противоточных восстановительных печах для получения железа из железосодержащего сырья (сыродутных горнах, штюкофенах, блауофенах, доменных печах и пр.) загружаемого в них кокса или угля, образуется значительное количество восстановительного газа CO в результате неполного (т.е. при недостатке кислорода) горения углерода, содержащегося в указанных материалах: 2C + O₂ = 2CO.

Считается [3], что при восстановлении железа в рудно–термических печах под воздействием газа–восстановителя CO из более высшего оксида марганца можно восстановить его более низший оксид:



Чёткая точка зрения об условиях протекания данных восстановительных процессов в современной металлургической науке отсутствует.

По одной версии [4], Mn₂O₃ и частично Mn₃O₄ восстанавливается из MnO₂ на верхних горизонтах засыпи при 300–400°C с выделением тепла. Восстановление остальной части Mn₃O₄ и MnO соответственно по реакциям (2) и (3) происходит в шахте печи при 400–800°C. При использовании марганцовистого агломерата высшие оксиды марганца (Mn₂O₃ и Mn₃O₄) восстанавливаются при агломерации.

По другой версии [5] восстановление Mn_2O_3 из MnO_2 начинается при $500^\circ C$ или при более низкой температуре. Примерно при этих же температурах отдает свой кислород оксид Mn_2O_3 , образуя оксид Mn_3O_4 . Mn_3O_4 – более прочный оксид, поэтому из него MnO восстанавливается в интервале температур $570–1050^\circ C$. При этом часть Mn_3O_4 и часть MnO восстанавливается соответственно из MnO_2 и Mn_2O_3 . Соединение Mn_3O_4 обычно улетучивается (вернее сначала возгоняется металлический марганец, а в верхних горизонтах он окисляется до Mn_3O_4 и в таком виде уходит из печи).

По третьей версии [6] высшие оксиды марганца (Mn_2O_3 и Mn_3O_4) восстанавливаются практически до конца уже при $400–500^\circ C$. Восстановление MnO из Mn_3O_4 протекает в интервале $600–1000^\circ C$.

По поводу восстановления Mn из низшего оксида MnO за счёт газа CO также существуют различные теории [3, 7–17].

По одной из них [7–9] Mn из MnO может восстанавливаться газом CO по реакции косвенного восстановления [2]:



По другой теории предполагается [3, 6, 10–12], что для протекания реакции (4) непрямого восстановления марганца требуется менее $0,01\%$ CO_2 в газовой фазе, а в реальных условиях восстановительной плавки это недостижимо; при этом даже при небольших количествах CO_2 возможна обратная реакция (4). На основании несоответствия реального состава газовой фазы в восстановительной печи якобы необходимым условиям протекания реакции (4) принимают, что Mn из MnO в реальных условиях может восстанавливаться только прямым путём, т.е. за счёт твёрдого углерода. Данное положение о содержании CO_2 в газовой фазе было изложено в источнике [10], с которого авторы всех последующих работ, по-видимому, просто копировали себе эту фразу.

Ещё одна теория предусматривает [2, 4, 5, 13–17], что косвенным путём (за счёт CO) Mn из MnO восстанавливается значительно труднее, чем Fe из FeO , поэтому реакция (4) непрямого восстановления марганца в условиях реальной восстановительной плавки практически невозможна, а Mn из MnO восстанавливается только прямым путём, да и то частично.

На основании двух последних теорий считают, что заключительная стадия восстановления марганца из его оксидов – это эндотермическая реакция прямого восстановления Mn из MnO твёрдым углеродом C [3]:



а количество восстанавливаемого марганца, согласно указанной реакции (5), существенно возрастает с повышением температуры.

При этом указывается [4], что термодинамически осуществление этого процесса в стандартных условиях становится возможным, начиная с $1430^\circ C$, а в доменной печи Mn из MnO восстанавливается при частичном связывании его с углеродом в виде карбида, и это обстоятельство обеспечивает восстановление марганца углеродом при более низких температурах, чем $1430^\circ C$.

По другой версии [5] металлический марганец восстанавливается твёрдым углеродом из MnO , начиная с $1100^\circ C$; в присутствии железа (не понятно почему? – прим. автора) восстановление начинается при $1030^\circ C$, а в заметных количествах (от 15 до 73%) – при $1200–1400^\circ C$. При восстановлении графитом в вакууме процесс начинается при температуре $850–900^\circ C$ и заканчивается при $1050^\circ C$. В условиях доменной печи Mn не полностью переходит в чугуны – обычно переходит 40–60% всего марганца; 5–10% уносится с газом, а остальное уходит в шлак.

При этом часть учёных–металлургов всё же пытается объяснить реакцию (5) «восстановлением марганца через газовую фазу»¹ (теория Г.И.Чуфарова) – за счёт суммарного протекания реакций (4) и (6), из которых и выводят реакцию (5), говоря о возможности восстановления Mn газом CO (4) «в присутствии твёрдого углерода»¹ [8–12, 18].

¹ Сомнительные формулировки, к тому же противоречащие научным положениям физической химии о химическом средстве веществ к кислороду и о роли катализатора.

В печи газ CO образуется не только по приведённой выше реакции горения твёрдого углерода C при недостатке окислителя, но и за счёт реакции газификации твёрдого C [14], больше известной как реакция Белла–Будуара [3]:



которая является важной с точки зрения обеспечения косвенного восстановления прежде всего Fe, а также Mn и других элементов из их оксидов, содержащихся в железе [15].

Для оценки возможности протекания указанных реакций (1)–(4) и (6) построим с помощью выражений, имеющих в литературе, графические зависимости от температуры T свободных энергий Гиббса $\Delta G_T^0 = \Delta H - T \cdot \Delta S$ реакций (1)–(4) и (6), численные значения которых будут свидетельствовать о возможности или невозможности протекания каждой из указанных реакций при определённых температурах, при этом для каждой из них получим значение граничной температуры $T_{гр}$. Для процесса ступенчатого восстановления железа из гематита газом CO такой анализ автором уже был сделан [19].

Термодинамические исследования

Из теории металлургических процессов (ТМП) известны выражения для нахождения в зависимости от температуры T численных значений изобарно–изотермического потенциала ΔG_T^0 реакции (4) [7] и констант равновесия для реакций (1)–(4) и (6) [3, 18, 20–23], последние из которых также позволяют, используя уравнение изотермы Вант–Гоффа [7, 24]

$$\Delta G_T^0 = -2,3RT \cdot \lg K_p = -RT \cdot \ln K_p, \quad (7)$$

получить выражения для расчёта численных значений ΔG_T^0 :

$$\text{для реакции (1) –} \quad \Delta G_T^0 = -23862,508 + 33,840 \cdot T, \text{ Дж/моль CO [3, 20];} \quad (1.1)$$

$$\text{для реакции (2) –} \quad \Delta G_T^0 = -214754,255 + 37,498 \cdot T, \text{ Дж/моль CO [3, 20];} \quad (2.1)$$

$$\text{для реакции (3) –} \quad \Delta G_T^0 = -10043,871 - 12,222 \cdot T, \text{ Дж/моль CO [3, 20];} \quad (3.1)$$

$$\text{для реакции (4) –} \quad \Delta G_T^0 = 102309,463 + 14,384 \cdot T, \text{ Дж/моль CO [3, 20],} \quad (4.1)$$

$$\Delta G_T^0 = 102491,000 + 13,855 \cdot T, \text{ Дж/моль CO [7];} \quad (4.2)$$

$$\Delta G_T^0 = 102118,230 + 14,342 \cdot T, \text{ Дж/моль CO [18],} \quad (4.3)$$

$$\Delta G_T^0 = 124745,000 - 1,840 \cdot T, \text{ Дж/моль CO [21];} \quad (4.4)$$

$$\text{для реакции (6) –} \quad \Delta G_T^0 = 172130,000 - 177,46 \cdot T, \text{ Дж/моль CO}_2 \text{ [7, 22],} \quad (6.1)$$

$$\Delta G_T^0 = 170821,000 - 174,58 \cdot T, \text{ Дж/моль CO}_2 \text{ [23]} \quad (6.2)$$

Зависимости численных значений энергии Гиббса ΔG_T^0 от температуры T (в °C) для реакций (1)–(4) и (6) иллюстрирует рис. 1, который построен автором по значениям ΔG_T^0 , полученным с помощью приведённых выше выражений (1.1)–(6.2).

Расчётные значения граничных температур $T_{гр}$ для химических реакций (1)–(4) и (6), вычисленные по формуле $\Delta H = T \cdot \Delta S$ (т.е. при $\Delta G_T^0 = 0$), и диапазон температур протекания $T_{пр}$ указанных химических реакций занесём в табл. 1.

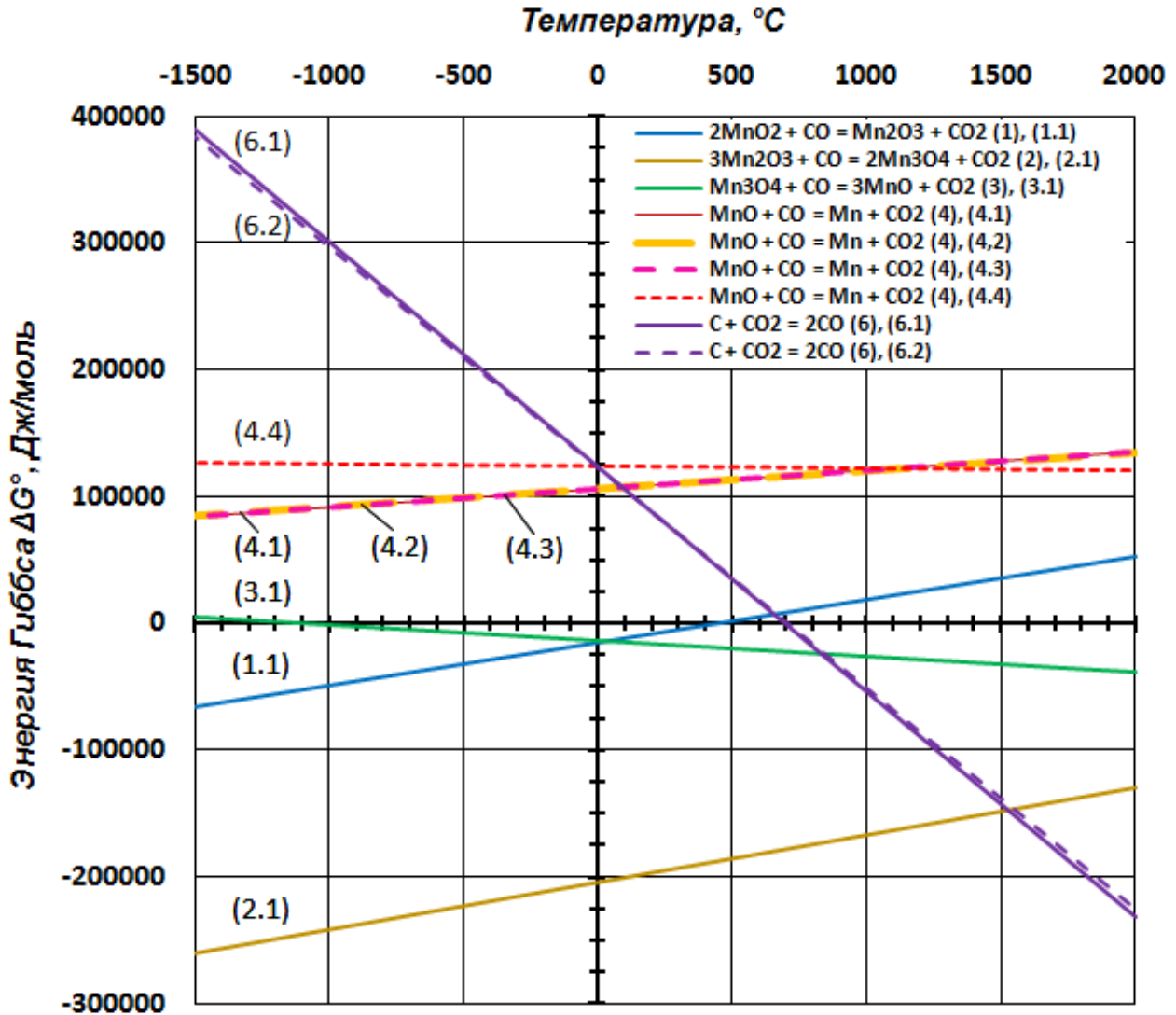


Рисунок 1. Зависимости значений энергии Гиббса ΔG_T^0 от температуры T для реакций (1)–(4) и (6), рассчитанные по выражениям (1.1), (2.1), (3.1), (4.1)–(4.4) и (6.1), (6.2), взятым или полученным из литературных источников [3, 7, 18, 20–24]

Таблица 1. Температуры $T_{гр}$ и $T_{пр}$ для химических реакций (1)–(4) и (6)²

Химические реакции	Формулы расчёта ΔG_T^0	Расчётные значения $T_{гр}$ и диапазона $T_{пр}$, °C
$2MnO_2 + CO = Mn_2O_3 + CO_2 + Q_1$ (1)	(1.1)	$T_{гр} = 432,157$; $T_{пр} < T_{гр}$
$3Mn_2O_3 + CO = 2Mn_3O_4 + CO_2 + Q_2$ (2)	(2.1)	$T_{гр} = 5454,086$; $T_{пр} < T_{гр}$
$Mn_3O_4 + CO = 3MnO + CO_2 + Q_3$ (3)	(3.1)	$T_{гр} = -1094,773$; $T_{пр} > T_{гр}$
$MnO + CO = Mn + CO_2 - Q_4$ (4)	(4.1)	$T_{гр} = -7406,556$; $T_{пр} < T_{гр}$
	(4.2)	$T_{гр} = -7670,402$; $T_{пр} < T_{гр}$
	(4.3)	$T_{гр} = -7393,222$; $T_{пр} < T_{гр}$
	(4.4)	$T_{гр} = 67523,196$; $T_{пр} > T_{гр}$
$C + CO_2 = 2CO - Q_6$ (6)	(6.1)	$T_{гр} = 696,965$; $T_{пр} > T_{гр}$
	(6.2)	$T_{гр} = 705,468$; $T_{пр} > T_{гр}$

² Обусловия протекания реакций (1)–(4) и (6) свидетельствуют знаки «>» и «<» между $T_{пр}$ и $T_{гр}$.

Анализ полученных результатов

Проанализируем графические зависимости, изображённые на рис. 1, и данные табл. 1.

Как известно [25], самопроизвольное протекание любого изобарно–изотермического процесса определяется двумя факторами:

- энтальпийным, связанным с уменьшением энтальпии системы (ΔH);
- энтропийным $T \cdot \Delta S$, обусловленным увеличением беспорядка в системе вследствие роста её энтропии (ΔS).

Разность этих термодинамических факторов является функцией состояния системы, называемой изобарно–изотермическим потенциалом или свободной энергией Гиббса ΔG_T^0 .

Свободная энергия Гиббса ΔG_T^0 является термодинамическим критерием принципиальной возможности самопроизвольного протекания того или иного химического процесса (химической реакции) при постоянной температуре и давлении [26].

Направление всех химических реакций зависит от их характера. Так, если для химической реакция $\Delta G_T^0 < 0$, то данный химический процесс может самопроизвольно протекать в прямом направлении протекания данной реакции. Процесс при данных условиях не осуществим в направлении прямой химической реакции, если $\Delta G_T^0 > 0$; т.е. имеет место обратная реакция. Если энергия Гиббса $\Delta G_T^0 = 0$, то реакция обратима – процесс термодинамически может протекать как в прямом, так и в обратном направлениях, т.е. система находится в состоянии химического равновесия [27].

Таким образом, возможность самопроизвольного протекания химических реакций зависит от соотношения величин ΔH и $T \Delta S$. При этом возможны 4 основных случая [28, 29]:

1. Если энтальпия системы $\Delta H < 0$ (реакция экзотермическая), а энтропия системы $\Delta S > 0$ (в ходе реакции возрастает число молей газообразных веществ), то энергия Гиббса всегда будет величиной отрицательной ($\Delta G_T^0 < 0$), т.к. обе движущие силы ΔH и $T \cdot \Delta S$ направлены в сторону протекания прямой реакции. Такие реакции в прямом направлении термодинамически возможны при любой температуре и являются необратимыми.

2. Если $\Delta H < 0$ (реакция экзотермическая) и $\Delta S < 0$ (в ходе реакции уменьшается число молей газообразных веществ), то прямая реакция возможна только при низких температурах, т.е. $\Delta G_T^0 < 0$ при $|\Delta H| > |T \Delta S|$.

3. Если $\Delta H > 0$ (реакция эндотермическая), а $\Delta S > 0$ (в ходе реакции возрастает число молей газообразных веществ), то прямое направление реакции возможно только при высоких температурах, т.е. $\Delta G_T^0 < 0$ при $\Delta H < T \Delta S$.

4. Если $\Delta H > 0$ (реакция эндотермическая), а $\Delta S < 0$ (в ходе реакции уменьшается число молей газообразных веществ), то такие реакции в прямом направлении термодинамически невозможны при любых температурах, т.к. всегда $\Delta G_T^0 > 0$.

Таким образом, учитывая вышеизложенные положения физической химии, которые положены в основу ТМГП, прямые реакции (1) и (2) должны протекать только при низких температурах, прямая реакция (3) должна протекать при любых температурах и быть необратимой, протекание реакция (4) в прямом направлении невозможно при любых температурах, а прямая реакция (6) возможна только при высоких температурах.

Однако, как показал проведённый термодинамический анализ (см. рис. 1 и табл. 1) существующих в литературе выражений для расчёта энергия Гиббса ΔG_T^0 для химических реакций (1)–(4) и (6) это не совсем так. Как оказалось:

– протекание прямой реакции (1) возможно только при низких (ниже расчётной температуры 432,157°C) температурах, т.е. невозможно при температурах реального процесса в восстановительных печах, что ставит под сомнение правильность формулы (1.1);

– прямая реакция (2) возможна как при низких, так и при высоких температурах (ниже расчётной температуры 5454,086°C), т.е. возможна при температурах реального процесса в восстановительных печах;

– прямая реакция (3) возможна при температурах выше расчётной температуры –1094,773°C, т.е. также возможна при температурах реального процесса в восстановительных печах;

– протекание реакция (4) в прямом направлении возможно по одним данным – ниже определённых значений расчётных температур: или –7393,222°C, или –7406,556°C, или –7670,402°C, а по другим – выше расчётной температуры 67523,196°C, т.е. в обоих случаях

невозможно при температурах реального процесса в восстановительных печах (при этом правильность формулы (4.4) вызывает некоторые сомнения).

Относительно реакции (6) научные положения физической химии (и ТМП соответственно) полностью соблюдаются – в прямом направлении данная реакция возможна только при высоких (выше расчётных температур 696,965°C или 705,468°C) температурах.

Выводы

На основании проведённого термодинамического анализа процесса восстановления Mn из его оксидов по имеющимся выражениям в различных литературных источниках сделаны следующие выводы:

1. Восстановление Mn_2O_3 из MnO_2 газом CO термодинамически возможно при температурах ниже $T_{гр} = 432,157^\circ C$, т.е. невозможно при температурах реального процесса в восстановительных печах.

2. Восстановление Mn_3O_4 из Mn_2O_3 газом CO термодинамически возможно при температурах ниже $T_{гр} = 5454,086^\circ C$, т.е. возможно при температурах реального процесса в восстановительных печах.

3. Восстановление MnO из Mn_3O_4 газом CO термодинамически возможно при температурах выше $T_{гр} = -1094,773^\circ C$, т.е. возможно при температурах реального процесса в восстановительных печах.

4. Восстановление Mn из MnO за счёт CO термодинамически возможно при температурах ниже $T_{гр} = -7393,222^\circ C$ или ниже $T_{гр} = -7406,556^\circ C$, или ниже $T_{гр} = -7670,402^\circ C$, или выше $T_{гр} = 67523,196^\circ C$, т.е. невозможно при температурах реального процесса в восстановительных печах; по всей видимости, восстановление Mn из MnO происходит твёрдым углеродом угля (кокса, древесного угля).

5. Газификация твёрдого углерода (реакция Белла–Будуара) термодинамически возможна при температурах выше $T_{гр} = 696,965^\circ C$ или выше $T_{гр} = 705,468^\circ C$ (согласно источника [30] выше $T_{гр} \approx 557^\circ C$), т.е. возможна при температурах реального процесса в восстановительных печах.

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LEARNING MODELS OF ARTIFICIAL INTELLIGENCE

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Abstract

Artificial intelligence uses machine learning techniques such as deep neural networks, regression, decision trees, and random forests to interpret data and make informed decisions. Although creating human-like AI is difficult, AI has made significant advances in image recognition, language understanding, and predictive analytics. Key Python tools such as Scikit-learn, TensorFlow, PyTorch, and Keras play an important role in developing and improving these models, enabling AI to thrive in various fields through its data-driven capabilities.

Keywords: *Artificial intelligence, Machine learning, Python tools, Neural networks, Artificial intelligence models*

Data scientists use artificial intelligence models to perform multiple tasks and solve complex problems. Artificial intelligence models rely on Machine Learning algorithms and artificial neural networks to simulate a logical decision-making process using existing data and input datasets. These models are the foundation of modern intelligence tools and enable us to analyze data, make decisions and predictions, and provide valuable insights. Artificial intelligence is one of the most interesting areas of computer science. Artificial intelligence research aims to create a machine that can replicate human intelligence in real time. True artificial intelligence that can think like humans has yet to be achieved. But that doesn't mean we can't benefit from AI algorithms. Today, we use AI models for several analytical and decision-making tasks. An artificial intelligence model is a program or algorithm based on training data to recognize patterns and make predictions or decisions. The more data an AI model receives, the more accurate it can be in data analysis and predictions. AI models rely on computer vision, natural language processing, and Machine Learning to recognize various patterns. AI models also use decision-making algorithms to learn from their training, gather and review data points, and ultimately apply what they learn to achieve predetermined goals. AI models are very adept at solving complex problems with large amounts of data. As a result, they can solve complex problems with very high accuracy. Many people mistakenly conflate machine learning and artificial intelligence. This is likely due to the fact that machine learning is a subset of Artificial Intelligence. However, there are critical differences between the two. As we defined earlier, artificial intelligence deals with creating machines that simulate human thoughts, intelligence, and behaviors. Machine learning, on the other hand, allows machines to learn for themselves from experience and lessons without the need to be explicitly programmed. All machine learning models are AI models, but not all AI models are necessarily machine learning models. This is an important distinction. There are different types of machine learning and they include:[1]

- Supervised learning*
- Unsupervised learning*
- Semi-supervised learning*

In a supervised learning model, a human trains or teaches an algorithm what to look for. Often, the person performing this training is a data engineer who is a subject matter expert in whatever task the algorithm is being trained to perform. For example, an algorithm working on image recognition might be trained by a data engineer on images containing offensive or explicit content. The algorithm then uses this information to find other images with similar content. Artificial intelligence models built with supervised learning, such as support vector machines, are often used to perform predictive analysis. These models use past decisions made by subject matter experts to predict future choices the expert might make.[2]

AI models do not always have to be developed with human training. Instead, it trains a software algorithm in an unsupervised learning model. In some cases, the training method used by the training program mimics that of a human, but they do not necessarily have to train in the same way. Artificial intelligence models built with unsupervised learning are often used to perform descriptive analysis. These include content summarization, classification, extraction and video analytics. These types of AI models

can identify patterns and classify data without human training. Semi-supervised learning models combine some of the two previous models we discussed. In semi-supervised learning, a human performs part of the training and the software handles the rest based on human pre-training. Because AI models built with semi-supervised learning capture both learning styles, they can be both predictive and predictive, depending on their intended purpose. they can also perform descriptive analysis tasks.[4]

There are several different AI models and they all work differently. These include:

- Deep neural networks
- Linear regression
- Logistic regression
- Decision trees
- Random Forest(RF)

Deep neural network is one of the most popular AI/ML models. The design of this deep learning model is inspired by the human brain and its neural network. This artificial intelligence model uses artificial neural layers to combine multiple inputs and provide a single output value. Deep neural networks have been widely used in mobile application development to provide image and speech recognition services and natural language processing. This AI model represents the cutting edge of AI. It is very adept at solving complex problems with large data sets. Linear regression model is very popular among data engineers working in the field of statistics. Linear regression is based on a supervised learning model. The main purpose of these artificial intelligence models is to determine the relationship between the input and output variables. A linear regression model can predict the value of the dependent variable based on the value of the independent variable. These models are used in linear analysis for a number of industries, including healthcare, insurance, e-commerce, and banking. Logistic regression is another popular AI model and is closely related to the linear regression model. However, the logistic regression model is different from the linear regression model because it is only used to solve classification-based problems. Logistic regression is the best artificial intelligence model to solve the binary classification problem. This model predicts the value or class of a dependent data point based on a set of independent variables.

The decision trees model is simple and at the same time highly efficient. A decision tree uses available information from past decisions to arrive at a conclusion. These trees often work based on an if/then pattern. For example, if you eat a sandwich at home, then you will not need to buy lunch. Decision trees can be used to solve both regression and classification problems. In addition, primitive decision trees powered the earliest forms of predictive analytics. A random forest is a collection of multiple decision trees. Each decision tree returns its own result or decision, which is then combined with the results from each tree. Finally, the combined results provide a more accurate final prediction or decision. Random forest is a great AI model when you have a large data set. This model is used to solve both regression and classification problems. Modern predictive analytics is mostly equipped with random forest models. In addition to artificial intelligence models, there are also artificial intelligence tools and tools that are widely used. Tools play an important role in the implementation of supervised learning algorithms and models. Tools used in supervised training may include:[3]

Scikit-learn: A versatile and easy-to-use machine learning library in Python. It provides simple and efficient tools for data extraction and analysis. Scikit-learn offers various algorithms for classification, regression, clustering, dimensionality reduction and model selection.

TensorFlow: Developed by Google, TensorFlow is an open source deep learning software widely used for building neural networks and implementing various machine learning algorithms. It has a flexible architectural design and can be deployed on different platforms

PyTorch: Created by Facebook's artificial intelligence research lab, PyTorch is a popular deep learning tool known for its dynamic computational graph. Neural networks are favored by researchers and developers for their simplicity and ease of use.[5]

Keras: Originally built on top of TensorFlow and now integrated with TensorFlow as part of its core, Keras provides a high-level interface for building neural networks. It enables rapid prototyping and testing and is user-friendly. These tools and environments enable data engineers and machine learning professionals to efficiently develop, test, and deploy supervised learning models in a variety of applications. Tool selection often depends on task-specific requirements, familiarity, scalability, and available resources.

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THE EFFECT OF THERMAL CYCLING ON THE FORMATION OF A POROUS COMPOSITE MATERIAL BASED ON BASALT FIBER

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ВЛИЯНИЕ ТЕРМОЦИКЛИРОВАНИЯ НА ФОРМИРОВАНИЕ ПОРИСТОГО КОМПОЗИЦИОННОГО МАТЕРИАЛА НА ОСНОВЕ БАЗАЛЬТОВОГО ВОЛОКНА

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Abstract

The effect of thermal cycling on the formation of a porous composite material based on basalt fiber is investigated. It is shown that thermal cycling of a composite material compressed at 20 MPa changes the structure of the pore space from a slit-like pore shape to a volumetrically equiaxed one with a change in the average pore size from 59.0 microns to 15.2 microns, which leads to a decrease in permeability from $30.9 \times 10^{-12} \text{ m}^2$ to $13.8 \times 10^{-12} \text{ m}^2$ and open porosity from 75.5 up to 56.1%. With an increase in the number of heating cycles, the compressive strength increases from 2.9 MPa to 14.9 MPa. It has been found that when the pressing pressure increases to 40 MPa, the fibers are compacted to form a regular porous structure. An increase in the number of cycles has practically no effect on the average pore size (15.1 microns at cycle I and 14.4 microns at cycle III). There is no change in gas permeability and porosity. The gas permeability is $11 \times 10^{-12} \text{ m}^2$, the average porosity is 58%. The compressive strength increases from 11.9 MPa to 31.5 MPa.

Аннотация

Исследовано влияние термоциклирования на формирование пористого композиционного материала на основе базальтового волокна. Показано, что термоциклирование композиционного материала, спрессованного при 20 МПа, изменяет структуру порового пространства от щелевидной формы пор до объемно-равноосной с изменением среднего размера пор от 59,0 мкм до 15,2 мкм, что приводит к уменьшению проницаемости от $30,9 \times 10^{-12} \text{ м}^2$ до $13,8 \times 10^{-12} \text{ м}^2$ и открытой пористости от 75,5 до 56,1 %. С увеличением количества циклов нагрева повышается предел прочности на сжатие с 2,9 МПа до 14,9 МПа. Установлено, что при увеличении давления прессования до 40 МПа, происходит уплотнение волокон с образованием регулярной пористой структуры. Увеличение количества циклов практически не влияет на средний размер пор (15,1 мкм при I цикле и 14,4 мкм при III циклах). Изменение газовой проницаемости и пористости не наблюдается. Газовая проницаемость составляет $11 \times 10^{-12} \text{ м}^2$, средняя пористость – 58 %. Предел прочности на сжатие увеличивается с 11,9 МПа до 31,5 МПа.

Keywords: composite material, basalt fiber, morphological analysis, mechanical properties, porosity, permeability.

Ключевые слова: композиционный материал, базальтовое волокно, морфологический анализ, механические свойства, пористость, проницаемость.

Уровень современной техники требует все более широкого применения различных средств и способов, улучшающих качество пористых материалов [1]. В связи с этим поиск новых керамических пористых проницаемых фильтровальных материалов с высокой прочностью, пригодных к внедрению в технологические схемы очистки газов при давлениях свыше 10 МПа, является актуальным [2, 3].

Объектами исследования являлись образцы композитов на основе базальтового волокна, сформированные в процессе термоциклирования.

Образцы изготавливались из шихты следующего состава (вес.): 37% базальтового волокна + 19% муллита + 11% модификатора Al_2SO_4 в качестве связки + 19% порообразователя + 4% фарфора в качестве упрочнителя + 11% пластификатора. После гранулирования осуществлялось радиальное прессование при давлениях 20 и 40 МПа. Маркировка образцов с режимами термоциклирования указаны в табл. 1.

Таблица 1

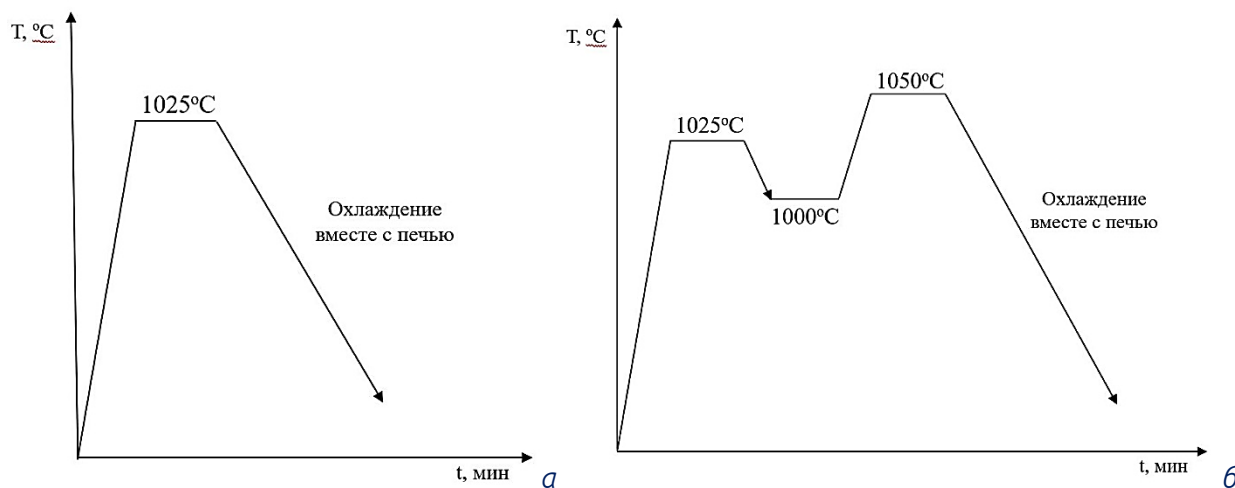
Маркировка образцов с режимами термоциклирования

Маркировка образца	Давление прессования, МПа	Режим термоциклирования
1-1025-20	20	I цикл: нагрев до 1025 °С – охлаждение вместе с печью
2-1050-20	20	II цикла: нагрев до 1025 °С – охлаждение до 1000 °С + нагрев до 1050 °С – охлаждение вместе с печью
3-1075-20	20	III цикла: нагрев до 1025 °С – охлаждение до 1000 °С + нагрев до 1050 °С – охлаждение до 1025 °С + нагрев до 1075 °С – охлаждение вместе с печью
1-1025-40	40	I цикл: нагрев до 1025 °С – охлаждение вместе с печью
2-1050-40	40	II цикла: нагрев до 1025 °С – охлаждение до 1000 °С + нагрев до 1050 °С – охлаждение вместе с печью
3-1075-40	40	III цикла: нагрев до 1025 °С – охлаждение до 1000 °С + нагрев до 1050 °С – охлаждение до 1025 °С + нагрев до 1075 °С – охлаждение вместе с печью

Для контроля морфологии поверхности, пористости, проницаемости и прочностных свойств проводили контроль образцов на каждой стадии термоциклирования.

Термоциклирование проводилось с целью повышения прочности композиций за счет сохранения части аморфного состояния волокна и снятия микронапряжений.

Режимы термоциклирования в виде графиков представлены на рис. 1.



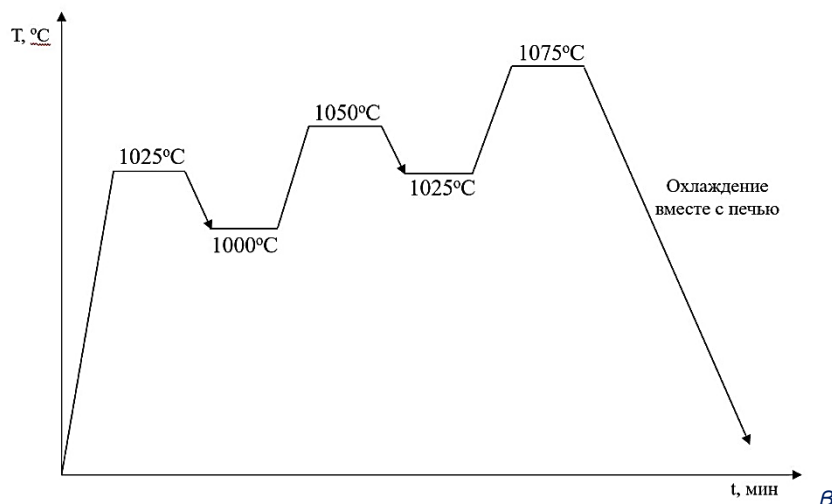
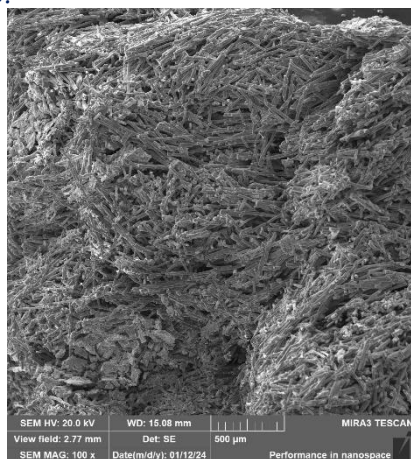


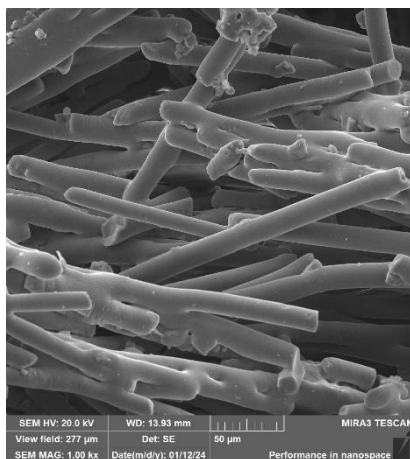
Рис. 1. Режимы термоциклирования в виде графиков: а – I цикл: нагрев до 1025 °С – охлаждение вместе с печью; б – II цикла: нагрев до 1025 °С – охлаждение до 1000 °С + нагрев до 1050 °С – охлаждение вместе с печью; в – III цикла: нагрев до 1025 °С – охлаждение до 1000 °С + нагрев до 1050 °С – охлаждение до 1025 °С + нагрев до 1075 °С – охлаждение вместе с печью

Морфологический анализ поверхности выполнялся на сканирующем электронном микроскопе высокого разрешения «Mira» фирмы «Tescan» (Чехия) фирмы «Oxford Instruments Analytical» (Великобритания). Испытание на сжатие осуществлялось на универсальной испытательной машине "Tinius Olsen H150K-U" (Англия). Погрешность измерения 1 %. Пористость и проницаемость определялась на автоматизированном порометре капиллярных потоков Porolux 500 по исследованию порошковых материалов газодинамическим методом. Общая пористость определялась по методу гидростатического взвешивания по ГОСТ 24409-80.

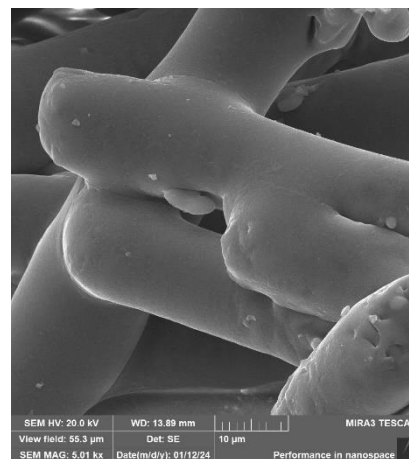
Морфология поверхности композитов на основе базальтового волокна, после прессования при 20 МПа и 40 МПа, сформированных в процессе термоциклирования, представлена на рис. 2, 3.



а



б



в

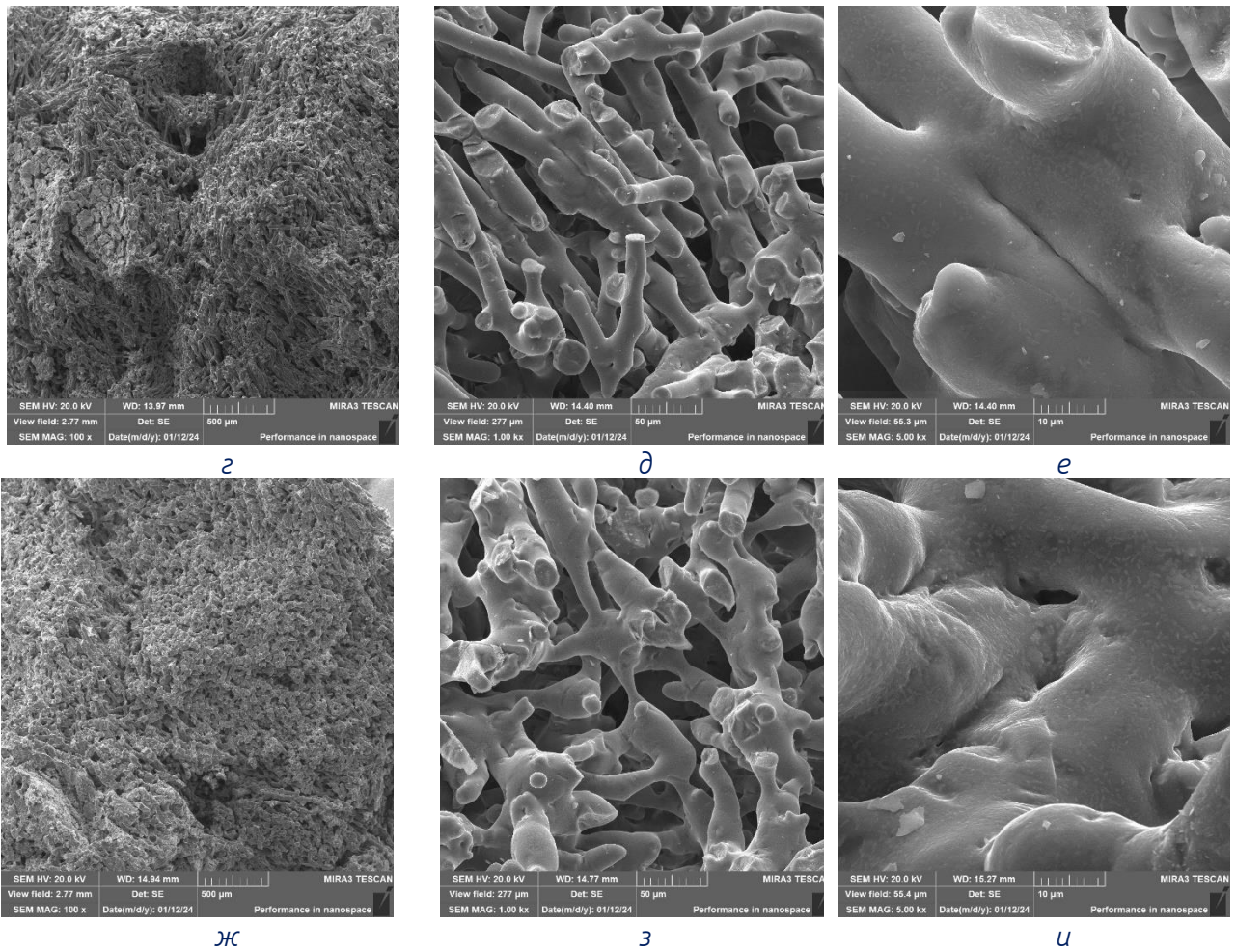
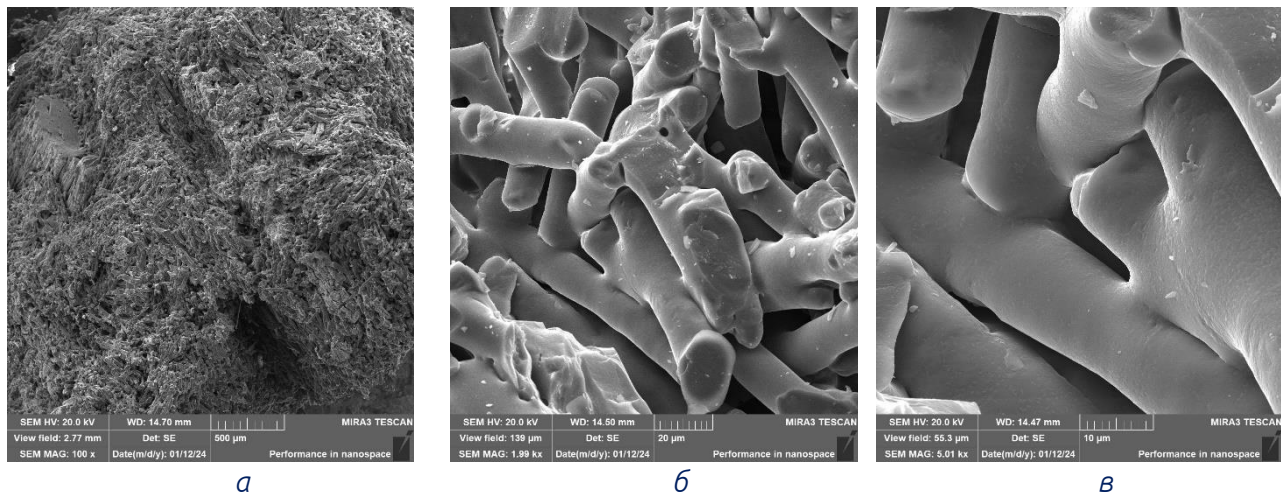


Рис. 2. Морфология поверхности композитов на основе базальтового волокна, после прессования при 20 МПа, сформированных в процессе термоциклирования: а - в – образец с маркировкой 1-1025-20 (I цикл); г - е – образец с маркировкой 2-1050-20 (II цикла); ж - и – образец с маркировкой 3-1075-20 (III цикла)



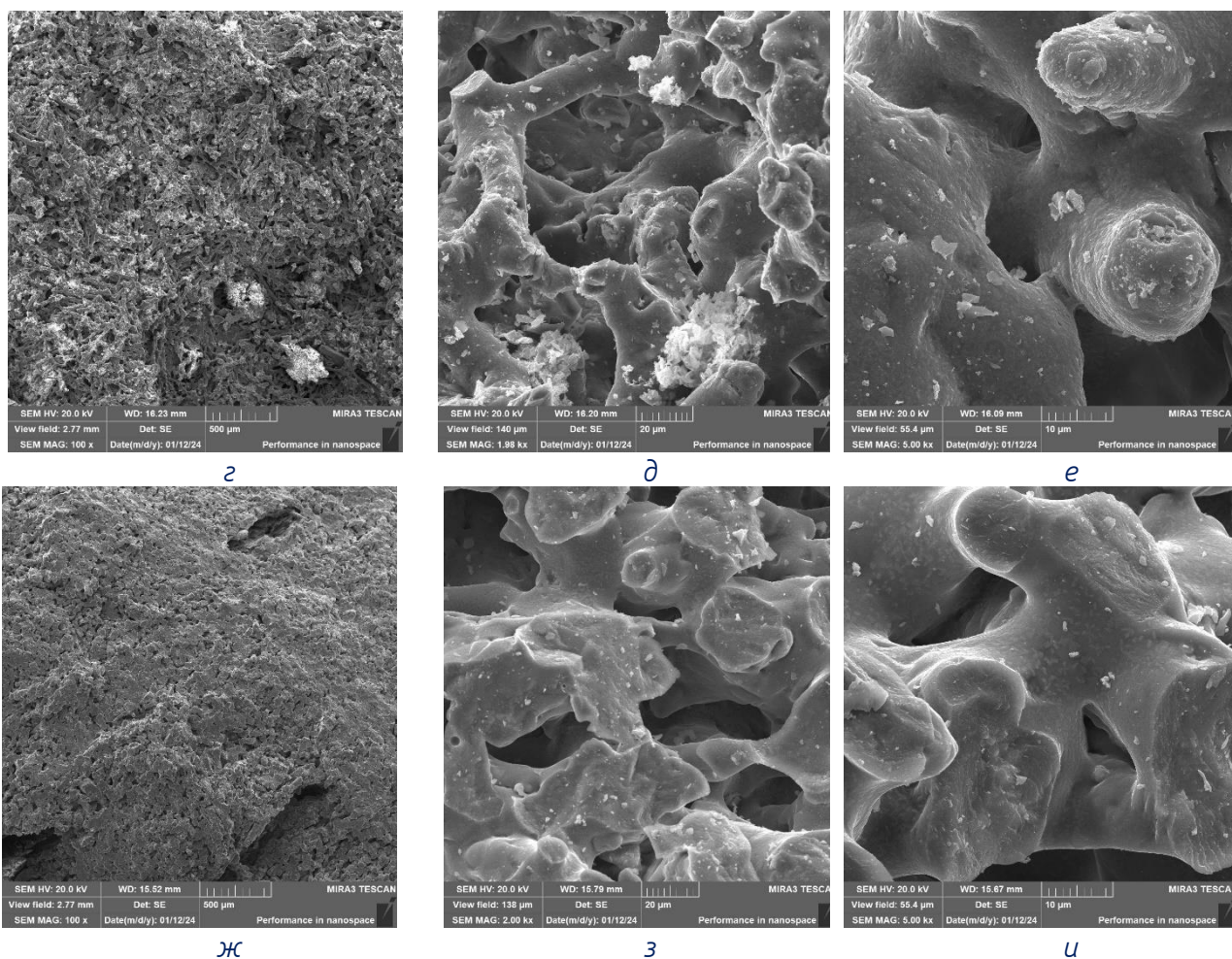


Рис. 3. Морфология поверхности композитов на основе базальтового волокна, после прессования при 40 МПа, сформированных в процессе термоциклирования: а - в – образец с маркировкой 1-1025-40 (I цикл); г - е – образец с маркировкой 2-1050-40 (II цикла); ж - и – образец с маркировкой 3-1075-40 (III цикла)

Исследование морфологии поверхности композитов на основе базальтового волокна, спрессованных при давлении 20 МПа, после проведения III циклов нагрева от 1025 °С до 1075 °С с охлаждением вместе с печью показало (рис. 2), что за счет спекания базальтового волокна в композите происходит образование каркасной структуры при сохранении гладкости поверхности волокон, указывающей на аморфность. Наблюдается незначительное количество закристаллизованной жидкой фазы на его поверхности. Спекание изменяет структуру порового пространства от щелевидной формы пор до объемно-равноосной с изменением среднего размера пор от 59,0 мкм до 15,2 мкм. Это приводит к уменьшению проницаемости от $30,9 \times 10^{-12} \text{ м}^2$ до $13,8 \times 10^{-12} \text{ м}^2$ и открытой пористости от 75,5 % до 56,1 %. С увеличением количества циклов нагрева повышается предел прочности на сжатие с 2,9 МПа до 14,9 МПа.

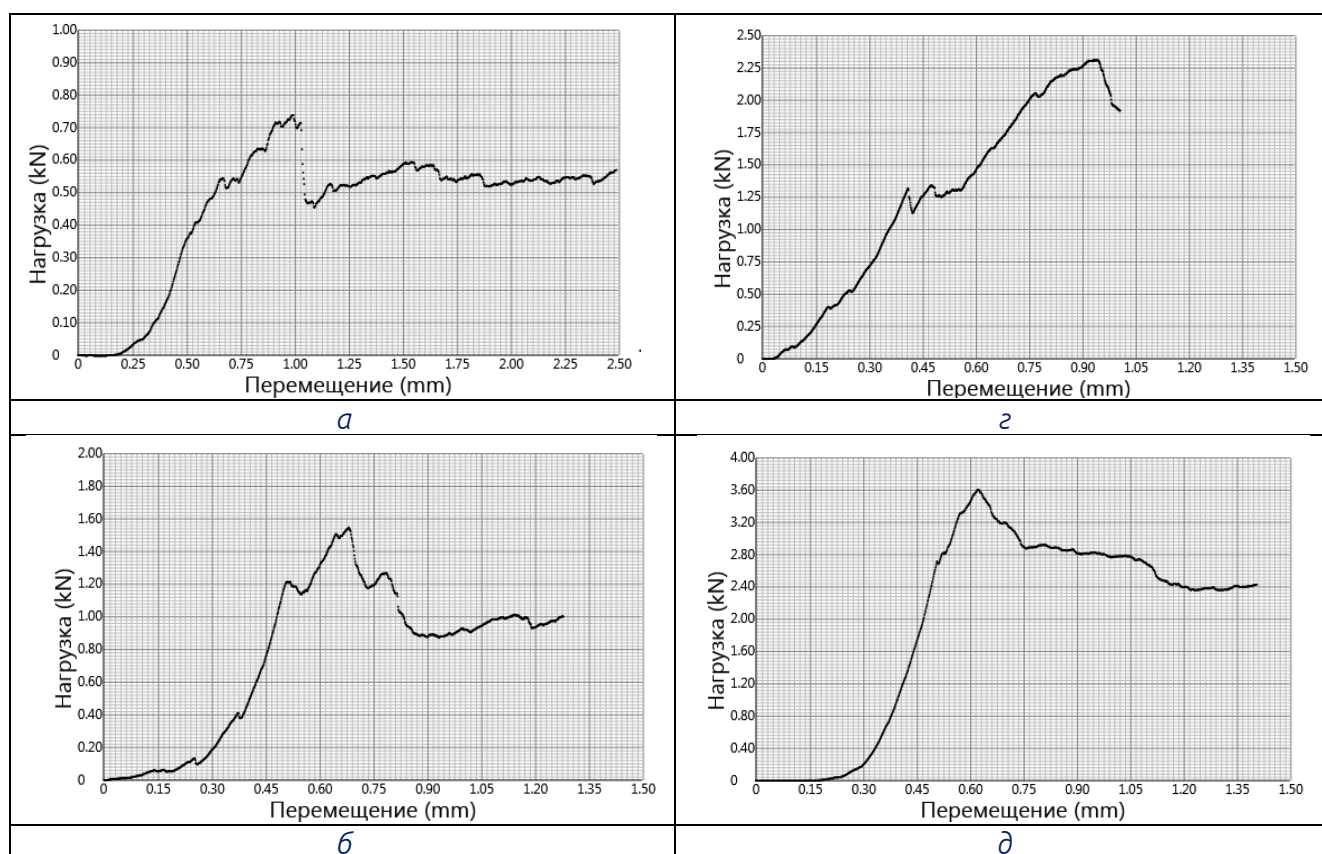
Увеличение давления прессования до 40 МПа приводит к уплотнению волокон и образованию регулярной пористой структуры (рис. 3). Увеличение количества циклов практически не влияет на средний размер пор (15,1 мкм при I цикле и 14,4 мкм при III циклах). Изменение газовой проницаемости и пористости также не наблюдается. Газовая проницаемость составляет $11 \times 10^{-12} \text{ м}^2$, пористость в среднем - 58 %. Предел прочности на сжатие увеличивается с 11,9 МПа до 31,5 МПа. Поверхность волокон остается практически гладкой.

Результаты измерения среднего размера пор, пористости, газовой проницаемости и предела прочности на сжатие в зависимости от режимов термоциклирования представлены в табл. 2.

Таблица 2
Средний размер пор, пористость, газовая проницаемость и предел прочности на сжатие в зависимости от режимов термоциклирования

Маркировка	Средний размер пор, мкм	Пористость, %	Газовая проницаемость (при 0,4 бар), 10^{-12} м^2	Предел прочности на сжатие, МПа
1-1025-20	59,0	75,5	30,9	2,9
2-1050-20	18,1	63,3	24,1	6,4
3-1075-20	15,2	56,1	13,8	14,9
1-1025-40	15,1	59,9	11,3	11,9
2-1050-40	14,9	58,6	11,1	15,7
3-1075-40	14,4	54,7	11,0	31,5

На рис. 4 представлены диаграммы сжатия образцов после термоциклирования, спрессованных при давлениях 20 МПа и 40 МПа. В образцах, спрессованных при 20 МПа, происходит значительное разрушение волокон на небольших нагрузках 0,5 кН до 1,4 кН. Максимальный предел прочности на сжатие - 14,9 МПа. Дальнейшее увеличение испытательной нагрузки «прессует» разрушенные волокна, о чем свидетельствует образование полочки на диаграмме. При давлении 40 МПа значение выдерживаемых нагрузок повышается до 2,1 кН с увеличением предела прочности до 31,5 МПа. Полочка на диаграмме также присутствует, однако отличается плавностью распределения, что говорит о меньшем разрушении волокон.



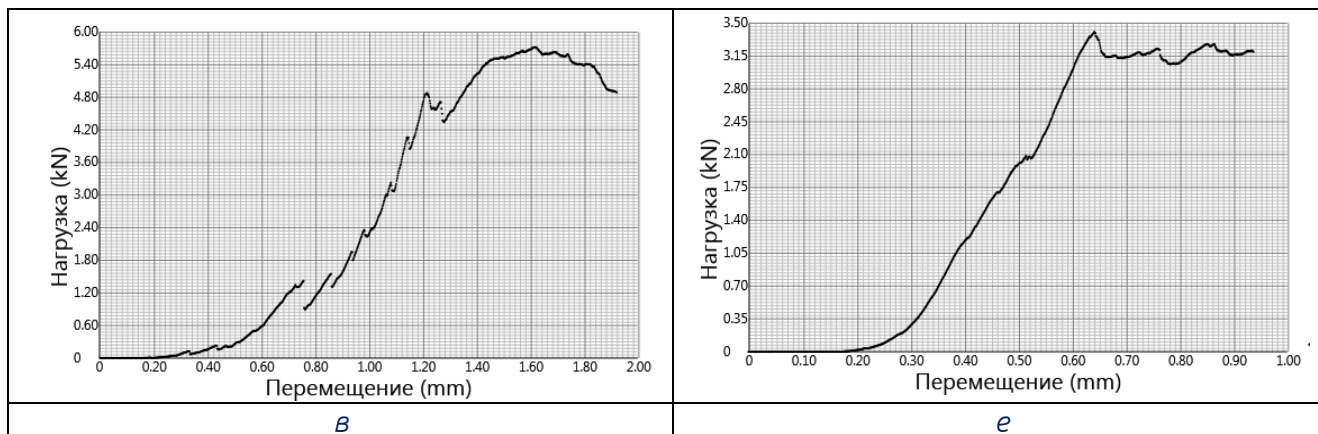


Рис. 4. Диаграммы сжатия композитов на основе базальтового волокна, после прессования при 20 МПа (а-в) и 40 МПа (г-е), сформированных в процессе термоциклирования: а, г – образцы с маркировками 1-1025-20 и 1-1025-40 (I цикл); б, д – образцы с маркировками 2-1050-20 и 2-1050-40 (II цикла); в, е – образцы с маркировками 3-1075-20 и 3-1075-40 (III цикла)

Выводы. Исследовано, что композиты на основе базальтового волокна, спрессованные при давлении 20 МПа, после термоциклирования имеют каркасную структуру. Поверхность волокон преимущественно гладкая, на поверхности волокон присутствует незначительное количество закристаллизованной жидкой фазы, образованной в процессе спекания. Термоциклирование изменяет структуру порового пространства от щелевидной формы пор до объемно-равноосной с изменением среднего размера пор от 59,0 мкм до 15,2 мкм, что приводит к уменьшению проницаемости от $30,9 \times 10^{-12} \text{ м}^2$ до $13,8 \times 10^{-12} \text{ м}^2$ и открытой пористости от 75,5 до 56,1 %. С увеличением количества циклов нагрева повышается предел прочности на сжатие с 2,9 МПа до 14,9 МПа.

Изучено, что при увеличении давления прессования до 40 МПа, происходит уплотнение волокон и образование регулярной пористой структуры. Увеличение количества циклов практически не влияет на средний размер пор (15,1 мкм при I цикле и 14,4 мкм при III цикла). Изменение газовой проницаемости и пористости также не наблюдается. Газовая проницаемость составляет $11 \times 10^{-12} \text{ м}^2$, средняя пористость – 58 %. Предел прочности на сжатие увеличивается с 11,9 МПа до 31,5 МПа. Поверхность волокон остается практически гладкой.

Определено, что в образцах, спрессованных при 20 МПа, происходит значительное разрушение волокон на небольших нагрузках 0,5 кН до 1,4 кН. Максимальный предел прочности на сжатие составляет 14,9 МПа. Дальнейшее увеличение испытательной нагрузки «прессует» разрушенные волокна, о чем свидетельствует образование полочки на диаграмме. При давлении 40 МПа значение выдерживаемых нагрузок повышается до 2,1 кН с увеличением предела прочности до 31,5 МПа. Полочка на диаграмме также присутствует, однако отличается плавностью распределения, что говорит о меньшем разрушении волокон.

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