



МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ  
СУМСЬКИЙ ДЕРЖАВНИЙ УНІВЕРСИТЕТ  
КАФЕДРА ІНОЗЕМНИХ МОВ ТА ЛІНГВОДИДАКТИКИ  
ЛІНГВІСТИЧНИЙ НАВЧАЛЬНО-МЕТОДИЧНИЙ ЦЕНТР

## **МАТЕРІАЛИ**

### **ХVІІ ВСЕУКРАЇНСЬКОЇ НАУКОВО-ПРАКТИЧНОЇ КОНФЕРЕНЦІЇ СТУДЕНТІВ, АСПІРАНТІВ ТА ВИКЛАДАЧІВ ЛІНГВІСТИЧНОГО НАВЧАЛЬНО-МЕТОДИЧНОГО ЦЕНТРУ КАФЕДРИ ІНОЗЕМНИХ МОВ ТА ЛІНГВОДИДАКТИКИ**

**«TO MAKE THE WORLD SMARTER AND SAFER»**

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FOREIGN LANGUAGE TEACHING CENTRE

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LINGUODIDACTICS**

**"TO MAKE THE WORLD SMARTER AND SAFER"**

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**To Make the World Smarter and Safer:** Матеріали XVII всеукраїнської науково-практичної конференції студентів, аспірантів та викладачів Лінгвістичного навчально-методичного центру кафедри іноземних мов та лінгводидактики СумДУ (5 травня 2023 р.) / за заг. ред. професора Таценко Н.В. – Суми : СумДУ, 2023. – 119 с.

У матеріалах подані тези XVII Всеукраїнської науково-практичної конференції студентів, аспірантів та викладачів Лінгвістичного навчально-методичного центру кафедри іноземних мов та лінгводидактики СумДУ. До збірника ввійшли наукові дослідження, присвячені актуальним проблемам сучасних інноваційних технологій та процесів у науці, техніці та різних сферах людської діяльності.

Для молодих науковців, викладачів і студентів усіх факультетів.

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## **SECTION 1 THE ROLE OF A FOREIGN LANGUAGE IN TODAY'S DIFFICULT CONDITIONS**

### **THE ROLE OF FOREIGN LANGUAGE IN THE DIFFICULT CONDITIONS OF THE PRESENT**

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Amid the ongoing conflict in Ukraine, the role of foreign language skills cannot be overstated. The ability to speak a language other than one's native tongue has become increasingly vital, especially for those displaced by the war.

Refugees from Ukraine can use their foreign language skills to communicate with locals and navigate unfamiliar environments in the countries they have fled to. In a new land, where the customs and language can be vastly different, being able to communicate in a foreign language can make all the difference in accessing crucial resources, such as healthcare or housing.

For those who have remained in Ukraine, knowing a foreign language can also prove to be a valuable asset. With the country's economy struggling in the wake of the conflict, job opportunities can be scarce. However, by having the ability to speak a foreign language, individuals can open up new avenues for employment, including the possibility of working for foreign companies.

Furthermore, in an increasingly globalized world, foreign language skills have become increasingly important for personal and professional development. Knowing a second or third language can broaden one's horizons and provide a deeper understanding of other cultures. In addition, multilingualism can open new opportunities for travel, education, and job prospects.

While acquiring foreign language skills can be challenging, especially for those affected by conflict and displacement, there are resources available for those willing to invest in their language abilities. From language schools to online courses, there are various ways to develop one's foreign language skills, which can have far-reaching benefits for individuals and communities alike.

In conclusion, the importance of foreign language skills in the context of the war in Ukraine cannot be overstated. Whether for refugees seeking to adapt to new environments or for those seeking new job opportunities, knowledge of foreign languages can provide individuals with a valuable tool for navigating complex situations and promoting personal and professional growth.

## HOW TO GET CHILDREN INTERESTED IN LEARNING ENGLISH

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Today, many parents are faced with the fact that their child is not interested in learning. Most children believe that the English language is very difficult and not understood at all.

In my opinion, this is closely related to the fact that teachers use the wrong teaching methods. And some of them, instead of explaining again, simply raise their voice at the students. Thus, the child loses faith that he can do something on his own. It often happens to me that a child, for example, does not want to read in English, because he was constantly shouted at because he pronounced something incorrectly, hence the fear of learning new things.

I have chosen teaching methods that, in my opinion, will help to interest the child in learning English, namely:

1. Make it fun: Use games, songs and exercises to make learning English fun. For example, you can play word games, sing songs in English, or watch English-language shows movies

2. Use visuals: Use pictures, flashcards and videos to help children connect words- subjects and concepts. This will help them remember new vocabulary and grammar rules.

3. Set realistic goals: Set achievable goals for children and celebrate their successes. For example, you can set a goal for them to learn 10 new words each week or to be able to introduce yourself in English.

4. Be patient and encouraging: Learning a new language can be challenging, so be patient and supporting children's efforts. Encourage them to keep trying and celebrate their successes

5. To introduce children to the English language outside the classroom. For example, you can lead them to English stories in the library or encourage them watch English-language TV shows or listen to English-language music.

6. Use technology. There are many programs, websites, and educational games that can help children learn English. Incorporate these tools into their learning experience to keep they are interested and motivated.

Remember that every child is unique, so it's important to find the learning style that works best for each individual. With these tips and a little creativity, you can help children develop a lifelong interest in learning English.

### POLYGLOTTE: ÊTRE OU NE PAS ÊTRE?

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Le but de cette recherche est de clarifier les avantages de la connaissance des langues étrangères et leur nombre pour une personne ordinaire instruite.

Il n'y a pas de définition généralement acceptée du terme "polyglotte". Le plus simple - "Un polyglotte est (du grec. πολλι, "beaucoup" et γλώττα, "langue") une personne qui parle plusieurs langues." Mais il n'en dit pas exactement combien et n'indique pas ce que signifie "possède". Sur la base du fait qu'il existe des pays avec 4 langues d'État officielles, où de nombreuses personnes parlent 4 langues (comme la Suisse, le Luxembourg, le Maroc, et l'Afrique du Sud ont 11 langues d'État au total), alors un polyglotte est considéré comme un personne qui peut communiquer librement au niveau quotidien en 4 langues. Cela rapprochera le concept de "polyglotte" de nombreuses personnes. Après tout, sur la planète, selon diverses estimations, de 60 à 75% des gens parlent 2 langues ou plus. Bilingues 43%, trilingues 13%,

3% parlent 4 langues ou plus, tandis que moins de 1% parlent 5 langues à un niveau aussi élevé.

Les principaux avantages de la maîtrise des langues étrangères:

1) Un ruban dans le CV est un respect supplémentaire.

2) Croissance multiple des opportunités - parce que la mondialisation et les technologies augmentent considérablement le nombre d'opportunités internationales.

3) Une longévité en bonne santé, car même le bilinguisme protège contre le retard mental. "Chez les bilingues, les symptômes de la maladie d'Alzheimer sont apparus environ quatre à cinq ans plus tard que chez les monolingues atteints de la même pathologie", - la découverte de la psycholinguiste Ellen Bialystok de l'Université York à Toronto. Un tel diagnostic a été donné au trilingue 6,4 ans plus tard que le "monolingue", et ceux qui parlent 4 langues ou plus avaient une conscience saine 9 ans de plus (a3). Une autre étude a montré qu'après un AVC, les bilingues récupéraient deux fois plus souvent leur activité mentale que les monolingues.

4) Les langues peuvent rendre tout âge intéressant, créatif et productif. Y compris et incliné.

5) Gains supplémentaires.

6) Il y a une tendance au développement - les personnes dans la production sont remplacées par des robots et l'IA, et l'emploi dans le secteur des services est en constante augmentation. Les services sont la communication et la communication. Les langues y contribuent. Et plus les technologies se développent rapidement et profondément, remplaçant les personnes, plus la valeur et le besoin de communication humaine en direct sont rapides et profonds, la créativité conjointe se développe...

7) Affichage des nouvelles. À notre époque de propagande totale et de manipulation de la conscience de masse à travers les médias de masse, l'analyse des informations dans différentes langues peut protéger contre la zombification.

8) La possession d'une ou plusieurs langues étrangères augmente également la probabilité de mariages multiculturels, la recherche de nouvelles idées, ...

Chaque nouvelle langue est une nouvelle culture, une nouvelle mentalité, un nouveau monde coloré. "Combien de langues connaissez-vous - tant de fois vous êtes une personne", a déclaré Goethe.

En même temps, lorsque vous maîtrisez une langue étrangère, la suivante est plus facile à apprendre. Et curieusement, malgré le fait que l'hégémonie de l'anglais rend l'apprentissage d'autres langues apparemment peu pratique, l'attrait d'apprendre et de connaître plusieurs langues est en croissance. Le nombre de groupes linguophiles sur les réseaux sociaux augmente, il y a une conférence annuelle des polyglottes et un prix international annuel pour le meilleur polyglotte de l'année - le prix Babylon.

Beaucoup s'inquiètent de la question du "comment" et "à quel prix" on peut apprendre des langues. La réponse courte est d'apprendre la langue avec plaisir, mais systématiquement. C'est-à-dire étudier systématiquement, obtenir du plaisir. Il existe de nombreuses méthodes, astuces, relations, plateformes, outils pour cela. Pour le concret initial: la technique d'immersion, les conseils "écrire un journal en langue étrangère, même pour 10 minutes", l'application Duolingo, la plateforme LingQ, des outils - écouter de la musique, écrire des sonnets, des cours, un tuteur, voyager et vivre dans un pays avec des locuteurs natifs, apprentissage mutuel ou pratique avec des locuteurs d'autres langues par le biais de messagers...

Et à la question "à quel prix?"... Par exemple, Rojas-Bercia (maîtrisant 28 langues, un Péruvien qui a renoncé à une carrière de tennis pour les langues) a dit: "Je suis amoureux des langues. Et quand je tombe amoureux d'une langue, j'ai besoin de l'apprendre. Je n'ai pas de motifs pratiques - c'est une sorte de jeu." Mais en même temps, il dit qu'"il y a environ 20 personnes comme moi en Europe, et chacun de nous connaît - ou est connu de - tout le monde" (a5). C'est-à-dire qu'il n'y a pas beaucoup de personnes qui parlent couramment plus de 10 langues. Après tout,



maîtriser les langues à un niveau élevé est une activité constante et difficile qui prend beaucoup de temps. On sait que les traducteurs professionnels pratiquent et améliorent généralement constamment 1 à 2 langues déjà apprises et n'essaient pas d'en maîtriser des dizaines. Après tout, plus vous apprenez de langues, moins vous pouvez leur consacrer de temps. Michael Erard, qui a étudié la virtuosité linguistique de 400 génies linguistiques historiques et vivants, pensait que leur capacité à communiquer diminuait, que chaque nouvelle langue était pour la plupart une tentative d'échapper à la solitude. Les résultats de ses recherches ont été publiés en 2012 dans le livre "Babel No More". Cela nous rappelle de sentir et d'observer la mesure. Chacun a sa propre "proportion d'or" bénéfice-satisfaction-temps. Le temps donné par la vie, les langues étrangères peuvent se transformer en plaisir et en bénéfice. Mais 7-10 langues peuvent prendre du temps sur d'autres composantes importantes et heureuses de la vie... Mais ajouter le plaisir et le bénéfice de 1-2-3 langues supplémentaires aux deux habituelles en rejoignant le prestigieux club des polyglottes peut être intéressant, utile et brillant.

Ainsi, les langues doivent être apprises pour le bénéfice, la satisfaction, les impressions vives! Apprendre les langues est un investissement de temps rentable. Et le nombre de langues dépend de manière optimale du plaisir et des avantages qu'une personne peut retirer de l'apprentissage et de l'utilisation des langues. Et, bien sûr, du prix qu'il paie, par exemple en temps.

En général, tout le monde n'a pas besoin d'une seule langue étrangère. Comme la charge, les voyages, la pêche, les poèmes... Beaucoup de gens s'en passent. Beaucoup se contentent, comme disent les Français, de "métro, boulot, dodo"...

Par conséquent, "être ou ne pas être" polyglotte, "apprendre ou ne pas apprendre" des langues étrangères, chacun décide pour lui-même. C'est sa vie. Il est important de rappeler les avantages et les inconvénients.

## WILL ENGLISH REMAIN INTERNATIONAL?

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There are so many languages in the world that people from different countries use to communicate with each other. Some examples are Spanish, Italian, German, French, Chinese, Hindi, etc.

An international language is a language that can be used for communication by a significant number of people around the world. Today, English is spoken by a massive number of people around the world, and in many countries, it has become the second official language along with the native one.

Communication in English has become a necessity for everyone in today's world. In 2022, about 1.5 billion people worldwide spoke English as their first or second language, slightly more than the 1.1 billion people who spoke Mandarin Chinese at the time of the survey. This year, Hindi and Spanish were the third and fourth most spoken languages [1].

Can Chinese become international with so many speakers? Mandarin Chinese already has the most significant number of speakers of any language. And China may soon overtake the United States as the world's largest economy. Chinese language learning is on the rise in the United States and worldwide. Consequently, Chinese may well claim to be the future international language: if the Chinese economy continues to develop rapidly, interest in the country will increase, resulting in interest in the Chinese language.

However, there are reasons why Chinese is unlikely to be the future language of international communication. Firstly, more than 50% of the content on the Internet is in English. Secondly, English is the language of business communication. Besides, English is the official language of diplomacy, international correspondence, and business documents. In addition, Chinese is complicated to learn, especially pronunciation: learning English is much easier. Finally, the culture of English-speaking countries is highly developed (e.g. music, cinematography, literature), and it

will take much longer than one or two years to change the culture frameworks [2].

Therefore, one should not expect that in the foreseeable future, Chinese will become the language of international business. In the short term, English will undoubtedly retain its leading position.

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## WHY LEARN A FOREIGN LANGUAGE?

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Knowledge of foreign languages is the key to success in today's world, where communication in foreign languages and the processing of vast amounts of information is becoming increasingly important. Learning languages can benefit you in many ways. One of the most rewarding aspects of the human experience is our ability to connect with others. It can also advance your career, feed your brain, deepen your connection to other cultures, and boost your confidence.

Moreover, recent research conducted at the University of London showed that learners of foreign languages are more flexible and creative thinkers. British scientists have confirmed a direct link between the activity of gray matter and the acquisition of several languages. No wonder the wise old sayings say: "How many languages you know, so many times you are a man", "He who knows languages, owns the world". The study of foreign languages teaches and encourages respect for other peoples: it fosters an understanding of the interrelation of language and human nature. Foreign languages expand your view of the world,

liberalize your experiences, and make you more flexible and tolerant.

English is now the most important and widespread language in the world. It is the official language in five countries: Great Britain, Canada, SILA, Australia, and New Zealand. English is one of the six official and working languages of the United Nations. It is the second working language in the European Community. In many Asian and African countries, such as India or Egypt, people in the former British colonies speak English in addition to their native language. People also speak English in Europe. English is spoken almost all over the world. It is the official language of international business and trade, the Internet and technology, science, and art.

As for me, I study English to communicate with others. I like to meet new people, share my knowledge, and obtain new information from others. I like to discuss different issues and just socialize with interesting people.

English is a wonderful language. It is the language of great literature, the language of William Shakespeare, Jonathan Swift, Walter Scott, and Charles Dickens.

The great German poet Wolfgang Goethe once said: "He who does not know a foreign language does not know his own." That is why, in order to better understand yourself and the world around you, you need to learn foreign languages.

## TIPS AND METHODS FOR MASTERING ENGLISH

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Mastering English is a challenging but rewarding endeavor that can lead to better career opportunities, improved communication skills, personal growth, and greater cultural awareness. Undoubtedly, to achieve proficiency in any foreign language, learners must develop a strong grammar, vocabulary, and pronunciation foundation and cultivate compelling reading, writing, speaking, and listening skills. In this abstract, we would

like to present some tips, techniques, and methods to help learners master English. We consider the following ways very effective:

- Immersing oneself in the language through exposure to authentic materials such as books, films, and podcasts. Listening to English songs and watching movies with subtitles is an excellent way to improve one's English;
- Regularly practicing with a language partner or a tutor. Regularity is precisely the aspect that will speed up language learning;
- Having a skilled and experienced teacher who can provide clear explanations, engaging activities, and constructive feedback can make a big difference in how quickly and effectively learners acquire English skills;
- Using online resources and language learning apps to supplement formal education;
- Setting achievable goals and tracking progress over time;
- Practicing speaking in simple but understandable sentences is an essential step on the way to excellent knowledge;
- Learning words with picture cards is the best way to improve one's English vocabulary;
- Writing a wish list in English is quite an exciting and vital activity for practicing English;
- Searching in English on Google helps find an answer to a question and practice understanding what is written in English;
- When adding a photo to a page, using an English caption or quote is a leap in the knowledge of the language;
- Being in an English-speaking environment can be very helpful for language learners, providing opportunities for immersion and natural language use;
- Communicating with native speakers or language partners;
- Creating an atmosphere in which a learner will have the desire and interest to learn;
- Determining one's short-term and long-term language learning goals.

One more crucial factor that can contribute to successful language learning is motivation. Motivation is the drive, desire,

and willingness to learn a foreign language. It can influence how much effort learners put into their studies, how long they persist in facing challenges, and how actively they seek opportunities to use the language. Motivation can come from many sources, such as personal interest in the language, a desire to achieve academic, career, or personal goals, or a need to communicate with others who speak the language, when motivated learners are more likely to engage in activities that promote language learning, such as practicing regularly, seeking feedback from teachers or language partners, and taking risks with the language.

In conclusion, every learner has to find his or her way, which will lead to success in learning English. We are all unique, and what works well for one person may not work well for another when it comes to learning English. Therefore, learners need to find ways to study and practice that are effective for them. This process can involve experimenting with different methods, techniques, and resources until they find what works best for their learning style and preferences. While many factors contribute to successful language learning, learners must take ownership of their learning and find the best individual approaches. By being proactive, adaptable, and persistent, learners can achieve their language learning goals and develop the skills and confidence to communicate effectively in English.

## АСПЕКТИ ВИВЧЕННЯ ІНОЗЕМНИХ МОВ У СУЧАСНОМУ СВІТІ

Ю.С. Козаченко

В умовах інноваційного розвитку суспільства актуальною стає необхідність підвищення якості підготовки фахівців та формування системи компетентностей.

Комунікативна культура є необхідною складовою фахової підготовки медичного персоналу, оскільки недостатній рівень сформованості у медика комунікативних умінь і навичок суттєво знижує його професійну придатність. Системно-структурний аналіз дозволяє з'ясувати, що в Україні основні норми та стандарти медичної підготовки (у т.

ч. комунікативної) базуються на принципі централізації та визначаються на рівні міністерств. Тому регіональний рівень формування комунікативної культури студентів не отримав розвитку, а інституційний відображений лише на рівні робочих програм, які розробляються викладачами навчальних закладів на основі навчальних планів і програм, затверджених Міністерством охорони здоров'я України. Основними компонентами комунікативної культури студентів-медиків можемо визначити комунікативну майстерність та організаційну культуру. Критеріями сформованості комунікативної культури виокремлено: мотиваційно-ціннісний (професійно-комунікативна мотивація, гуманістичні ціннісні орієнтації та комунікативні якості особистості), інформаційно-когнітивний (знання законодавчої бази й етичного кодексу медика, комунікативні знання, уміння та навички, комунікативно-пізнавальна активність) та діяльнісно-результативний (техніка вербальної та невербальної комунікації).

Отже, можемо визначити, комунікативну культуру студентів медичних коледжів як сукупність особистісних якостей, комунікативних умінь і навичок майбутнього медика, що реалізуються під час професійного спілкування; стан інтелектуальної, психологічної та фізичної готовності до успішної взаємодії з пацієнтами та іншими учасниками лікувального процесу.

## MULTIMODAL ARTIFACT: LINGUISTIC PERSPECTIVE

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The contemporary world is pervasively artifactual. Even our most mundane, biologically based activities, such as eating, sleeping, and sex, depend on engagement with artifacts. But unlike language, which also pervades human life from top to bottom, artifacts as such are not the subject matter of any well-defined area of philosophical research [1].

An artifact may be defined as an object that has been intentionally made or produced for a certain purpose. Often the word ‘artifact’ is used in a more restricted sense to refer to simple, hand-made objects which represent a particular culture. According to *Webster's Third New International Dictionary*, an artifact is “a usually simple object (as a tool or an ornament) showing human workmanship and modification as distinguished from a natural object.” *The Oxford English Dictionary* defines an artifact (artefact) as “anything made by human art and workmanship; an artificial product.” In experimental science, the expression ‘artifact’ is sometimes used to refer to experimental results which are not manifestations of the natural phenomena under investigation, but are due to the particular experimental arrangement, and hence indirectly to human agency.

Artifacts are not only objects of knowledge; they are also involved in cognition itself. An artifact has necessarily a maker or an author; thus, *artifact* and *author* can be regarded as correlative concepts [2, p. 156–157].

According to Kathy Schick and Nicholas Toth, (human) artifacts are “objects that have been modified by humans, either intentionally or unintentionally”. The existence and some of the properties of an artifact depend on an author's intention to make an object of certain kind. Because of this dependence of an author's intentions, artifacts can be said to be “creations of the mind” [3, p.52].

From a linguistic perspective, an artifact is any linguistic element that is the result of human activity and has historical, cultural, or scientific value. Language artifacts can be of different types, such as words, phrases, grammatical constructions, written texts, and other linguistic units.

Artifacts of language may also include idioms that have historical or cultural significance, or different dialectal forms that are the heritage of different regions. They can help to learn the etymology of words, reveal the connection between different languages, and explore different aspects of language use.



Marking contains text elements such as product name, brand, instructions for use, and other information about the product. In addition, the marking may contain graphic elements such as logos, product images, and diagrams with the composition or use of the product.

It can also be said that product labeling as a multimodal artifact is a complex and multifaceted object of research. It includes various dimensions such as appearance, textual information, semantic content, way of presentation, and use.

Based on research, we can argue that product labeling is a multimodal artifact. Studying marking as a multimodal artifact allows us to consider it from different perspectives and investigate the effectiveness of its various elements in interaction with users.

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## THE FUTURE OF ENGLISH: HOW LIKELY IS IT TO RETAIN ITS LEADERSHIP POSITION?

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L.V. Hnapovska – E L Adviser

English has been the dominant language of international business for several decades, but there is growing interest in other languages that could take over this role. From the short-term perspective, Chinese is considered the most likely candidate to challenge English as the primary language of business. In contrast, Spanish and Arabic could also gain more prominence in future.

Chinese is already the most widely spoken language globally, with over 1.1 billion speakers. China's economy has proliferated in recent years, making it an increasingly important player in the global business arena. According to a report published by Bloomberg, by 2030, China is expected to outstrip the United

States as the world's largest economy. That is why Chinese is becoming more critical in international business dealings. Companies that want to do business in China or with Chinese companies are likely to need employees who are proficient in the language.

In the longer term, Spanish is another potential candidate to take over English as the language of international business. It is the official language of several fast-growing economies, including Mexico, Brazil, and Spain. A report published by Forbes in 2021 claims that Spanish is spoken by more than 559 million people globally. Of those, 460 million are native speakers, making Spanish the language with the first most extensive population of native speakers after Mandarin.

Arabic is the third language that tops the rating of the languages that can compete with English. Over 420 million people speak it, and many Arab countries are experiencing significant economic growth since the Middle East is an essential destination for oil and gas businesses. According to Alexika's research, in 2018, Arabic ranked fourth in Business Languages of the World after English, Mandarin, and Spanish.

In general, the dominance of English is likely to persist for many years. The control of English in international business is deeply rooted: English is the language of international diplomacy, science, and technology, and it has become the default language of communication for many people worldwide.

However, while English is likely to remain the dominant language of international business in the near future, other languages, such as Mandarin Chinese, Spanish, and Arabic, could gain more prominence in this field in the short-term or longer-term perspective. The increasing globalisation of business and the growing importance of emerging economies are the fundamental driving forces behind this trend.

It is also important to note that language dominance is based on not only the number of speakers or economic influence but also factors such as cultural influence and ease of learning. Therefore, it is difficult to predict which language will surely replace English as the international language of business.

## THE IMPORTANCE OF LEARNING FOREIGN LANGUAGES FOR MODERN YOUTH THROUGH THE PARTICIPATION IN ONLINE MEETINGS WITH FOREIGN STUDENTS

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In the conditions of European integration, knowing a foreign language is the first step to a successful life. Modern technologies are so developed, that you can learn a foreign language without leaving your home. Knowing at least one foreign language opens up a wide range of opportunities: studying in prestigious universities, making new contacts, travelling a lot, working abroad and self-developing in a certain field. An old proverb says: “How many languages you know, so many times you are a person”. Therefore, the more languages you know today, so that is better. After all, each language is a key, that opens the door to something of its own, to something new [1].

Any foreign language reflects the country’s culture, customs and traditions in different ways. In order to master a language perfectly, you need to understand all its intricacies. So, for example, English is the official language of international business and trade, the Internet and technology, science and the arts. 80% of the business language space is occupied by English. Each of us encounters it more and more often in communication with partners at work and on vacation. English is used when filling in questionnaires, compiling resumes, in business and private correspondence. Proficiency in English is no longer a wonderful skill, but a necessity. Nowadays, it is taught in kindergartens, schools, universities, not to mention numerous courses and trainings. And in some countries, even mathematics and some other subjects of the school curriculum are taught in English [1]. If a person wants to develop his own business not only within his country, but also abroad, he needs to spend a lot of time and efforts to achieve results and constantly improve. Modern youth have all the opportunities to build a successful career and achieve success. Knowledge of foreign languages significantly increases

your chances of getting a promising job. Today, almost every employer expects job applicants to eventually master at least one foreign language. Knowledge of foreign languages will provide you with significant competitive advantages over other applicants for one or another position. If you want to succeed, you must not only have access to information, but also understand it yourself, analyze it and make conclusions. In difficult times for us, Ukrainians, it is important to communicate with other people, who may support. Due to the international activities of Sumy State University, you can get a number of opportunities - this is a good chance to show your communicative skills. As an example, the online meetings with foreign students are proposed. The international meetings were organized within the projects “BIEM: united by the language of profession (Ukrainian and international students)” and “United by the language of art: Ukrainian and international students”. Foreign guests shared their ideas about studying foreign languages, their experience of study English and Ukrainian languages. Firstly, it contributes to the effective improvement and expansion of language ability; secondly, it teaches to train phonetics, because talking with a native speaker allows Ukrainian students to learn something new about the language of different countries, its peculiarities of pronunciation, usage and spelling. Communicating with foreigners, in addition to learning a foreign language, also spread awareness of the importance of the Ukrainian language in other countries of the world. The successful intercultural communication is determined by quality of teaching foreign language [2].

In conclusion, knowing a foreign language is one of the requirements of progress and self-perfection for modern youth. Linguistic culture is an integral part of human culture in general. So, participation in international online projects with foreign students help to receive new skills of communicative culture, enrich vocabulary and train phonetic ear. Intercultural communication, without doubt, is one of the way to improve English language.

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IS THE IMPORTANCE OF ENGLISH IN THE FIELD OF  
INFORMATION TECHNOLOGIES OVERSTATED?

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English is the most spoken language in the entire world: a quarter of our planet, i.e. 1.5 billion people, currently speak English as a first, second or third language. 75% of the world's mail and 80% of the world's e-mail is written in English. Those who do not speak English at least a little risk losing business to the increasing number of those who do. English is nowadays an international language used in practically every field of human activity. The sphere of Information Technologies (IT) which is developing rapidly and gaining more new features every year is not an exception. Programming, since its very roots, has used English as a language, which any programmer can and should easily understand. Even after many years, English is still an international language for everyone involved in IT.

I have been studying programming for almost two years, and I realise that the internet contains an incredible amount of useful information relevant to the IT sphere. Numerous websites, books and articles have been created to help programmers find mistakes, improve their knowledge and enhance their skills. The introductory part and basics of programming are not hard to comprehend, and many articles on these topics can be easily found

in many languages. But the more complicated the IT issue becomes, the more difficult it is to find the information on it that is translated from the language of the original to the user's language. Furthermore, since these materials typically contain much specific language (expressions and terms used in the IT field only), understanding this language requires a high level of English proficiency. For example, there is an American website "Stack Overflow" which is created to let programmers ask the international IT community for advice. As it is mentioned on the site, the number of hits "Stack Overflow" gets per month exceeds more than a hundred million, the visitors coming from countries all over the world [1]. There does not exist any similar website that uses the Ukrainian language and has at least a comparable amount of visitors.

Foreign languages are also important for people who are trying to keep up with innovations. Artificial intelligence issues have been developing rapidly in recent years, gaining special popularity among students who are trying to find their career path. Almost everyone has heard about ChatGPT or Midjourney, which are probably the most popular AIs. Although people, who took part in the development of these AIs come from different countries, they used English to communicate. That's why their websites and documentation are not available in languages other rather than English. So, if you are eager to learn more about these projects, you won't go far without good knowledge of English.

To sum up, English is very important in the modern world, and its significance for people who are in Information Technologies is hard to overstate. The same refers to students who are currently taking degree programmes in Informatics and are making the first steps in their career ladder in IT. It is almost impossible to master programming or keep up to date with new trends and inventions in IT without a sufficient level of English. That's why students should not forget about studying foreign languages. I believe that universities and other educational establishments should remember the importance of foreign languages and offer more possibilities to study them.

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THE INFLUENCE OF LANGUAGE ENVIRONMENT ON THE  
DEVELOPMENT OF SPEECH

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People's speech development is significantly influenced by the linguistic context in which they are raised. There are several linguistic contexts, such as those found in the family, classroom, office, community, etc.

The family language environment is where a child's speech is first formed. Parents and other adults around a child influence speech development through the speech patterns they model. Children who grow up in multilingual families have a broader vocabulary, better pronunciation, and a better ability to pick up new languages. Many studies have demonstrated numerous cognitive, social, and economic advantages of multilingualism. Because they must move between languages and adjust to various linguistic and cultural situations, multilingual people frequently have higher cognitive flexibility, memory, and problem-solving skills. They might also value diversity more and comprehend various cultures and worldviews better. The requirement to maintain a degree of competency in many languages, which can take a lot of time and effort, and the potential for language interference, where one language can affect how another is used, are some of the issues that can arise from multilingualism.

The language environment can impact a child's speech development in many ways:

1. *Vocabulary.* A child's vocabulary is greatly influenced by the setting in which they learn words. Youngsters exposed to diverse words and expressions in a rich linguistic environment are likely to have a broader vocabulary and better communication skills.

2. *Grammar.* Children's language environment can influence their comprehension and application of grammar. Youngsters are more likely to learn proper grammar themselves if they hear it used in sentences.

3. *Pronunciation.* Children's pronunciation can be influenced by the sounds of a language they hear. Youngsters exposed to a language that contains a wide range of sounds may find it simpler to make those sounds on their own.

4. *Social and cultural norms.* The context in which language is used, such as courtesy and respect, can impact the social and cultural norms that govern language use. Children who grow up in a language environment that values decency and courtesy are likely to have greater morality and decency in their speech. The school language environment also affects students' speech development. If the school provides high-quality language education and supports students' speaking activities, it helps them develop language skills and become fluent in the language.

Because the working language environment has its own terminology and aesthetic aspects that affect language perception and use, it can also impact speech development. The social, cultural, and linguistic context also affects how speech develops. Speaking and language abilities can be developed and improved by engaging in cultural activities, interacting with other individuals, and utilizing the language in daily life.

In conclusion, I would like to emphasize how crucial the children's linguistic environment is to the way their speech will turn out. Giving youngsters as much exposure to the language as possible will help them feel confident utilizing rules, vocabulary, and grammar.



## THE IMPORTANCE OF STUDYING HISTORY IN THE MODERN WORLD

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Of course, we cannot underestimate the importance of any science in the modern world. However, history plays an extremely important role today. We are writing history day after day.

There is an opinion that history develops in a spiral, and it is hard to disagree with this opinion. All events that happened before, all types of leaders and rulers who ruled before - all the events regularly manifest themselves repeatedly in a new round of the same spiral. History provides us with tools for looking at and explaining problems of the past, which helps us see patterns that might otherwise be difficult to see in the present.

Historical knowledge enables us to be informed participants in the ongoing development of customary laws and institutions passive subjects of the people who define us. We often discover how our own lives fit into the human experience when we learn about the past.

Ignoring history makes people repeat the mistakes of past generations. And we can observe these facts for ourselves in our present days: russia's war against Ukraine did not start out of anything; it was preceded by historical and political events that we ignored. For example, most European countries did not pay attention to the annexation of Ukrainian Crimea, which has brought us to where we are today.

Everything in this world including our activity, and studying is the result of a complex set of causes, ideas, and practices.

Teaching history means teaching culture to remember the pages from this history such as the Holocaust, the Holodomor, Orange revolution, Euromaidan and Revolution of Dignity, the Annexation of Crimea by the Russian Federation, the 2022 russian invasion of Ukraine, and others.

Nations are composed of stories, myths, and legends. These facts affect our manner of thinking and our place in history.

## HOW LANGUAGE LEARNING OPENS DOORS

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G. Kozlovska – Associate Professor

Many years ago, foreign languages were important mostly for translators, diplomats, politicians. In our digital age, foreign languages have become an inseparable part of our life. The research deals with the advantages of knowing a foreign language as it is the real key to success in life nowadays. The problem of foreign languages learning is one of the most popular topics in methodology and linguistics. That fact can serve as the proof of the topicality of the research.

There are such excuses to keep from learning any foreign languages as lack of time, fear of failure, age and many other reasons. We should keep in mind the following facts: Ivan Mazepa knew eight foreign languages, Ahatanhel Krymsky had a good command of thirty-five foreign languages. These outstanding personalities have learned languages without any electronic devices or internet. That is why we can speak not about the real reasons but about the real excuses not to learn the language. Learning foreign languages is a time-consuming process that needs patience and persistent work. When doing some work, you cannot but err sometimes because he who makes no mistakes makes nothing.

Language learning opens doors to success in the modern world. The more languages you know, the better because each language opens the door to something new and interesting. English, for example, is the official language of international business, communication, science, culture and technology. German is the language of technology and finance. French is an official or administrative language of different international organizations such as European Union, United Nations Organization. Thus, good command of foreign languages is one of the most important elements in the education of successful people. Moreover, knowledge of foreign languages is priority-number-one issue in the process of job-hunting and a competitive advantage over the other employees.

Knowing a foreign language connects you with people from our global community because each language has historical, cultural and state values. Moreover, according to Goethe, those who know nothing of foreign languages know nothing of their own. By learning another language, you can open the door to a greater comprehension and appreciation of your native tongue and culture.

It is noteworthy that foreign language opens the door to the world of innovations, science, technology, art, music, fashion, cuisine, philosophy, millions of carrier opportunities. International travel will be easier and more pleasant via knowing a foreign language. Foreign languages study boots your confidence, creates less bias towards people who are different and expands your view of the world. Thus, you are as many times a human as many languages you know.

#### FOREIGN LANGUAGES IN THE MODERN WORLD: THE KEY THAT OPENS MANY DOORS

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L.V. Hnapovska – E L Adviser

Nowadays, the many cognitive benefits of learning languages are undeniable. People who speak more than one language have improved memory, problem-solving and critical-thinking skills, enhanced concentration, multitasking ability, and better listening skills. Learning foreign languages is essential to succeed in today's world, where globalisation is increasingly widespread.

One of the main advantages of knowing foreign languages is the opportunity to gain *cultural knowledge and perspective*. It's important to remember that languages aren't simply different sets of words to express the same ideas – they're entirely **different outlooks on the world, which** allows to open you up to the world, **broaden your horizons** and bring you closer to people of all races and nationalities. Foreign languages allow people to establish new contacts worldwide, share knowledge and experience, understand traditions and culture, and find new business and career growth opportunities.

Multilingual people can **communicate and interact with diverse communities**. This is a valuable asset in an *employee's* skill set. You definitely up your professional value if you can negotiate with manufacturers in another country or communicate with customers who don't speak your native language. Plus, your ability to speak another language **conveys that you're motivated and driven to learn new skills**.

*Travelling* – whether for business, vacation or visiting family or friends – is much easier if you speak the language of your destination. Knowledge of foreign languages makes your travel more accessible and fulfilling, helps you avoid misunderstandings and assists in solving problems that may arise in emergencies.

To wrap it up, learning foreign languages can be seen as the key that opens numerous doors – the doors to personal and professional development, to more information and entertainment, to international communication, to the whole world full of new adventures, discoveries, and findings.

INTERNATIONAL ONLINE COURSE: SYNERGY OF  
PROFESSIONAL PSYCHOLOGICAL TRAINING, ENGLISH  
LANGUAGE DEVELOPMENT AND DISTANCE TECHNOLOGIES

Yulia Typtiuk – Sumy State University, group PL-21  
Tetiana Plokhuta – Sumy State University, Academic Supervisor

During the war Ukrainian students, especially future psychologists, have free-of-charge access to the variety of educational courses to obtain professional training due to the knowledge of English and distance education.

In June 2022 the International Catholic Child Bureau and the Catholic University of the Sacred Heart of Milan in Italy opened a free course “Training Tutors of Resilience and monitoring sessions” for Ukrainian Women’s Consortium participants. The formation of resilience in adolescents, the difference between the terms “resilience” and “resistance”, and the provision of immediate psychological assistance were the main topics of this course. The most important goal was to learn how to provide psychological assistance to Ukrainians affected by the war. The

participants were taught to use effective psychological methods for 9 months. Breathing practices and art therapy were the most popular among the students.

Students from Kharkiv, Kyiv, Sumy, Poltava and other Ukrainian cities took part in numerous lecture sessions and practical online trainings. They had a great chance not only to improve their communication, teamwork and empathy skills but also English language skills, especially psychology terminology. The classes were conducted on the Zoom platform, which was the principal privilege to save time and money on housing and traveling. The organizers provided course certificates to all participants who successfully completed it.

Thus, international educational online courses provide the opportunity to grow professionally and get a unique experience of communication with English speakers from all over the world. We hope that Ukrainian students in the future will more often attend such courses due to distance technologies.

## HOW TO LEARN ENGLISH EFFECTIVELY

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The English language has become an integral part of our everyday lives. Time and time again, each resource promises quick results in a short period. Nevertheless, is it possible to learn English quickly? Learning English effectively requires consistent effort, active engagement, and practical strategies.

A quick English language study is only possible with daily work and repetition of the material studied. Today, there are countless free resources for learning English quickly. So why not take advantage of it? Attending courses two or three times a week provides a great foundation to learn English quickly, but more is needed to learn English quickly. 90% of the work depends on a person's daily studies. We should remember that practice makes perfect.

We should set clear goals, i.e., determine our objectives for learning English and set realistic goals that align with our objectives. For instance, we may want to communicate fluently with native English speakers, pass an English proficiency exam, or improve our career prospects. Thus, setting a realistic goal and creating a study plan are necessary.

Oleksandr Dragunkin suggests studying English by associating Ukrainian with English words. Thus, a student can make analogies with his native language, significantly simplifying and speeding up learning. The method provides an excellent basis for further learning the language and expanding one's vocabulary. Read, read, and read again.

The following technique is reading news feeds in English. News is the best resource for express learning of the English language. Most news articles are written in simple and understandable language, with correct grammar and comprehensible text.

We would like to consider some fundamental mistakes in learning English.

#### 1. Memorize a small number of words.

Studies show that even native speakers use a maximum of two to three thousand words in a conversation. For example, an adult native English speaker knows tens of thousands of words, but only 3,000 words are needed to communicate fluently and read most English-language literature. It is the same with foreign languages, where a few thousand words are enough for fluent communication and reading modern literature. We all live in a world of modern technology and the Internet. We can always download an application (Memrise, Quizlet, Busuu) to help us pick up the most used words and quickly learn English.

#### 2. Refrain from trying to memorize grammar.

Regardless of the language, grammar is a constant obstacle for many students. These countless articles, exceptions, and verb tenses are essential for writing an essay, research paper, or letter to the boss. Nevertheless, we need a good grammar base to communicate freely. In particular, if grammar and memorization

are not our strong points, we should learn "verbs". We should not be lazy! If we feel overwhelmed by grammar, watch a movie with subtitles or read a light story.

Remember the first rule of learning English quickly: devote time to it every day. Once we learn, we will not have to push ourselves anymore.

Moreover, we should remember to take notes. Write down something new every day: what we feel, want to remember, and in the future.

In conclusion, by understanding the basic principles of learning english quickly and avoiding common mistakes, we will discover many advantages of learning english. English is the most common foreign language taught. If we need to talk to someone from a non-english speaking country, there is a good chance that they will speak english. Furthermore, finally, learning english is fast and fun. The english language opens up a completely new world for us and allows us to understand previously mysterious things.

## MEMES AS AN INSTRUMENT FOR LANGUAGE LEARNING

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N.V. Tatsenko – DSc, Professor

The Internet has become an integral part of people's life. Every day human beings explore the deepest parts of World Web and use it for their own tusks. Today society is divided into two worlds: the real one and the virtual one. And we cannot ignore the fact that the Internet has taken control of people's lives.

Digital technologies such as Web 2.0 and computer-mediated communication (CMC) tools have changed the way people communicate and, more importantly, the way language is used and information is presented [2, p. 155]. And in that case, we must do something to involve these modern technologies to help people learn and teach something. That is why memes can be used for learning languages.

Internet meme – usually used in the form of an image, GIF, or video with text – is spread from person to person in a culture by

imitation. It often carries symbolic meaning describing a particular phenomenon or theme. As Nurda Karadeniz Kayali said: “*The concept of a meme was first applied to evolutionary theory in the 1970s to explain how cultural information (i.e., norms, attitudes, values, and beliefs) spread from person to person by the biologist Richard Dawkins (1976)*” [3, p. 155].

So, the meme concept is quite old, but with the help of the Internet, it can evolve and spread much faster and farther than ever before. In our case meme is defined as an idea or image that spreads very quickly on the Internet.

Memes can be used for different purposes in studying. It is used for learning vocabulary, grammar, and even writing stories. Students can analyze memes that are already made and make new ones.

One study revealed that memes and Instagram encouraged student engagement [4]. The study participants were 23 EFL students from Malang College of Health. In their study, they used observation and questionnaires. Each group was asked to create a meme based on a topic they had received in English class. Each team was assigned to upload or post their meme creations to a designated Instagram account. Findings suggest that creating memes supports intrinsic, integrative, and instrumental values influencing student motivation. Namely, memes provide the actual learning process of the target language – an integrated value of the target language and its speakers, and the consequences and benefits of the instrumental importance of learning the target language.

Another study [1] created a brief history of memes, researched early Internet memes, and current Internet memes. In addition, it gave some linguistic examples of memes.

Psychological phenomenology was used to describe teachers’ life experiences of using humor memes with 21<sup>st</sup>-century learners and how they responded to the challenges of using humor memes in the classroom. Teachers shared their experience with such words as “it makes the class happy”, “concretely visualize an idea or concept”, “set the mood of the class”, “sustain learning



interest”, and “make the setting a very light atmosphere” [3, p. 156].

Consequently, using memes has many positive effects on language learners making them more creative and engaged in language learning. Firstly, using memes in studying vocabulary review activities increases student proficiency. After acting out the meme in class, the students perform better on the test. Secondly, students develop a greater interest in the activity through the pictures. They try to find the context and use the target word correctly. Finally, memes create a positive teaching environment that helps students remove the burden of learning a new language and focus on the learning task.

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## WHY SHOULD A PROGRAMMER KNOW ENGLISH?

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O. R. Gladchenko – Academic Supervisor

Nowadays English is very important for the programmer. Foreign companies suggest open vacancies and sometimes you can be asked to pass an English Test, even if your specialty has nothing to do with philology.

Programmer may not work for a foreign company and may not require English working hours to communicate with business partners from the United States or United Kingdom, but basic

language skills can certainly turn out to be useful because at least programming languages are written in English. We must highlight three important points:

- 1) general computer terms;
- 2) IT professional terminology;
- 3) ability to work with technical documentation in English.

IT also has certain terms that every programmer encounters in his daily work, which are desirable to know and not to confuse with others. For example: 1) backbone - a term that is often used to describe the main network connections that comprise the Internet or other major network; 2) hardware - the physical components of a computer including the keyboard, monitor, disk drive, and internal chips and wiring (hardware is the counterpart of software); 3) virtual hosting – the method for hosting multiple domain names on a computer using a single IP address. Many of these phrases are often used by programmers and some students sometimes even do not realize how important they are in the IT industry. English is required to study the technical documentation. It contains all the necessary information needed for work or study.

In the conclusion, every programmer should have a good level of English to be able to work with technical documentation, stay up to date with the latest news and information, communicate with foreign colleagues, attend conferences and webinars.

## SECTION 2 ACHIEVEMENTS IN THE FIELD OF HIGH TECHNOLOGIES TO IMPROVE LIFE IN THE MODERN WORLD

### LINUX OR WINDOWS? THAT IS THE QUESTION

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L.V. Hnapovska – E L Adviser

As the world continues to evolve and technology progresses, the need for an operating system that can keep up with modern demands is becoming increasingly urgent. Windows is the most popular operating system in the world. However, Windows' numerous disadvantages make it less feasible and popular with some users. And this is where Linux comes in the front as an operating system developed specifically to solve many of the problems that Windows possesses.

Firstly, Linux is considered to be more secure than Windows because of its open-source nature and robust security features. Linux distributions such as Ubuntu and Fedora are less prone to malware attacks than Windows, making them a more secure option for users.

Secondly, Linux is highly customisable, allowing users to modify the operating system according to their individual needs and preferences. This high level of flexibility ensures a more personalised user experience, which can improve productivity and efficiency. Linux as a significantly more efficient and faster system, especially regarding resource-intensive tasks, does not require as much processing power or memory to run smoothly as Windows.

Moreover, Linux with its many distributions offering long-term support options provides better stability compared with Windows. This means that users can rely on Linux to run consistently and without crashing, making it a more stable option than Windows.

Finally, Linux is a lot more cost-effective. It is available for free, with many distributions offering open-source software programs and applications at no cost

To wrap it all up, it should be highlighted that the feasibility of using Linux instead of Windows depends on each user's individual needs and preferences. However, in today's world, where security threats and system crashes are becoming increasingly common, Linux offers several advantages over Windows that make it by far the most appropriate option for many users.

### COMPRESSED AIR CONTACT COOLING SYSTEM

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One of the most important problems of compressed air is humidity, since almost all impurities contained in the air dissolve in water. The aggressive mixture resulting from dissolution causes active corrosion in tubes, and oxidized particles are transferred to equipment that consumes compressed air, leading to its premature wear. As a rule, moisture in the compressor itself does not condense due to the high temperature of the air during the compression process. Condensation usually occurs after cooling the compressed air to the temperature of the dew point in the main or workshop network. Therefore, drying compressed air becomes a priority task.

Modern industrial methods of compressed air cooling and drying require the use of the whole range of devices, namely: non-contact after coolers of air or water cooling, refrigeration type dryers, adsorption type dryers of cold or hot regeneration, membrane dryers of adsorption type.

The paper examines a promising method of compressed air cooling using a contact heat exchanger. Its principle of operation is based on the direct contact of compressed air and cooling water. Water is injected into the warm compressed air duct behind the compressor and cools it down to wet bulb temperature. The results of the research showed that the main advantage of this method is

the high intensity of heat exchange due to the absence of separating surfaces prone to scale contamination. The disadvantage is a somewhat complicated, compared to the traditional, scheme of water supply. To implement this method of cooling compressed air, a venture tube - a centrifugal separator – can be used, as it combines high heat and mass exchange and relatively small hydraulic resistance. Further research is needed to verify rational parameters of contact air coolers at modes different from the nominal ones.

## BLOCKCHAIN

Artem Borukha – Sumy State University, group IN-02  
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Cryptocurrency and smart contracts are new symbols of the digital revolution era. Everyone has heard about it at least once, but few have any idea how it all works.

Blockchain technology is the basis of all the above terms. The term blockchain is translated from English as "chain of blocks". It is a way of encrypting, transmitting, and storing data in a distributed network. The name reflects the essence of the concept because the information in the blockchain is stored in the form of a chain of digital blocks. In it, each subsequent block is inextricably linked to the previous one, and all blocks are stored in computer network bundles called nodes. In other words, blockchain is a distributed digital ledger that contains records of all transactions of system participants. This database does not have a single center and governing bodies. Every operation in it is documented and confirmed by all network participants, so it is almost impossible to falsify or delete records. Therefore, the use of blockchain is best suited for solving financial issues and signing agreements.

### **The history of blockchain**

In most people's view the history of the blockchain began on October 21, 2008, when a developer (or group of developers) under the pseudonym Satoshi Nakamoto mentioned the technology in the "White Paper", the basic document of Bitcoin.

In 1995, S. Scott and H. Stewart launched the first-ever blockchain called Surety. Interestingly, his focus was not related to cryptocurrencies. Blockchain pioneers saw the task of their creation as confirmation of the authenticity of digital documents. And they were going to do this by adding temporary marks to them.

#### **Advantages of blockchain:**

- **Trust and security** – users can be sure that they are receiving error-free data. Data cannot be edited. No administrator can delete or edit data. Confidential information is not public. It is worth noting that each additional block gives credibility to the previous block. Thus, any attempt to manipulate the data is visible and third parties can't tamper with the data.
- **Increased efficiency** – there is no problem with the time-consuming reconciliation of records (thanks to the fact that the network and data are stored in a single integrated ecosystem operating based on a peer-to-peer network).
- **Smart contracts** – a set of rules can be stored on the blockchain (in the form of an intelligent agreement, called a smart contract). Within such a set of rules, different types of conditions can be defined depending on the needs, for example, the conditions for the sale / purchase of a specific asset.

#### **Blockchain in practice:**

- The voting system is characterized by the transparency of submitted votes without disclosure of personal data. An example is FollowMyVote.
- Bookkeeping is used by a well-known financial industry.
- Management of data related to public services such as land registers, mortgages, taxes, and deeds (which are reliable without a notary and other institutions). Examples are ShoCard or BitNation.
- Court register or any other public administration register. A similar registry based on blockchain technology can function in corporations and various types of institutions. Examples of information collection include information about: personal data (PESEL, NIP, name or any other identifier), certificates received, commitments made, location, driver's license, medical records.

## CHARACTERISTICS OF NANOPOWDER AND THEIR APPLICATION

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Currently, the properties of nanopowder systems of various compositions based on iron, nickel, cobalt, copper, silver, gold, tungsten, molybdenum have been obtained and investigated; oxides of iron, nickel, cobalt, copper, aluminum, magnesium, titanium; carbides and nitrides of various elements. Their application is already a reality, not a distant prospect.

The peculiarity of nanopowders is that the material they represent is an independent group of nanomaterials (zero-dimensional) and at the same time is the starting material for obtaining bulk (compact) nanomaterials, including hard alloys, ceramic and composite materials.

Compared to powders of traditional sizes nanopowder materials are characterized by a number of features.

- The formation of nanopowders occurs in conditions far from balance, so their particles are unbalanced, they have excess energy stored in them compared to ordinary coarse-grained material.

- Nanopowders differ in significantly larger values of specific surface area against traditional powder masses. Under the specific surface, the most important characteristic of any of a dispersed system, we understand the size of the surface as a mass unit or volume units of powder material. Usually, for metal powders used in powder metallurgy technology the specific surface rarely exceeds 1 m<sup>2</sup>/p. For nanopowders the values of the specific surface range from 20...40 m<sup>2</sup>/g with a diameter of 100 nm to 110...120 m<sup>2</sup>/g with a diameter of 10 nm. The specific surface area values play an important role in the determination of technological properties of the powder, the choice of technology and modes obtaining compact products.

- Nanopowders are characterized by high reactivity, that is why nanopowders are often used as catalysts [1].

Based on the above, it should be noted that nanopowders are solid powder-like substances of artificial origin containing nanoobjects, aggregates or their mixture.

As for the application of nanopowders, there has been a strong growth of interest in nanotechnologies and nanomaterials in recent years. Nanopowders attract the attention of scientists due to their unique properties in traditional substances and materials when they move to an ultradispersed state.

The special properties of nanopowders open up ways of using them in:

- therapy of oncological and genetic diseases,
- creation of biocompatible materials, implants based on them,
- methods of diagnosing diseases, as well as directed delivery of medicinal substances to organs, tissues and cells. [2]

Today, nanopowders of iron oxides are used as contrast agents for magnetic resonance studies, and gold nanoobjects are used for biological labeling methods. Nanopowders are part of bone growth accelerators, used to detect viruses and treat cancer.

We believe that the use of nanopowder in the next 20 years will be one of the newest factors for a scientific breakthrough in many countries of the world.

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# INFORMATION TECHNOLOGIES FOR DESIGN AND MANAGEMENT OF SMART GRIDS

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Energy consumption has been increasing steadily for several decades, and this trend is expected to continue in the coming years because of population growth, further industrialization, and urbanization. Higher energy demand requires more flexible energy networks that allow to utilize advanced technologies for optimizing energy generation, distribution, and consumption. Traditional centralized energy systems suffer from significant energy losses during transmissions and distributions, resulting in higher costs and increased greenhouse gas emissions. That is why in recent years researchers have become increasingly interested in transforming traditional centralized fossil fuels-based energy networks into a flexible array of decentralized smart energy networks based on renewable energy sources.

The process of transformation introduces an abundance of challenges, especially in the design and management of smart grid systems. Substantial progress in hardware development for smart grids based on renewable energy sources made them affordable for a wider audience of consumers, but both tasks require considering dozens of different parameters like grid location, weather conditions, consumption levels and schedules, generation levels, economic justifications, etc. Information technologies are essential in such types of tasks, and there are a lot of different products that allow you to do the development or even management steps in quite an effective way, but all of them lack flexibility, are quite complex to use, and are unable to do design and management tasks end to end.

Our study is focused on building an information technology of distributed data processing that will help users to design optimal smart grid structures and then manage them using semi-automatic decision support systems based on machine learning, fuzzy logic, and real-time parameter tracking models. This information technology will include more than 20 different

models that are capable to handle individual tasks related to the design and management of smart grids. Even though these models show decent results in their individual tasks the integration level between them is pretty low and requires standardization of data exchange formats and technologies stack. That is the main challenge of the study in the current step. We did good progress on it and built a data flow diagram of planned information technology that includes all available models for both grid design and management steps. The next step of the study is to unify the technology stack and start the data exchange decomposition of the design task.

Building affordable, scalable, and full-cycle information technologies for smart grids is one of the key steps in the process of transformation of centralized energy systems into smart energy grids and this study attempts to cover information technology for design and management aspects of that transformation.

## FUTURE OF ARTIFICIAL INTELLIGENCE

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N. V. Tatsenko – DSc, Professor

Artificial Intelligence (AI) has become increasingly popular over the last few months. Today the most popular is chatGPT. But there are already talks about new Artificial Intelligence that will be even smarter.

Artificial Intelligence is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence.

Intelligence is tricky to define, so AI experts typically distinguish between strong and weak AI. Weak AI, sometimes called specialized AI, operates within a limited context and is a simulation of human intelligence applied to a narrowly defined problem. Weak AI is often focused on performing a single task extremely well. While these machines may seem intelligent, they operate under far more constraints and limitations than the most basic human intelligence. Strong AI is a machine that can solve problems it's never been trained to work on – much like a human

can. In contrast to weak AI, strong AI represents a machine with a complete set of cognitive abilities – and an equally wide array of use cases – but time hasn't eased the difficulty of achieving such a feat.

Nowadays, AI has many applications in almost every field, which seems optimistic and replaces human jobs that might be considered harmful.

AI-assisted Military technologies have built autonomous weapon systems which won't need humans at all, making the safest way to enhance the security of a nation. We could see a robot Military soon, which is as intelligent as a soldier/commando and will be able to perform some tasks. AI-assisted strategies would enhance mission effectiveness and provide the safest way to execute it. But it could possess devastating results when it reaches the wrong hands or makes bad decisions on its own.

It's not far away when AI detects common diseases and provides proper medication suggestions. Suppose you don't go to the doctor. In that case, AI will read the data from an individual's fitness band/medical history to analyze the pattern, suggest proper medication, and even deliver it to one's fingertips just through a cell phone. The long-term consequences could be no need for doctors, resulting in job reduction.

Today, the AI algorithm is being used in managing equity funds. As AI has enormous scope in almost every field, it has great potential to boost individuals' economic health and a nation. An AI system could take many parameters while determining the best way to manage funds. It would perform better than a human manager. It would perform better than a human manager. AI-driven strategies in the field of finance are going to change the classical form of trading and investing.

Also, AI will transform the classical way of education in the future. Now the world doesn't need skilled laborers for manufacturing industries, which are mostly replaced by robots and automation. The education system could be effective according to the individual's personality and ability. It would give chance for

brighter students the to shine and to imbeciles a better way to cope.

So, on the one hand, Artificial Intelligence is a boon for society if focused on improving the quality of our lives to a great extent or it could be a curse if it reached the wrong hands.

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## POSSIBLE AREAS OF NON-TRADITIONAL DESIGN TURBINES APPLICATION

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S.V. Podolkova – E L Adviser

In Ukraine, as well as in the global economy as a whole, the issue of energy conservation and reducing the use of fossil natural resources is becoming increasingly acute. Constantly growing demand for electricity supply to industrial and household consumers stimulates the development of energy-efficient solutions.

Scientific and technological progress over the past decades has led to the development and improvement of new types and designs of turbine equipment, known as non-traditional designs. Such turbines of non-traditional design include the vortex turbine and the jet-reactive turbine, which have the potential to find a wide range of applications in industry.

In recent years, the researchers have become increasingly interested in one of the energy-efficient solutions, that is, the use of compressed gas and steam exergy, which is lost on reducers and regulators at gas distribution stations (GDS), gas distribution points (GDP), chemical and other energy enterprises, and in the communal and household sectors.

Vortex turbines can be used in the utilization of the potential energy of compressed gas or steam at GDS, GDP, and chemical enterprises in energy-generating installations to meet their own needs for electrical and thermal energy.

Moreover, vortex turbines can find their application in pneumatic systems as a pneumatic engine; in industry as turbine drives for compressors, pumps, and fans; in numerous boiler

houses, for participation in the process of throttling steam and transforming these boiler houses into mini combined heat and power plant and increasing the efficiency of fuel utilization.

Another area of possible application that urgently needs development in modern-day Ukraine is the creation of small-scale energy complexes for autonomous and individual consumers, i.e. decentralization of energy supply to increase national security. Vortex and jet-reactive turbines make possible to create turbo-generators with a capacity of up to 500 kW to provide energy to industrial, municipal, or household consumers.

Jet-reactive turbines have been used in the design of pneumatic actuators for pipeline faucets in main gas pipelines. Such pneumatic actuators have a simpler, more reliable, more efficient design and are more convenient to use than pipeline faucet actuators with hydraulic drives. Further research will be aimed at implementing the most promising directions of application for this type of gas turbine equipment.

#### THE PROCESS OF STUDYING IN THE SPHERE OF COMPUTERISED AND AUTOMATIC CONTROL SYSTEMS

D. Melnikov – Sumy State University, group SU-22  
O.R. Gladchenko – Academic Supervisor

Computerized and automatical control systems and ones has existed as a specialty for a very long time. This is a specialization, which trains specialists in the field of development of control programs and control computerized complexes for industry, transport, energy and security services. The educational program considers computer-integrated control systems of technological objects and complexes as a subject of study. The students allocate sufficient time for programming and study the necessary subjects of this specialty and the learning process is carried out with the maximum interest of students at Sumy State University. It is focused on the development of both control systems themselves from low to high levels as well as the application software for devices and systems that are used to control technological processes and equipment in various industries.

During the educational process students are taught electronics which is implemented in the Google Classroom, Google Meet, Zoom, Moodle system and they also use self-study systems with the acquisition of general and professional competencies.

The specialization "Computer-integrated production and applied programming" is focused on training modern specialists in the development and maintenance of computer - integrated management systems and their software. The main positions that graduates of the master's degree can occupy are as follows: computerized and automatic systems, a research engineer, a computer systems developer, a computer systems analyst, a computer systems designer, a programming professional, a computer program developer, a computer engineer. All these positions are quite relevant and profitable nowadays. One of the factors that is of high interest in this specialty is robotics. The creation of robotic systems, participation in various SumDU competitions teach students to design and implement highly reliable automatic systems and their application software for the implementation of management functions and information processing and engineering solutions.

### ChatGPT: A REVOLUTION IN TECHNOLOGY

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O.I. Nefedchenko – E L Adviser

ChatGPT was created by OpenAI, an artificial intelligence research lab comprised of leading AI experts. ChatGPT development began in 2020 and the model was publicly released in June 2021. It was created using the GPT-3.5 architecture, which is an extension of the very successful GPT-3 model.

The model was trained using a huge data set of over 45 terabytes of text from various sources, including books, articles and websites. The learning process lasted several weeks and involved a huge amount of computing resources. However, the result was a highly accurate and versatile language model capable of performing a wide range of natural language processing tasks.

Language models have been around for decades, but recent advances in artificial intelligence have led to the development of powerful models that can mimic human language processing. ChatGPT is one such language model that has attracted the attention of researchers, developers, and industry experts.

ChatGPT demonstrated impressive performance in a variety of language tasks, including text completion, question answering, and dialogue generation. The model's capabilities have the potential to revolutionize many industries, including customer service, education, and healthcare. In healthcare, it can be used to analyze patient data and provide personalized treatment recommendations. In finance, it can be used to predict market trends and provide investment advice. In the legal field, it can be used to analyze legal documents and aid in research.

ChatGPT is a groundbreaking technology innovation that has the potential to change the way we interact with machines and uses natural language processing in a variety of fields. Its creation and development of OpenAI demonstrates the power of artificial intelligence and its potential to fundamentally change the way we live and work.

## DETERMINATION OF WITHDRAWAL VELOCITY AS PREPARATION FOR THE CLASSIFICATION PROCESS

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I. Zaitseva – E L Adviser

Classification processes are used when it is necessary to separate loose materials into fractions (two or more). Fractions traditionally differ among themselves in terms of particle size, but they can also differ in other parameters that affect the separation process: speed of flight and shape of particles, material, and others. Pneumatic classification has become widely used in the production of mineral fertilizers, in the production of paint and varnish materials, the removal of highly dispersed particles from firing furnaces, the production of chamber electrodes, purified solutions for sowing, the creation of spraying of one material on others, purified electrolysis baths, and so on. The quality of

separation in the process of classifying dispersed materials affects the consumption of raw materials, obtaining the quality of the commodity product, the efficiency of other equipment in the process. Therefore, this work is focused on experimental studies of the determination of the speed of particles among various polydisperse materials, as the first stage for the creation or modernization of a pneumatic classifier. Annual sand, urea granules, buckwheat groats, wheat grains and cucumber grains will be used as model materials. The method of researching the speed of greeting on a laboratory stand is formed in the work. The presented stand is important in the study of separation and separation processes, as well as for the creation of new types of equipment. After the research and processing of the obtained results, graphs were drawn comparing the speed of model materials, as well as the dependence of the received speed that makes an influence on the total mass of the material. On the basis of the obtained values, during the construction of a new pneumatic classifier, it is possible to judge the efficiency of its work with high probability, because basically the value of the speed of greeting is taken averaged, and this will ensure a large discrepancy between the modeling process and its implementation in the created apparatus.

## INVESTIGATION OF THE FRAGRANCE OF ALITATED COATINGS AFTER ELECTRO-SPARK ALLOYING

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Promising methods of surface strengthening and modification are methods that are, based on the treatment of metals and alloys with concentrated flows of energy and matter. Among the modern methods of processing metal surfaces is electrospark alloying, which makes it possible to obtain surface structures with unique physical, mechanical and tribological properties. The advantage of electrospark alloying is the high adhesion strength of the alloyed layer and the base material and the possibility of applying any current-conducting materials to the surface, the low energy



consumption of the process, and the simplicity of the technological operation.

Despite the significant advantages of this process, its use for purpose of improving the surface layer is not widespread in industry, because there is no reference material on the optimization of the modes of this process.

As indicated in works [1, 2], coatings obtained by the method of electrospark alloying, using an aluminum electrode, will protect the base well in phosphoric acid and water-salt environments.

When conducting comparative studies of the heat resistance of alitized coatings obtained by classical technology and an aluminum electrode, the results showed that the coatings are characterized by fairly high heat resistance. A metallographic analysis was carried out (Fig. 1) on the nature of oxidation of the samples, after the heat resistance test, they indicate that after the test the main metal of the sample is oxidized, which was evidenced by the presence of oxides in the surface layer. Samples are especially intensively oxidized, which are without a protective coating.

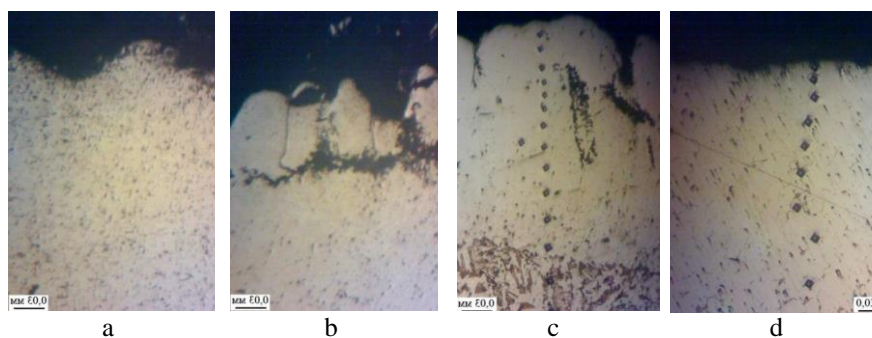


Figure 1 – Microstructures of coatings on steel 20 after the heat resistance test (test at 980 °C in air, 50 h): a – without coating (unetched grind); b – alitization in molten aluminum (unetched grind); c – alitization in molten aluminum (after etching in a 3-5% HNO<sub>3</sub> solution); d – alitization by the EIL method (after etching in a 3-5% HNO<sub>3</sub> solution)

Aluminized coatings, obtained in molten aluminum and by the EIL method, retain increased hardness protect the base metal from oxidation, as evidenced by the lower content of oxides in the

surface layer of the base metal and sufficient hardness of the coating. The results of the study make it possible to recommend the EIL technology with an aluminum electrode in order to increase the resistance of steel to oxidation at elevated temperatures.

Therefore, the method of electrospark alloying is one of the promising ones for further study, and also for receiving aluminum coatings. The essence of the electrospark alloying process occurs in the transfer of the electrode material to the processing of the surface of the parts with the help of an electric spark discharge. a way to ensure a strong adhesion of diffund This material consists of a surface part.

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JUSTIFICATION OF THE FEASIBILITY OF USING A SHELF  
PNEUMOCCLASSIFIER FOR THE SEPARATION OF  
POLYDISPERSE MIXTURES IN THE PRODUCTION OF  
MINERAL FERTILIZERS

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Now it is generally accepted that one of the important areas of the chemical industry is the production of granular phosphate fertilizers. Among phosphate fertilizers, various types of granular superphosphates, ammophos, and other complex fertilizers are in high demand by consumers.

Technological operations of obtaining granular fertilizers lead to the formation of a product of polydisperse granulometric

composition. At the same time, the consumer's requirements for this indicator are quite stringent: the commercial fraction with a granule size of 1–4 mm should be at least 85–90 %, and fractions less than 1 mm – no more than 5 %.

The used granulation methods do not guarantee the production of a product with a specified range of granule sizes. Therefore, any technological line must be equipped with equipment that would limit the granulometric composition. Such equipment includes classifiers and crushers. They should enable the return of large fractions of more than 4 mm for crushing and extraction of small fractions less than 1 mm.

To separate granules by size in modern technologies, mechanical classification on screens is used. The most common is mechanical separation. The polydisperse mixture is divided on vibrating screens, thus separating the fraction of more than 4 mm on the upper sieve, and less than 1 mm on the lower one. However, superphosphate granules have a sufficiently high temperature at the outlet of the granulator (about 90°C), they are prone to agglomeration and adhesion. Therefore, the fine fraction clogs the cells of the lower sieve while reducing the passage section of the holes. This leads to a deterioration in the sifting capacity of the lower sieve. As a result, the fraction content of less than 1 mm in the material is overestimated, which does not meet the requirements for the quality indicators of the finished product. The operational reliability of the screen is also degraded as it must stop to clean the surface of the lower sieve. To partially solve this problem, additional mechanical screens are installed after the fluidized bed coolers. However, this approach complicates the technological scheme and leads to an increase in energy costs for production.

The research shows that a rational way to solve this problem is to use pneumatic classification in order to remove small fractions from granular material using a shelf-type pneumatic classifier. The pneumatic classifier is installed after the granulator, which makes it possible to eliminate the need for mechanical screen in the lower sieve and at the same time to cool down the

granulated product. At the same time, the need to use a separate fluidized bed cooler in the technological line is eliminated, which avoids the above-mentioned disadvantages.

## METHODS FOR TRAFFIC ANALYSIS TO ENSURE THE CYBERSECURITY OF NETWORKS AND INFORMATION AND COMMUNICATION SYSTEMS

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Cybersecurity is becoming increasingly important in the modern world, as a large amount of information is processed in networks, information systems, and cloud platforms. Traffic recognition is an important component of network security, as it allows for the detection and analysis of abnormal traffic that may be caused by malicious software or malicious attacks.

To recognize traffic, it is necessary to identify the characteristics that distinguish different types of traffic, such as protocol, port, source, the destination of data packets, and others.

A considerable amount of research has been devoted to various models for analyzing traffic. One of the most widely used is the OSI (Open Systems Interconnection) model. This model is used to describe communication processes between hosts and consists of seven levels. The combination of these levels allows for the transmission of information through the network.

Analysis of network traffic at various levels of the OSI model has been extensively studied recently. This can help identify potential threats and attacks on the network. For example, at the network level, a DDoS attack occurs when attackers attempt to flood the channel with a large number of requests. Analyzing traffic at the transport level can help identify attacks such as "buffer overflow."

Various methods of traffic analysis are also used to help detect threats and attacks. Few investigations have focused on the method of statistical traffic analysis, which can help identify unusual activity in the network, such as a large number of requests to one server or an excessive amount of data sent. The method of

packet change analysis can help detect attacks that use packet fragmentation to evade detection.

In traffic analysis, it is important to consider the context in which it occurs. Machine learning methods, particularly neural networks, can be used for this purpose. They allow for high accuracy in recognizing atypical traffic by learning certain characteristics of it.

However, like any other method, the use of neural networks has its drawbacks. One of them is that this approach requires significant computational resources as well as a large amount of data for training. In addition, neural networks themselves can be vulnerable to attacks, which can also lead to network security breaches.

Another method is anomaly analysis, which is based on comparing traffic flows with normal network behavior patterns. If the traffic flow differs from what is expected, it can be classified as anomalous and considered a potential threat. This method allows for the detection of new and unknown attacks but may have a high rate of false positives.

A central issue in the detection and prevention of cyber attacks can prevent the leakage of confidential information, and disruptions in availability and integrity. However, when using experimental models and methods, caution should be exercised, and the obtained results should be carefully analyzed to avoid false results.

To address this problem, a specialized recognition model is proposed, which will be effective in recognizing traffic and automating the detection of anomalous behavior in the network to prevent cyber attacks.

The paper concludes that models and methods for analyzing and recognizing network and system traffic in information and communication systems are necessary tools for ensuring cybersecurity.

## ENHANCING ENGLISH WRITING SKILLS USING CHATGPT

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ChatGPT is a chatbot with artificial intelligence that can give answers and share information on any topic, find and analyze information, conduct constructive dialogues, etc. In this work we will consider the possibilities of ChatGPT for assisting text creation while learning English as a foreign language.

ChatGPT can be used to analyse and paraphrase your text, translate it, write essays and stories, check students' own writings for mistakes and provide an explanation. It should be noted that it creates great essays with a perfect structure which includes excellent introduction and conclusion. We gave it a task to write an advantages / disadvantages essay on the importance of doing homework. The output essay included 4 paragraphs: introduction that consisted of two sentences, a paragraph on advantages, a paragraph on disadvantages and a conclusion. Conclusion included two sentences: one sentence summarized the discussed items on advantages and disadvantages, the second sentence presented a final opinion on the topic. Although the essay was perfectly structured, we should note that it was not unique and didn't include any interesting information. It was average.

One more issue to be considered is that it can be a threat to academic integrity, especially while writing essays and speeches. Even the resource ChatGPTZero which was used by us to detect AI generated texts once was claimed by one of our students to give an incorrect response and accusing him of cheating which was not true.

In our opinion, the best way ChatGPT can be used to enhance writing skills in English classes is checking essays or students' texts for mistakes. It greatly spots the mistakes in the English text and provides the explanation, as well as suggested correction. It can also equip students with synonyms for different registers and levels of English while they are creating texts, written works in particular.

## EFFECT OF FINISHING ON COMPOSITE RESTARATIONS

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N.V. Maliovana – E L Adviser

Composite restorations of anterior teeth have high aesthetic properties. Therefore, they are used in the treatment of carious, non-carious defects, a discoloration of teeth. Even with the use of any modern material, it is not always possible to achieve a good result in the long run without paying enough attention to the final processing of the composite restoration. Finishing a composite restoration influences the durability of the restoration, improves its marginal integrity and decreases a plaque formation.

The level of gloss and polishing of restorations play a key role in preventing not only such complications as the restoration color changes or changes in its texture in the future, but also preventing a secondary caries and a sealing disintegration, since areas with a high roughness play the role of retention points for the accumulation of a bacterial plaque and the further progression of the above-described complications.

The major issue of finishing the composite restorations are to remove the dispersed layer from the surface of the filling to prevent staining of the filling. Smoothing the surface of the restoration to reduce plaque retention. Eliminating the transition at the filling-tooth interface is also an important task, because it helps improve the marginal fit of the restoration to the tooth tissues, as well as obtaining a smooth shiny surface to simulate the optical properties of tooth tissues. The “correct” conditions and sequence of finishing steps will lead to a good result of the tooth restoration. Any unified terminologies, methods and approaches of the finishing of fillings also contribute to improving the quality of dental restoration.

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## FLEXIBLE SOLAR ELEMENTS OF THE THIRD GENERATION

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Nowadays, renewable energy sources are becoming especially important. One of them is solar energy. It is usually converted to electricity using photovoltaic converters (FETs), which uses an internal photoelectric effect in semiconductor materials. Suitable devices containing p-n junction, heterojunction or MDN structure are called solar cells (CE).

The development of solar energy in our time increases the efficiency of SE with a simultaneous decrease in their cost, increasing the stability and service life when changing external conditions such as humidity, temperature differences and others. Historically, the first photoconverters were created on the basis of absorbing layers of monocrystalline silicon (c-Si), which had a thickness of 100-300 microns. These SEs are called first-generation devices. Today, they occupy about 90% of the commercial FEP market and have an efficiency of more than twenty percent ( $\eta=23.2\%-27.6\%$ ). However, such devices have a number of disadvantages, which include the high cost of manufacture, toxicity of production and waste.

Attempts to overcome these shortcomings have led to the creation of alternative FEP, which include film elements with an absorption layer thickness of 3-5  $\mu\text{m}$ . They are called second-generation CEs. Such devices are made of amorphous ( $\alpha\text{-Si}$ ), microcrystalline ( $\mu\text{c-Si}$ ) or polycrystalline silicon (multi c-Si), two-component compounds of group A3B5 (GaAs, GaP, InP, GaInP) and A2B6 (CdTe), as well as multicomponent chalcogenide materials such as CIS (CuInS<sub>2</sub>), CIGS (CuInS<sub>2</sub>).

Second-generation SEs have eliminated a number of significant shortcomings of silicon PVs: their production is simpler, requires less material and energy. As a result, the cost of such devices is decreased by an order of magnitude or two, but



they lose the efficiency of solar energy conversion. Some of these SEs are flexible and can be placed on surfaces of complex shape.

These advantages have led to the rapid development of second-generation PV based on both silicon and multicomponent compounds. However, these devices currently occupy about 10% of the market for commercial CE and this percentage does not increase over time. This is due to the relatively low efficiency of such FEP ( $\eta=21.0\%-24.2\%$ ), environmental hazards of production of multicomponent compounds, the presence in their composition of toxic Cd (CE based on CdTe) or high-value and insufficiently common elements in the earth's crust - In, Ga, Te (CE based on GaAs, InP, GaP, CIS, CIGS).

These shortcomings should be corrected by third generation CEs, which will be based on new semiconductor materials such as multicomponent  $\text{Cu}_2\text{ZnSn}$  (S, Se) 4 (CZTSSe), perovskites ( $\text{ABX}_3$ ,  $\text{CH}_3\text{NH}_3\text{PbX}_3$ ), photosensitized dyes, organic (polymeric) materials, etc. These materials do not contain environmentally hazardous, scarce and expensive elements, they are all flexible, which allows you to make flexible CE on their basis.

In addition, the creation of a new generation of FEP involves the use of new physical principles of solar energy conversion and new designs of devices (cascade CE, devices with energy concentrators, based on intermediate zone materials, quantum dots, using hot electrons, etc.). This should increase the efficiency of the third generation CE above the theoretical values predicted by the Shockley-Kweiser calculations (30-32%).

In the conditions of AM1.5 lighting with the use of cascading SEs containing five transitions, the efficiency of  $\eta=38.8\%$  was obtained. Three-transition FEP with AlGaInP / AlGaAs / GaAs / GaInAs design under Sun 143 lighting conditions showed even higher efficiency of  $\eta=47.1\%$ .

## DEVELOPMENT OF AN IMAGE RECOGNITION SYSTEM USING ADVANCED DATA PROCESSING TECHNOLOGIES

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The process of machine learning for image recognition is an active field of research in the area of artificial intelligence. One of the main directions in this field is the development of image recognition systems using a hierarchical data structure. This structure allows images to be described at different levels of abstraction, which results in higher accuracy in object recognition of images. The hierarchical data structure is used in our research because it also reduces the amount of data required to train the model, which is an important factor when working with large volumes of data.

A range of machine learning methods and models use the hierarchical data structure for object recognition on images. Methods such as deep neural networks typically have multiple layers that correspond to different levels of abstraction. Each layer of the neural network performs certain computations on the data and passes the result to the next layer. This allows the neural network to automatically select the most important features at different levels of abstraction and use them for further image analysis.

Various methods can be used to construct a hierarchical data structure. One of the most common methods is to use an image pyramid, where each level of the pyramid contains an image with reduced resolution compared to the previous level. Another method is to use clustering, where images are grouped based on similar features at different levels of abstraction.

In this study, the hierarchical data structure is used to improve the speed of the image recognition system. In particular, a so-called lazy evaluation is used, where the image recognition system does not consider all elements of the hierarchical data structure but is limited to selected elements. This reduces the processing time and improves the speed of recognition.

## E-LEARNING AND DISTANCE EDUCATION: CHALLENGES AND OPPORTUNITIES

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Education has become a necessity for people who want to succeed in their personal and professional lives in today's fast-paced and ever-changing world. With the coming of innovation and the web, e-learning, and distance schooling have arisen as practical choices for individuals hoping to secure information and abilities. Individuals who are unable to attend traditional classroom settings can take advantage of flexible and convenient learning opportunities through e-learning and distance education. These novel approaches to education have a number of advantages, but they also come with unique difficulties.

The lack of face-to-face interaction and engagement is one of the major issues with e-learning and distance education. Students are able to interact with their teachers and classmates, ask questions, and participate in discussions in traditional classroom settings, which aids in comprehension and retention. Students may find it difficult to maintain their interest and motivation in e-learning and distance education due to the lack of this personal interaction.

The requirement for self-motivation and discipline is yet another obstacle that comes with e-learning and distance education. Students must be self-disciplined and effective time managers in order to finish their coursework because there are no regular in-person classes or deadlines. Students who have to balance work and family obligations may find this particularly challenging.

E-learning and distance education face significant difficulties due to technological obstacles as well. Even though technology has made e-learning and distance education possible, it can also make it difficult, especially for students who don't have access to the internet or the technology they need.

E-learning and distance education offer numerous opportunities despite these obstacles. E-learning and distance

education, for instance, make education more accessible to people who live in rural or underserved areas, struggle with mobility, or face other obstacles that prevent them from attending traditional classroom settings.

Additionally, e-learning and distance education frequently offer better value for money than conventional classroom settings. Because students do not have to pay for the costs of transportation or lodging that are associated with attending conventional classes.

E-learning and distance education are more cost-effective options for many students.

Personalized learning experiences are provided by e-learning and distance education. Students can learn at their own pace with e-learning and distance education, which can be especially helpful for students who struggle to keep up with the pace of traditional classroom settings.

E-learning and distance education present both opportunities and challenges, but research and development in this area must continue. The advantages of e-learning and distance training are clear, however, there is still a lot of work to be finished to address the difficulties related to these instructive methodologies.

In conclusion, students seeking to acquire knowledge and skills can take advantage of a variety of opportunities and challenges provided by e-learning and distance education. E-learning and distance education are viable options for many students despite obstacles like a lack of personal interaction, technological barriers, and the need for self-discipline and motivation. However, the advantages of increased accessibility, cost-effectiveness, and personalized learning experiences make them viable options. E-learning and distance education will undoubtedly become even more common with technological advances. This makes it essential to address the challenges they pose and take advantage of the opportunities they provide.

## THE ROLE OF DIGITAL TWINS IN MODERN PRODUCTION

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In recent years, the rapid leap in the development of science and technology has led to the introduction of new and sophisticated technologies in various fields, including engineering, medicine, and entertainment. While traditional methods of testing and experimentation are still in use, the high cost of experiments and the need for accuracy have pushed researchers to explore alternative methods such as computer modeling and virtual reality.

One promising direction of virtual reality is the development of digital twins, which are virtual replicas of physical objects or systems. Digital twins offer a cost-effective and efficient way to simulate real-world scenarios, enabling researchers to test and optimize designs without the need for physical prototypes. With the ability to replicate physical objects and environments with a remarkable accuracy, digital twins have become increasingly popular in various industries, including manufacturing, aerospace, etc.

In manufacturing, digital twins can be used to model and optimize the production process, to help identify potential issues or inefficiencies before they occur. For example, a digital twin could be used to simulate the behavior of a production line, making possible optimization and refinement of the design without the need for physical prototyping. This can help to reduce costs and increase efficiency, ultimately leading to better products and services.

Digital twins can also be used in the aviation and automotive industries to improve safety and reliability. By creating virtual models of planes, trains, and automobiles, engineers can simulate various scenarios and identify potential safety hazards or issues. This can lead to reduction of accident risks and improve the overall safety of these transportation systems.

Overall, digital twin technology has the potential to revolutionize many industries, providing better products, services,

and outcomes. As this technology continues to evolve and improve, we can expect to see even more innovative applications in the future.

## ARTIFICIAL INTELLIGENCE: A BENEFIT OR A THREAT?

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ChatGPT, a new artificial intelligence (AI) chatbot interacting with users, has caused a stir in the technology world. Because of its ability to perform a wide range of functions from program coding to essay writing, ChatGPT has gained incredible popularity.

Until recently, we only theorised about how AI would affect our lives. Now we can observe it in action. Experts claim that we are in for a technological revolution which will change the Internet and the world as a whole.

At first sight, it may seem that this innovation can make people's lives easier and bring benefits only: a robot can be entrusted with boring tasks, ask and solve many exciting questions, entertain and be entertained. However, many experts consider artificial intelligence dangerous in many ways.

The most plausible threat is the loss of jobs. Why hire a whole office of workers and pay their salaries when AI can accomplish some tasks many times faster? Some IT startups already use ChatGPT instead of people to write code and create programs. This, of course, does not apply to all areas. But given the rapid development, scientists envision an AI that can even perform surgical operations.

The worst threat to humanity caused by AI is its escape from human control. Nowadays, rumours are circulating online about a failed and unfinished experiment with an AI that wrote escape code. If sources are to be believed, the experiment was terminated without waiting for the final action of the AI. Escape could have unintended consequences: robot use of weapons (including nuclear weapons), mass provocations, disclosure of secret documents, genocide, etc.

In general, ChatGPT can be called a very interesting, useful and exciting discovery. But mankind should research it 100% before using it freely and to its full potential. Let's admit that artificial intelligence contains much information many people can't handle. Only thorough vetting and protection system can make AI a gift for humanity, not the end of it.

## SOFTWARE USE WITH OPEN SOURCE CODE IN MATERIALS SCIENCE

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In recent years, open source software is becoming more common in many application server operating systems, scientific computing and high-quality graphics. Such applications have source code and a number of restrictions on creation and distribution of improved versions. Therefore, there is a whole range of license fees, so, the access to source code is a grand advantage for teachers, researchers and those who need to modify it themselves.

Despite the disadvantages associated with underdeveloped application interface and lack of revenue licensing, some packages with open source code are available. Open source software has recently become more sophisticated and advanced to such level that they're widely used for dependable engineering modeling. Its interface is also improved, small, and a growing number of these tools are also available to non-professionals. Price, customization, number vendor lock-in and long-term serviceability make these tools potentially attractive. In fact, the phenomenon of open source cad is of great interest for the materials science and engineering community. The process of modeling tools in a new paradigm integrated computational materials engineering (ICME) enables to use a very rich and diverse set of software for modeling materials open by code.

Relatively new field of ICME involves the integration of comprehensive information about all relevant material phenomena, from atomic to macroscopic. This approach can

potentially speed up the development of new materials, primarily by reducing the effort associated with cycles design, synthesis and evaluation, achieved through the models processes integration of processing materials and modeling properties in the designing process. Essentially, ICME is based on the process-structure-property relationship (PSP), which has been a cornerstone of materials science for decades. Recent studies have demonstrated the role of ICME in reducing the number of iterations in the process of developing materials, which, in turn, reduces the cost and time of optimal engineering solutions search.

Thanks to the recent emergence of a collection of powerful software for calculating materials, open source has made possible a wide implementation of ICME for solving other problems of materials design. Understanding the macroscopic properties of fir material relies on the precise description of the relationship between these properties and the electronic structure material. The determination of the latter, in principle, requires the solution of the Schrödinger equation, which became possible due to the development of the approximation theory. Among them, DFT has become the most widely used in the materials science community. Recently, a very powerful DFT code with open source ABINIT has become one of the main computing tools for electrical engineering, molecular and periodic research structures of crystalline solids. A wide range of physical properties can be calculated using DFT calculations of the order former. As to thermodynamics, there are a number of open means, which help the complete models of technologically necessary systems become available to the public.

In order to create reasonable predictions about the evolution of the material system, as it approaches equilibrium, an accurate description of its first required phase stability is given. Successful approach to modeling of microstructural evolution is the phase field approach. Despite the success phase, fields weren't included in the large-scale ICME effort, in lack part of easy-to-open source software. In recent years, this problem has been solved with the help of the FiPy code, a solver of differential equations in partial derivatives, written in Python10. With this impressive tool in



hand, you can presently focus on development of complex phase field models for the study of complex phenomena materials, not focusing too much on the real implementation of numerical modeling. Therefore, this tool can be used for development simulations of a higher level in the spirit of ICME.

A relatively new approach to modeling microstructural response is a code OOF. This code combines the graphic data of the microstructure (genuine or virtual) with material properties (scalar or tensor) for each constituent phase of the microstructure. Although the code is currently Ltd to two-dimensional geometries and ordinary material responses, further development is expected to enable materials researchers OOF and other similar codes as computational tools microstructures.

Thus, there is an unsolved problem, which consists of incompleteness of interfaces and insufficient open source software functions source code. This allows proprietary programs to gain a larger popularity in many fields, in specific, in thermodynamics, macroscopic modeling and plasticity of crystals. But despite this, the role of open source will likely continue to expand, getting leading positions for many years.

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## TECHNOLOGICAL ADVANCES CHANGING THE WORLD AND HOW WE LIVE IN

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High technologies are deeply integrated in our life. We can't imagine our life without so simple and necessary tools like an alarm clock on the phone, messengers, video streaming and so on. It was the high tech fantastic 30 years ago, but nowadays these

technologies help us in everyday life and solve a wide range of problems. All tech advances which took place not so far from now were results of better education opportunities and communication between people around the globe.

The scope where tech advantages open new horizons is education. It was highly affected by the implementation of new computer technologies and companies which provide educational services worldwide. For example, Coursera platform offers anyone, anywhere access to online courses and degrees from world-class universities and companies on various subjects from cooking to web design. The platform provides access for most of the courses for free, so, it makes education service available for low-income families. The key advantage of this platform is freedom to choose time and place for studying. Most people have a job and can't join a university to get a degree, but such platforms offer a solution for this problem. The courses represent the official university courses in such a way it can help bring education to communities where it is required.

Modern technologies play an important role in communication of people with different backgrounds. Apps like Google translate provide translation services in minutes on your phone even without internet. It's a real-time dictionary in your pocket. That allows user of the app find a good translation in seconds instead of wasting your time for looking for a proper word. Such tech advance in the form of apps gives power to enhance learning skills of foreign languages. Technology innovations reduce the amount of efforts a man should make to learn a foreign language. For instance, wide spreading of online courses, portable dictionaries, and video courses eliminated the barriers for learning a foreign language.

Since the mid-1990s, the Internet has had a revolutionary impact on communication, including the rise of near-instant communication by electronic mail, instant messaging, telephone calls, discussion forums, blogs, and social networking. It has changed the way people communicate, do business, and even live their daily lives. The vivid illustrations of the implementation of

such solutions become Zoom and Google Meet. These tools allow users to stay connected with their friends and families during long trips. It's a great way to stay in touch with people even when they are far away. Zoom and Google Meet play an integral role in the education domain in post COVID years. Such tools provide a teacher with an opportunity to conduct lectures and classes without face-to-face contact. They enlarge the sphere of communication and result in better learning outcomes.

It's worth noticing that even scientific conferences could be conducted with the help of online technologies. It goes without saying that the main language of the communication on the international conferences is English. The foreign language makes it possible to publish scientific researches in the blink of an eye using online services. Moreover, it allows obtaining the feedback from the international team as fast as possible that leads to better results in researches.

So, advances in the technologies give us an opportunity to learn new things faster and easier, help people to communicate and obtain new information. They give rise to new inspirations and the next innovation, often launching a new era, whether in education, communications, or mobility. The use of technology has become an important part of the learning process in and out of the class.

## INTERACTIVE TECHNOLOGIES IN LEARNING FOREIGN LANGUAGES ONLINE

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Nowadays, the fast-moving development of technologies has made online learning and communication on the Internet much more effective and it has become more popular among students and lecturers from all over the world. Thanks to interactive technologies, students are actively involved in the educational process and constantly increase the efficiency of learning the material. This approach contributes to the creation of an exciting and interesting atmosphere during language learning.

It is important to remember that the term “interactive” simply means the ability to interact and dialogue, but in our case we are talking about a modern teaching method. According to T. I. Koval, she defines interactive learning as a special organization of students’ cognitive activity with one specific goal – to create comfortable studying conditions [1, p. 87]. The active use of interactive technologies in education involves the ability of classmates and lecturers to interact with material and communicate with each other. The essence of this approach is that the educational process should be progressive, encouraging students to engage in dialogue, discussions and joint work.

Interactive learning of foreign languages helps students to develop critical thinking and solve problematic situations. This implies the use of complex learning methods which can be developed with the help of various interactive technologies. For example, there are four categories of such methods: 1) collaborative learning in groups of different sizes (pairs, small groups or carousels); 2) brainstorming, solving problems in a team, using a microphone, analyzing situations; 3) situational modeling, imitation games and simulations; 4) discussions, debates [2, p. 27]. Any of these methods can and should be accompanied by the use of video conferences, virtual classes, electronic boards, webinars, online games and other tools.

There are certain interactive technologies used in learning foreign languages. For example, to improve grammatical competence, you can use such applications as “Grammarly” and “English Grammar in Use”. “Grammarly” helps students practice writing skills, it improves sentences, shows us how to find and correct grammar and punctuation mistakes, offers fresh ideas and assist to navigate them. “English Grammar in Use”, in turn, will offer to do some grammar tests on tenses and other things.

Other apps such as “Duolingo”, “Rosetta Stone”, “Babbel” and “HelloTalk” will help to learn new vocabulary. They have exercises to practice pronunciation and reproduce the authenticity of the language, and especially using “HelloTalk” allows us to find partners around the world and teach each other our native

languages through chats or video and audio calls. However, we can use platforms such as “Zoom” and “Google Meet” for video conferences, where speaking is practiced in real time with the lecturer and other students.

There are also LMS-systems that exist. These are learning management systems that provide online learning. They can store and organize learning material, conduct testing and estimate educators' knowledge. For example, we can create interactive courses in the “Moodle” system where there are already integrated tools for the main aspects of language learning, namely grammar, vocabulary, listening, reading and writing. Each course contains different sections, assignments and other materials. Apart from “Moodle”, there is the “Blackboard” system that helps to create matching based online exercises and tests of various levels. Also allows to add video and audio materials to courses for listening and language practice.

Therefore, the use of interactive technologies in learning foreign languages online is effective for students and lecturers. These technologies make it possible to create a more comfortable and progressive learning environment. They make the process more interesting and accessible, but they should be used with understanding and adapted to the needs and capabilities of each student.

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## SECTION 3 INNOVATIONS IN MEDICINE AND MODERN LIFE

### ROLE OF HYPERHOMOCYSTEINEMIA IN THE DEVELOPMENT OF NON-VALVULAR ATRIAL FIBRILLATION

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Atrial fibrillation (AF) is one of the most common types of arrhythmia. The main sign of AF is the uncoordinated rapid electrical activation of the atria, which leads to a loss of efficiency of their activity and disruption of the ventricular rhythm. The prevalence of AF in the world is estimated at 37.6 million cases (0.51% of the world population), but 30-45% of cases remain undiagnosed, which indicates a much higher prevalence of this rhythm disorder. Recent research proves the role of various biomarkers in the development of AF. At the same time, the influence of homocysteine (HC) level on the development of non-valvular AF remains open.

HC is an amino acid that is formed as a result of the metabolism of the amino acid methionine and participates in a number of biochemical processes in the human body. Hyperhomocysteinemia (HHC) develops as a result of a decrease in the activity of enzymes involved in the metabolism of HC, which can occur as a result of genetic mutations, as well as vitamins that act as cofactors of these enzymes (folic acid, vitamins B6 and B12). As a result of variations in the mutation of one or another gene that encodes enzymes (homozygous or heterozygous), the level of amino acids may increase slightly or more pronouncedly.

The increase in the level of HC is an independent factor in the development of thromboembolic phenomena and the development of a number of cardiovascular diseases closely related to AF. The role of HHC in the increasing the all-cause mortality rate has been proven. The pleiotropic action of HC (depending on its level) and

the interdependence of physiological and pathological processes of the cardiovascular system can cause a direct or indirect (due to a general increase in the risk of developing cardiovascular pathology) influence on the development of AF. HHC leads to structural and electrical remodelling of the myocardium (including the atria), which may increase the risk of developing AF and affect the frequency of its recurrence.

There is a certain relationship between non-valvular AF and mutations in the folate cycle system (for example, single-nucleotide mutations of the MTHFR enzyme C677T and A1298C), but determining the degree requires additional research. HHC is caused by mutations in genes encoding enzymes of the folate cycle, affecting the blood coagulation system in patients with non-valvular AF and requiring appropriate anticoagulant correction. The level of HC has a prognostic value for the development of AF and the risk of thromboembolic events.

In summary, the level of HC has some influence on the development of non-valvular AF, which remains poorly understood, including the role of mutations in the folate cycle system for the development and course of this heart rhythm disorder. In addition, the elevated level of HC in AF increases the risk of developing cardiovascular complications both as a result of a direct action on the structures of the heart and blood vessels, and indirectly through changes in the blood coagulation system, increasing the risk of thromboembolic events. The available data indicates the need for additional studies of AF on the background of HHC in order to improve diagnostic and treatment tactics.

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# BRILLIANT MEDICAL INVENTIONS THAT CHANGED THE WORLD

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There have been many medical inventions that have had a profound impact on healthcare and changed the world. Here are just a few:

**Vaccines:** Vaccines have been instrumental in eradicating diseases such as smallpox, and reducing the incidence of many other infectious diseases like polio, measles, and rubella.

**Penicillin:** Penicillin was the first antibiotic discovered and has saved countless lives by fighting bacterial infections.

**X-rays:** X-rays revolutionized medicine by allowing doctors to see inside the body without surgery, making diagnoses and treatments easier and less invasive. **Insulin:** The discovery of insulin has transformed the lives of people with diabetes, allowing them to manage their condition and live longer, healthier lives. **Heart transplant:** The first heart transplant was performed in 1967, and since then, thousands of people have received life-saving heart transplants. **Pacemaker:** The invention of the pacemaker has helped millions of people with heart problems maintain a regular heartbeat and improve their quality of life. **Artificial limbs:** Advances in prosthetics have allowed people who have lost limbs to regain mobility and independence, improving their quality of life. **Ultrasound:** Ultrasound technology has allowed doctors to diagnose and monitor a wide range of conditions, including pregnancy, cancer, and heart disease. **MRI:** Magnetic Resonance Imaging (MRI) has revolutionized medical imaging, providing detailed images of the body's internal structures without exposing patients to radiation. **Lasik:** lasik surgery has allowed millions of people with vision problems to see clearly without the need for glasses or contact lenses.

In conclusion, all inventions have made a big impact in human development. It is obvious, that these inventions have a great importance in future and medical inventions are called to help people all over the world.



## ACTION ALGORITHM IN TACTICAL MEDICINE

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Tactical medicine is the provision of emergency medical care during military operations. After the invasion of the Russian Federation on the territory of Ukraine, this issue became more relevant than ever. In general, in tactical medicine, 2 places of assistance are distinguished.

The first is directly in the firing sector, the so-called "Care under Fire" red zone. For obvious reasons, minimal assistance is provided at this time, such as applying a tourniquet and ensuring that the victim is transported to a safe place as quickly as possible.

The second place of assistance is giving help in the yellow zone called "Tactical Field Care". This also happens on the battlefield, but far from the line of fire in the so-called shelter zone. Help is provided according to the C-A-B-C rule.

C- Critical bleeding. A doctor's task is to identify it and eliminate it as soon as possible with the help of a tourniquet.

A-airways. The paramedic has to check the airways and in the event of an obstruction, eliminate it by any means.

B-breathing. The paramedic has to check the chest for open injuries and in case of tense pneumothorax, performs decompression.

C-circulation. The paramedic needs to check for minor bleeding that is not life threatening and eliminate it. Also, check the harnesses that we applied earlier, if necessary, loosen them or, on the contrary, apply them more strongly.

The "Tactical Evacuation Care" green zone is where the wounded are evacuated from the battlefield and assistance is provided in mobile field hospitals, hospitals, and specialized clinics.

Besides C-A-B-C algorithm, "MARCH" is also used. It stands for M-massive bleeding, A-airway management, R-respiration, C-circulation, H-head injury / hypothermia/hypovolemia. The first 4 points are identical but the main feature is the last one. We must ensure the maintenance of normal body

temperature of the victim to avoid hypothermia or overheating. We have to take off his wet clothes and put on dry ones, wrap the victim in a blanket or something similar to a blanket. It is necessary to examine the head, in case of minor injuries, treat the wounds and transfer the victim to the hospital as soon as possible.

When providing assistance, one should understand the victim's vital signs and be able to adequately assess the situation. We also have to remember that according to the TCCC protocol, in combat conditions, a wounded person who is unconscious and not breathing is not given help and is considered dead, but if you have time and resources, you should do everything possible. After all, the motto of tactical medicine is "Right actions at the right time".

#### INNOVATION IN MEDICINE AND MODERN LIFE

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Innovation and medicine go together. The ancient Egyptians are thought to have performed surgery back in 2750 BC, and the Romans developed medical tools such as forceps and surgical needles. In modern times medicine has been transformed by waves of discovery that have brought marvels like antibiotics, vaccines and heart stents. Now the industry is convinced that a third revolution is under way: the convergence of biology and engineering. A recent report from the Massachusetts Institute of Technology says that physical sciences have already been transformed by their adoption of information technology (IT), advanced materials, imaging, nanotechnology and sophisticated modelling and simulation. Michael A. De Miranda classified greatest medical innovations into 3 groups:

- Devices. There are a number of interesting medical devices that contribute to treat different conditions and diseases.
- Technology. Advances in medical technology allow us to have access to a number of advantages that help increase the ability to diagnose and treat conditions.

- **Drugs.** Some of the best medical innovations have been in the area of drug treatments and therapies.

The Global Innovation Index 2019 (GII), a report from the World Intellectual Property Organization and its research partners identifies five global trends driving this transformation: broadband access, developments in artificial intelligence and the human genome, changing business models, and the rise of consumerism. These trends are leading to breakthroughs across a range of medical frontiers. GII identified some of the technologies most likely to revolutionize healthcare over the next decade.

### **Mapping the brain**

Some of the most exciting BRAIN-funded studies since its inception six years ago include an experimental brain device that helps blind patients to distinguish light and motion, and a new method to use brain activity to reconstruct human speech. Over the next decade, BRAIN researchers will produce a dynamic picture of the brain that will show for the first time how complex neural circuits and individual cells interact.

### **Spinal cord injuries**

A ground-breaking research has enabled several young men paralyzed from the waist down to move their legs through the use of surgically implanted electrical stimulators that bypass the severed spinal cord. Soon, many of the millions of people worldwide coping with spinal cord damage could be given back freedom of movement.

### **Regenerative medicine**

#### *Heart Regeneration*

In 2018, a study led by ISCRM Director Dr. Charles Murry demonstrated that stem cell-derived cardiomyocytes have the potential to regenerate heart tissue in large non-human primates, a major step toward human clinical trials. In another investigation, ISCRM faculty members Jen Davis, PhD and Farid Moussavi-Harami, MD are developing new tools to help cardiologists design personalized treatments for certain heart diseases.

### *Vision Disorders*

Researchers at the Institute for Stem Cell and Regenerative Medicine (ISCRM) are using stem cell-derived retinal organoids to study how diseases of the retina form and how they can be treated. Organoids closely approximate human tissue without many of the ethical questions and supply limitations that complicate the use of fetal tissue.

The Reh Lab has successfully induced non-neuronal cells to become retinal neurons. In an October 2021 study published in the journal *Cell Reports*, Reh and his team using proteins (known as transcription factors) that regulate the activity of genes to induce glial cells in the retina to produce neurons. The effort demonstrates that gene therapy could someday be used in clinics to help repair damaged retinas and restore vision.

Medical innovations have occurred throughout history, continually advancing our ability to treat complex diseases and the 21st century is bringing more progress, with technological advances revolutionising the healthcare sector.

### RÉCUPÉRATION DE LA COURSE LONGUE DISTANCE

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**Introduction.** La récupération est la partie la plus importante du processus d'entraînement, car c'est à ce moment que le corps devient plus fort et plus rapide. Après un entraînement intense, il est très important de donner au corps le temps de se reposer avant la prochaine séance. C'est pendant la récupération que ces changements adaptatifs importants se produisent dans le corps, qui sont nécessaires pour améliorer ses propres enregistrements. Je peux dire que le secret principal des résultats élevés est le bon rapport entre l'entraînement et le repos.

La récupération est parfois encore plus importante que l'entraînement lui-même. Par exemple, si un athlète dort 4 heures, je ne recommande même pas de commencer l'entraînement pour les marathons. Dans 90% des cas, cela se terminera par des blessures. Un corps fatigué ne sera tout simplement pas en mesure

d'effectuer l'entraînement nécessaire et la blessure qui en résultera sera une sorte de mécanisme de protection. Par conséquent, les conséquences possibles de la négligence des mesures de récupération seront des blessures, de mauvaises performances (par rapport aux attentes) à l'entraînement et aux compétitions, l'apathie et la réticence à poursuivre l'entraînement, la détérioration du bien-être et même de la santé.

Lors d'une course longue distance, notre corps dépense une quantité incroyable d'énergie. Par conséquent, pour une récupération complète, vous devez suivre le régime, une alimentation équilibrée, un équilibre hydrique, une bonne nuit de sommeil et un massage.

Le processus de récupération commence immédiatement après avoir franchi la ligne d'arrivée. Ne vous arrêtez pas brusquement, ne vous asseyez pas ou ne vous allongez pas. Il est préférable de faire une petite marche pour rétablir la respiration et le travail du système cardiovasculaire.

Si nous parlons de la différence dans le processus de restauration pour les professionnels et les amateurs, il n'y a pas de différence significative dans les méthodes et les moyens de restauration. La différence réside uniquement dans le rapport en pourcentage et le temps consacré à la fois à l'entraînement et à la récupération après eux. Si un professionnel fait 12 entraînements par semaine (ce n'est que de la course à pied) et que l'amateur moyen en fait 3-4, alors le nombre d'activités de récupération sera différent. Par exemple, un professionnel visite un sauna et un massothérapeute 1 à 2 fois par semaine, et un athlète amateur peut suffire une fois toutes les 2 semaines.

Les exercices de récupération à longue distance comprennent :

- course facile et lente de 6 à 12 km dans la zone bleue et verte du pouls (120-135 bpm);

- le massage sportif (massage de tout le corps, en mettant l'accent sur les muscles des jambes et du dos), doit être de dureté moyenne et dure;

un ensemble d'exercices pour le développement de la flexibilité (peut être fait à la fois après l'entraînement et en tant qu'entraînement séparé);

auto-massage et libération myofasciale (vous pouvez utiliser des rouleaux et des balles professionnels de différents diamètres, ainsi qu'une balle de tennis ordinaire);

visiter la piscine, le sauna, etc. (l'entraînement dans la piscine devrait être facile);

alimentation sportive et utilisation de la nutrition sportive (gels énergétiques lors de courses longues et lors de compétitions, isotoniques pendant et après l'entraînement, BCAA après l'entraînement, protéines (si nécessaire), inosine, complexe vitaminé, etc.)

**Conclusions.** Courir et couvrir des distances devrait être amusant, développer l'endurance et avoir un effet positif sur votre santé globale. N'oubliez pas l'entraînement et la récupération, car sans eux, atteindre et établir de nouveaux records est impossible.

## RÉADAPTATION POUR BLESSURE DE L'ARTICULATION DE L'ÉPAULE

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**Introduction.** Dans cette thèse, je parlerai de l'une des blessures les plus fréquentes de l'articulation de l'épaule, qui complique grandement la vie des athlètes, qui n'est souvent pas diagnostiquée et qui n'est pas facilement traitée. Il s'agira de dégâts de Slap. Qu'est-ce qu'un dommage Slap - cette abréviation, qui signifie Labrum supérieur antérieur à postérieur, qui se traduit littéralement par la lèvre supérieure d'avant en arrière. De quel type de lèvre supérieure s'agit-il, où sera-t-elle dans l'articulation de l'épaule et pourquoi d'avant en arrière.

L'articulation de l'épaule est une structure anatomique complexe. Il est formé par les surfaces articulaires de l'humérus et de l'omoplate. Une lèvre articulaire est attachée autour de la cavité articulaire de l'omoplate, cette formation ressemble à une ventouse, entoure la tête de l'humérus et l'empêche de bouger lors

des mouvements. Le tendon du muscle biceps de l'épaule, ou comme on l'appelle le biceps, est attaché à la partie supérieure de la lèvre articulaire.

Avec une blessure par claque, la partie supérieure de la lèvre articulaire est rompue ou détachée à l'endroit où le tendon du muscle biceps y est attaché. Il se produit avec des mouvements brusques de la main ou en tombant sur un bras tendu. Le plus souvent, de telles blessures surviennent chez les athlètes qui exposent constamment les articulations de l'épaule à de lourdes charges aériennes. Il s'agit des lanceurs de poids ou de javelot, des volleyeurs, des handballeurs, des haltérophiles, des joueurs de baseball. Dans le même temps, la lèvre articulaire peut être perturbée entre la tête de l'humérus et l'omoplate. En conséquence, les parties supérieures de la lèvre articulaire commencent à se déchirer.

On peut suspecter une lésion de la lèvre articulaire sur la base de l'anamnèse et de l'examen clinique. Au cours de l'examen clinique, des tests d'effort spéciaux sont effectués pour révéler les symptômes qui sont vrais pour cette maladie. Une IRM peut être utile pour préciser le diagnostic.

Les principaux symptômes des blessures par gifle sont les suivants: douleur dans les parties antérieures de l'épaule; cliquetis et craquements lors du déplacement dans l'articulation de l'épaule. Dans le contexte de la douleur, il y a une diminution progressive du volume des mouvements actifs, en particulier au-dessus de la tête. À l'avenir, la rigidité de l'articulation se développe. Certains patients peuvent ressentir une instabilité de l'articulation de l'épaule lors de certains mouvements. En conséquence, notre tâche est l'hypertrophie musculaire, le renforcement de l'articulation de l'épaule et de l'omoplate.

Pour cela, il est nécessaire d'effectuer un certain nombre d'exercices.

Le premier exercice. Le patient est en position assise. Nous prenons la main du patient et l'aidons à effectuer cet exercice. Nous allons passivement lever le bras parallèlement au sol et le ramener derrière la tête en direction de l'arrière de la tête et

revenir à la position de départ. Lorsque la force apparaît dans la main, le patient peut effectuer cet exercice de manière indépendante. Après avoir vu que le patient a restauré la fonction motrice de l'articulation de l'épaule, nous ajoutons l'exercice suivant. déplacer les mains le long du bâton de fitness. Nous avons à notre disposition un bâton de fitness derrière le dos et effectuons des pompes avec nos mains en direction l'une de l'autre. Lorsque les mains se rencontrent, nous effectuons le mouvement inverse et les écartons sur les côtés et répétons. Dans cet exercice, il est permis d'utiliser une bande élastique au lieu d'un bâton de fitness. Passons au troisième exercice, la position initiale est la même que la précédente. Nous avons à notre disposition un bâton de fitness derrière le dos, les mains se rejoignent derrière le dos en bas. Nous effectuons une flexion dans les articulations du coude et essayons de lever les mains le long du dos, de les abaisser et de répéter. Dans cet exercice, il est important de contrôler la position du dos et d'éviter les inclinaisons du corps. Pour ce faire, vous pouvez faire face au mur.

**Conclusions.** Il faut se rappeler qu'après une douleur ou une fixation prolongée, le résultat viendra progressivement. Par conséquent, la tâche d'un médecin, d'un physiothérapeute ou d'un entraîneur sportif est de développer des complexes d'entraînement et des programmes de rééducation de manière à répondre aux besoins individuels des athlètes.

## ВПЛИВ ГАДЖЕТІВ НА ЗДОРОВ'Я ДІТЕЙ

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Гаджети стали невід'ємною частиною сучасного життя. Безконтрольне користування мобільним телефоном або ПК може призвести до номофобії.

Номофобія – термін, який описує фобію людини залишитися без мобільного зв'язку, телефону, інтернету. Цей стан може бути як самостійною фобією, так і ознакою



певного психологічного розладу. Під час діагностування цієї проблеми необхідно бути дуже обережним, адже номофобія може бути симптомом тривожного розладу, або навпаки самотність, відлюдкуватість та навіть інтровертність може бути причиною номофобії.

Метою нашого дослідження було виявити процент дітей, які мають номофобію та з'ясувати методом опитування стан їхнього здоров'я.

Під час дослідження ми використовували Гугл форми, таблиці Excel . З метою виявлення у дітей залежності від гаджетів їм було задано 5 запитань, та 10 запитань, для виявлення стану здоров'я дітей.

Дослідження виявило, що з опитаних 30 дітей: 20,0% - зовсім не мають гаджет-залежності; 26,7% - мають легку форму гаджет-залежності; 46,7% - помірна форма гаджет-залежності; 6,7% - яскраво виражена форма форма гаджет-залежності.

Дослідження самопочуття дітей показало, що у дітей, які не мають залежності від гаджетів менше скарг на самопочуття, в порівнянні з дітьми, які мають цю залежність. Діти з середньою та тяжкою формами цієї залежності скаржаться на болі в спині на 63% частіше, ніж діти з легкою формою.

Можна зробити висновки, що гаджети негативно впливають на здоров'я дітей в тому випадку, коли в них присутня номофобія, або вони занадто багато часу проводять за екраном телефона або ПК.

## СУЧАСНИЙ СТАН РОЗВИТКУ ІНФОРМАЦІЙНИХ ТЕХНОЛОГІЙ В ОХОРОНІ ЗДОРОВ'Я

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Протягом останніх років стрімкий розвиток нових технологій і їх впровадження в сферу медицини призвело до масштабних змін у поглядах на надання медичних послуг та

охорону здоров'я, а також на механізми взаємодії між пацієнтами та постачальниками медичних послуг. В основі цих пертурбацій лежить зміна шляхів, за якими відбуваються, обробка, зберігання, обмін, збір та аналіз медичної інформації.

Взяття у обіг електронних процесів у СОЗ сприяє ефективному розподілу і застосуванню ресурсів, завдяки цьому скорочуються витрати, підвищуються темпи надання послуг, економія часу, запобігання небезпечним взаємодіям лікарських препаратів або їх надмірному використанню, зменшення кількості вимушених поїздок і скорочення потреби в наявності фізичної інфраструктури для лікування пацієнтів.

Електронна охорона здоров'я (E-health) розуміє під собою використання інформаційних технологій для покращення рівня охорони здоров'я, беручи до уваги організацію процесів та спосіб мислення у системі охорони здоров'я та прилеглих сферах (освіті, науці, дослідницькій діяльності). E-health це галузь, яка складається не лише з інформаційно-телекомунікаційних систем, але й таких компонентів, як інфраструктура, правова база, контроль і стандарти відповідності, кадрові ресурси, органи управління, модель залучення інвестицій.

ЕСОЗ автоматизує ведення обліку управління медичною інформацією та медичних послуг шляхом створення, обміну, розміщення та оприлюднення інформації, в електронному вигляді. ЕСОЗ складається з центральної бази даних та МІС, між якими відбувається автоматизований обмін інформації, даних та документів через відкритий програмний інтерфейс.

Основною стратегією проекту Концепції інформатизації охорони здоров'я, що оприлюднювалася задля обговорення громадськістю у червні 2019 р. Міністерство охорони здоров'я, визнало тактику орієнтування на пацієнта, що означає безперебійне накопичення та зберігання документації з прив'язкою до облікового запису пацієнта в системі його електронної медичної картки, забезпечити пацієнту, як суб'єкту своїх даних, можливість правити власними

медичними даними й доступом до них. Від реалізації цього принципу випливає, що медичні дані “залишаються” разом з пацієнтом при зміні пацієнтом свого закладу або лікаря, що надає пацієнту послуги.

У 2019 р. у центральній базі даних ЕСОЗ був прийнятий в експлуатацію сервіс електронних рецептів для цілей програми Уряду «Доступні ліки». Майбутній розвиток ЦБД ЕСОЗ бачиться як розширення її до загальнонаціональної інформаційної платформи (центрального компонента ЕСОЗ), метою якої є, по-перше, сприяння створенню єдиного інформаційного простору шляхом побудови платформи для обміну даними між інформаційними системами у сфері охорони здоров'я та надання доступу до централізованих ключових реєстрів (пацієнти, медичні спеціалісти, надавачі медичних послуг), єдиних класифікаторів й словників.

По-друге, створення загальнонаціональної інформаційної платформи має забезпечити зберігання та обробку даних в такому обсязі, що є необхідним для злагодженого управління системою охорони здоров'я та керування програмою медичних гарантій, а також для забезпечення гарантованого доступу до найважливіших медичних даних пацієнтів і ефективного використання наданих бюджетних коштів.

Можемо зробити висновок, що наведені форми та технології розвитку позитивно вплинули на розвиток медицини в Україні. Електронні форми, каталоги та бази даних мінімізують час витрачений на аналіз та синтез інформації, заощаджують час та гроші.

## ROLE OF VITAMIN D AND THE GENETIC POLYMORPHISM OF THE VITAMIN D RECEPTOR IN THE DEVELOPMENT OF MYOPIA

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Myopia is one of the main causes of vision loss among young people and children. The prevalence of myopia is quite high in the countries of Asia, Europe and North America. Therefore, the

problem of the spread of myopia is important in Ukraine too. Sometimes, the term "myopia epidemic" is used by ophthalmologists all over the world.

There are many views on the causes of the development of myopia. However, there is no consensus. The reasons can be both external and internal. Much attention is paid to being much more time out-of-doors than indoors for all age groups whether they are small children, teenagers, young people, middle aged people or elderly people. This is a very relevant issue in our country. Young workers, students and apprentices work remotely. Small children do not go to kindergarten and stay at home with their parents. This is caused by the armed aggression against Ukraine today, and the corona virus epidemic in the past years. That is why the external activity of young people has decreased significantly. This fact may cause a dramatic increase in the prevalence of myopia in the future. Myopic patients have a low vision. They depend on the use of glasses and contact lenses. In some cases, patients choose surgery to restore a good vision. In addition to a reduced vision, there are complications. The complications of myopia are very serious: the increased risks of cataracts, glaucoma, myopic macular disease and others. Such diseases can cause a complete loss of vision. The risk of complications depends on the degree of myopia and the patient's age. High myopia and elderly age of the patients are a guarantee of such complications.

The metabolism of vitamin D plays a great role, it is affected by its entry into the body with food and medicines, its synthesis in the skin during solar radiation, and the genetic features of the structure of the vitamin D receptor. The mutual influence of all these factors is also vital. Scientific studies show that there is a direct relationship between the risk of myopia and the genetic characteristics of the vitamin D receptor. [2] The level of vitamin D is of great importance for the organ of vision in a general sense. This level affects the development of other eye diseases in adults (age-related macular degeneration, diabetic retinopathy, dry eye disease). [1] Therefore, controlling the level of vitamin D can be a

preventive measure for other eye diseases. No doubt, one should not forget about other risk factors in this group of patients.

The relationship between the development of myopia and the level of vitamin D was found in young children. Moreover, studies in this group show that a more important role belongs to the genetic characteristics of the vitamin D receptor. This group is less affected by time spent outdoors [3]. It is great necessity in further studies to understand more deeply the relationship between the level of vitamin D for the prevention of myopia and other diseases. It is necessary to extensively research the blood level of this vitamin and develop measures to prevent its deficiency for the people who are genetically predisposed to its low level.

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## THE POSSIBILITY OF EXTENDING THE INDICATIONS TO PERFORMING A CLOSED SINUS LIFTING

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Dental implantation is one of the major methods of treatment for patients with a partial or complete edentia. This type of operation is the latest, predicted and eliminates morphological, functional and aesthetic disorders of the dento-maxilar system. One of the conditions for its implementation is a sufficient supply

of a bone tissue in the intervention area. In cases of a significant atrophy of a bone tissue, it is possible to increase its volume with the help of a closed or open sinus lifting. The closed sinus lifting is preferred because it has fewer complications, is cheaper and less traumatic than an open sinus lifting. However, the height of the bone in the intervention area should be at least 5-6 mm [1]. In this connection, the issue of expanding the indications for the closed sinus lifting arises.

The use of osteoplastic materials to fill up a bone defect induces the formation of a new bone tissue. To improve this effect, you can use any autologous material, for example, derivatives of blood plasma. This is due to the fact that at the first stage of a bone formation, one of the vital roles is played by morphogenetic proteins with osteoinductive properties that are activated upon the connection with blood plasma. Another important aspect for achieving a successful result is the provision of micromobility. The gold standard is the micromotility threshold of 150  $\mu$ m [2]. This optimal amount of micromobility can stimulate osteoreparation and osseointegration. Therefore, a dosed early loading will improve the results of a surgical intervention.

It is also necessary to take into account the «implant-bone» contact area. The results from previous studies indicate that a denser bone provides a better primary implant stability and a greater contact area of the complex «implant-bone», resulting in a more predictable outcome [3]. Therefore, in order to successfully carry out the closed sinus lifting under the conditions of a small reserve of a bone tissue, it is necessary to pay attention to its density and strength.

To conclude everything up, there are still many unsolved issues in dental implantology, in particular a bone tissue atrophy and the methods of its elimination. Using osteoplastic materials, derivatives of an autologous blood plasma during the closed sinus lifting, as well as taking into consideration the initial characteristics of the bone and the optimal threshold of micromobility, good results from the surgical intervention can be achieved. In the further research it is of great necessity to use a

practical application of the above methods of the improving closed sinus lifting, as well as the search for new ones that can expand the indications for its use.

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## **SECTION 4 FINANCIAL AND ECONOMIC CHANGES TODAY**

### **THE SECURITIES MARKET AS A COMPONENT OF THE FINANCIAL MARKET: CURRENT STATE AND PROSPECTS OF DEVELOPMENT**

A. Fedan – Sumy State University, group BS-11  
O.R. Gladchenko – Academic Supervisor

Changes in the economic system according to political, social and political components economic conditions are generally not an easy task for each state formation of different countries. One of the effective ways to improve the economic potential of the state and increase its impact on the international economic arena is effective regulation of the financial market, mainly the stock market, which is one of its main components. An important element of the market economy at present is the securities market, which is a component of the financial market system.

The securities market is a system of relations between natural or legal persons connected with circulation, repayment and issuance of securities. Securities usually act as a means of raising capital and testify relationships between persons with respect to money or property law. In Ukraine, the securities market is still functioning as a result of its independence, but due to different external factors, mainly political ones, that is, no qualitative reforms have been carried out on this issue, Ukraine is at the initial level, at the stage of formation.

At present, the securities market in Ukraine is more similar to that it was conducted and created and based on other, foreign countries. This may not always be a positive outcome than a single, independent system, regulated by law.

At present, the current state of development of the Ukrainian securities market follows historical trends of development and somehow depends on the directions of development of international stock markets. Changes in the world securities markets require constant regulation. It is impossible to assess the



level of development of the securities market without qualitative and quantitative assessment of the market structure and types of securities that exist on it.

Regulation of the securities market is carried out by the National Commission of Securities and Stock Market. If we analyze the dynamics of the volume of securities issuance in Ukraine according to the annual report of the NSCAF, we can note that the securities market in Ukraine shows a tendency to decrease the issue of securities. The total volume of issuing securities issued by the National Securities and Stock Market Commission in January-December 2020 amounted to UAH 113,4 billion, which is less than UAH 79 million compared to the corresponding period in 2019 (UAH 113,48 billion). During 2020, the Commission registered 71 issues of shares amounting to UAH 32,98 billion. In comparison with the same period of 2019, the volume of registered shares issue decreased by 30,56 billion UAH [2].

The securities market is one of the main components of financial and economic development. The development of the Ukrainian stock market is not possible without overcoming a number of obstacles that impede the development and entry into the international securities market. In order to solve these problems, it is possible only with state regulation. If you do not establish a stock market in Ukraine, you should not rely on rapid economic growth. Achieving the goals for the development of the stock market will increase Ukraine's importance on the international market and attract not only domestic but also foreign investors [1].

Having analyzed the main indicators of stock market activity, the market in Ukraine has a high degree of fragmentation, limited liquidity, imperfect legal regulation, lack of investment, internal resources and a tendency to decrease the issue of securities. These main problems are obstacles to the development of the stock market as a whole. At present, the securities market for 2020 has seen a tendency to decrease the volume of securities issuance. Despite the shortcomings, the securities market has all the resources for further development.

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## ELECTRONIC BANKING AND ITS ADVANTAGES AND DISADVANTAGES

A. Fedan – Sumy State University, group BS-11  
S. Zolotova – E L Adviser

In the modern world, the banking sector is constantly developing, and new technologies and innovations appear every year. One of the most famous and common innovations is electronic banking.

Every year Ukrainian society demonstrates a growing interest in cashless transactions and the use of electronic payment systems. In particular, the use of the Internet for financial transactions is gaining popularity.

This trend indicates that Ukrainian society is becoming more educated and modern in the field of information technology, which contributes to the development of the financial system and facilitates financial transactions between people and enterprises. It should also be noted that in recent years, the Ukrainian authorities have been actively promoting reforms in the field of finance and information technology, which allows promoting the development of electronic banking in the country [1].

Internet banking (online/web banking) is a type of remote banking service that provides access to accounts and banking operations at any time via the Internet (using a computer, tablet, or phone) [2].

Internet banking provides a wide range of functions, including checking account balances, setting and managing limits

on cards, transferring funds between accounts, sending money from a personal account to accounts of others, creating virtual cards for online payments, access to consultations of bank specialists in real time, the possibility of purchasing insurance products, paying bills by details, making utility bills, automatic regular payments according to the templates and schedule specified by the client, receipt of statements, printing of scanned copies of receipts or sending them by e-mail, opening and replenishing deposits, as well as filing an application and receiving a decision on obtaining a loan or repayment of credit debt.

Internet banking is beneficial for bank customers because they can make transactions quickly and without having to stand in queues. The bank's application allows you to conduct operations in a few minutes, which saves users time.

Internet banking has another advantage, namely, a low commission for the provision of services. Compared to paying for a similar transaction at a bank branch, the commission for using the bank's application is much lower.

Online service has not only enough advantages but also has certain disadvantages that need to be minimized and carefully regulated.

Internet banking has its main drawback - the high risk of fraud to which customers may be exposed. However, banks spend a significant amount of money on the development and improvement of protection systems in order to avoid this negative factor and ensure reliable protection of the personal data of customers.

So, the use of internet banking in the banking system of Ukraine has its advantages and disadvantages. It is positive that operations are carried out quickly, and the costs of the operation are reduced. Negative qualities are expressed in the high risk of fraudulent schemes.

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## IMPLEMENTATION OF FINANCIAL DECENTRALIZATION IN UKRAINE: BENEFITS, RISKS, AND CHALLENGES

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Global business experience shows that local authorities are able to understand and reform the economic, social, and political state of local development. At the same time, it is local authorities that can (and should) create favorable conditions for local economic growth, use all levers to attract investments, develop entrepreneurship, and small or medium-sized businesses, and promote job creation and self-employment.

The welfare of local residents, guarantees of replenishment of local budgets, growth rates of state budget revenues, and thus the growth of the country's welfare as a whole directly depend on the resolution of these issues. The process of transferring powers to the local level, increasing the capacity of local self-government, and expanding its powers, which are transferred from the "center to the grassroots level of territorial communities" on the principles of subsidiarity, is an objective basis for decentralization, and at the same time, an integral part of the territorial power reforming processes.

Decentralization implies that the local and regional level should be given as many powers (backed by resources) as the local authorities can actually master in order to fulfill their responsibilities, including the provision of public services and improving the well-being of people living in a particular territory. Among the urgent issues that real decentralization must solve is the involvement of citizens in solving urgent issues of local development, raising the self-awareness of citizens as "masters" of

the territory where they live, finding and using internal resources (those located in the territory) for the needs of regional development, and introducing effective incentives and levers aimed at stimulating economic growth in communities. Thus, decentralization covers a huge range of activities - from the development of the political consciousness of citizens, the formation of civil society, and the solution of economic issues of the development of a certain territory (territorial community). Decentralization is based on the provisions of the European Charter of Local Self-Government and the best international standards of public relations in this area. The policy of decentralization of power in Ukraine covers several stages:

- 2014-2019: The legislative framework for a fundamental change in the system of government and its territorial basis at all levels started to take shape in 2014. In April 2014, the Government approved the main conceptual document "Concept of Reforming Local Self-Government and Territorial Organization of Power". This was followed by the approval of the Action Plan for its implementation, which launched the reform. In order to implement the provisions of the Concept and the objectives of the Action Plan, it was necessary, first of all, to amend the Constitution of Ukraine and to develop a package of new legislation. The constitutional amendments were primarily intended to address the establishment of executive bodies of regional and district councils, the reorganization of local state administrations into control and supervisory bodies, and to provide a clear definition of the administrative-territorial unit - the community. Through the efforts of domestic specialists, practitioners, scholars, and experts, the draft amendments to the Constitution were developed and submitted for a broad public discussion. The proposed amendments were supported by the public and highly appreciated by the Venice Commission.

- 2020-2021: The Cabinet of Ministers of Ukraine has identified support for the decentralization reform in Ukraine as one of its priorities, which will contribute to the development of local self-government and the country's economic development as a whole. 2020 was a key year for the formation of the basic level

of local self-government: On June 12, 2020, the Government approved a new administrative and territorial structure of the basic level. In accordance with the orders of the Cabinet of Ministers, 1469 territorial communities were formed in Ukraine, covering the entire territory of the country. On July 17, 2020, the Verkhovna Rada of Ukraine adopted Resolution No. 3650 "On the Formation and Liquidation of Districts". According to the document, there are now 136 districts in Ukraine. The Parliament liquidated the old 490 districts. On July 15, 2020, the Verkhovna Rada of Ukraine adopted Resolution 3809 on the appointment of regular local elections for October 25, 2020. On July 16, the Verkhovna Rada of Ukraine adopted amendments to the electoral law.

On October 25, 2020, local elections were held on a new territorial basis of communities and districts. All of this creates a stable foundation for the next steps of local government reform and also helps to accelerate reforms in healthcare, education, culture, social services, energy efficiency, and other sectors.

- 2022 to the present: local authorities and united territorial communities operate under martial law. The powers of local governments are regulated in addition to the Law "On Local Self-Government" by the provisions of the Law of Ukraine No. 389-VIII "On the Legal Regime of Martial Law" of May 12, 2015. This law regulates, in particular, the establishment of military administrations. The functions of military administrations are similar to the functions of civil-military administrations established in some regions, districts and communities under the Law of February 03, 2015 No. 141-VIII "On Civil-Military Administrations". However, there are significant differences that had not been worked out by February 24, 2022, due to the lack of practice of martial law throughout the country.

Local self-government in Ukraine has proven its viability under martial law. In most regions, LGEs have retained their functionality and manageability, their ability to carry out effective governance at the local level in cooperation with the state authorities represented by the military and their heads.

## ВПЛИВ COVID-19 НА ЕКОНОМІЧНИЙ РОЗВИТОК

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Стрімке та неконтрольоване поширення коронавірусу у світі стало викликом цілому людству, дуже сильно позначилось на поточних соціально-економічних процесах як у глобальному, так і в національному масштабі та, безперечно, вплине на економічний та соціальний розвиток у майбутньому. Ситуація виявилася занадто не прогнозованою для всілякої економіки, яку не передбачав жоден прогноз соціально-економічного розвитку. Понад 80 країн закрили свої кордони. Підприємства та установи у кращому разі перейшли на віддалену/домашню роботу, у гіршому — запровадили «час простою». Через карантин закрилися школи приблизно для 1,5 мільярда дітей. Десяток світових економік зазнали тяжких втрат. Серйозні збитки зазнали туризм та готельний бізнес. За даними ВООЗ, смертність від коронавірусу в країнах з низьким рівнем доступу до послуг охорони здоров'я з точки зору можливості госпіталізації при гострому захворюванні значно вища, ніж у країнах із більш розвиненою економікою, системою охорони здоров'я та суспільного захисту.

Все вищевикладене свідчить про необхідність використання зважених рішень урядами країн світу та органами місцевого самоврядування, які у тісній взаємодії з провідними експертами, корпоративним сектором та населенням мають здійснити оперативні соціально-економічні рішення. Як під час карантину, так і наступні місяці після його закінчення. Перспективи подальших досліджень включають аналіз економічних наслідків карантину, втрат світової економіки після подолання коронавірусної хвороби, а також реальних заходів, які були вжиті для стабілізації фінансово-економічної ситуації на мікро- та макrorівнях.

## LOCAL SELF-GOVERNMENT AS A FACTOR OF FINANCIAL SYSTEM STABILITY UNDER MARTIAL LAW

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The main strategic objective of the current system of public administration and territorial organization of power is to form effective local self-government, create comfortable living conditions for citizens, and provide them with high-quality and accessible public services. Achieving these goals is impossible without an adequate level of economic development of the respective territories, their financial support, and sufficient sources to fill local budgets. The financial aspect is one of the most important, and it largely determines the success of territorial communities' functioning.

The presence of economically active business entities, a sufficient number of skilled labor resources, and developed industrial and social infrastructure - all these issues and much more are the basis for successful community development.

Territorial communities have passed the hard test during the war and have become the basic link that ensures the stability of the state's financial system. Local self-government in Ukraine has proven its viability under martial state. In most regions, local authorities have retained their functionality and controllability, and the ability to carry out effective local governance in cooperation with the state authorities represented by military administrations and their leaders. Within a few months, the territorial communities were able to restore their economic performance to the levels, which existed before the start of full-scale Russian aggression. This made it possible to ensure the sustainability of the home front, in particular with regard to the accommodation of temporarily displaced persons and the relocation of businesses. At the same time, the challenges in the functioning of local self-government are not diminishing. One of them was the rapid change in legislation under martial state. Communities face the consequences of this phenomenon almost



every day. It was the first months of the war that had a rather negative impact on the financial and material basis of local self-government. The state had to ensure stable economic conditions for business, so it introduced certain tax benefits, to which territorial communities also had to adapt. Providing local governments with stable and sufficient financial resources is the key to establishing a capable and effective local government. Moreover, without the financial independence of local budgets with their numerous components and without taking into account the tax potential of each territory, the construction and development of an effective national economy are impossible.

According to the official website [Decentralization.gov.ua](http://Decentralization.gov.ua), in 2022, local budgets received UAH 555.1 billion in revenues from general and special funds. Of course, the largest share was made up of tax revenues of UAH 393.5 billion, or 70.9% of all revenues. Official transfers accounted for 24.7%, which is UAH 137 billion, and non-tax revenues for 3.9%, which is UAH 22 billion. Considering the largest revenues to the state and local budgets, the key ones are PIT - UAH 272.2 billion.

Of course, this is due to a significant increase in cash payments to military personnel, as personal income tax on payments to military personnel accounted for one-third of UAH 33.3 billion (UAH 11.1 billion). Considering the monthly dynamics of personal income tax revenues from cash allowances, remuneration, and other payments received by military personnel and rank-and-file and senior officers in 2018-2022, a record increase in such revenues is noticeable, starting in March 2022. International aid amounted to UAH 114.6 billion, and the single tax to UAH 47.2 billion. The share of local budgets in consolidated budget revenues also increased from 22.8% in 2021 to 24.4% in 2022. Most of the funds from the state and local budgets are spent on the Armed Forces, pensions, and debt service.

The largest expenditures by budget programs in January-December 2022 (with a breakdown between state and local budgets) are exposed below.

In terms of sectors, the largest expenditures are for defense, followed by social security, order and security, and general government functions. Housing and communal services are fully covered by local budgets' own funds. Education remains the largest area of funding from local budgets as a delegated authority. In the structure of local budgets, it is the revenues of territorial communities that increased by 15% compared to the previous year in the general and special funds without transfers and own revenues of budgetary institutions. Regional budgets increased their revenues by 9% compared to the previous year, while district budgets, on the contrary, reduced the level of budget revenues by 28%. Since 2018, the budgets of territorial communities have shown the highest revenue growth rates, which once again confirms the effectiveness of the reforms and the efficiency at the local level. By taking over the powers of the district level, territorial communities have shown that they are able to effectively manage and increase the financial resources they receive. It should be noted that in 2022, the least negative impact was experienced by regional budgets, which redistribute financial resources as subventions from the state budget.

Targeted transfers (subventions) account for the lion's share of transfers - 83%. Grants account for only 17%. This indicates a significant dependence of local budgets on targeted transfers from the state budget and low autonomy in the management of funds received from the state budget, as subventions are targeted and do not allow local governments to freely dispose of such funds. This, in turn, reduces the autonomy of local budgets.

In total, in 2022, the Government implemented 52 programs of state-regional support for the development of territories, for which more than UAH 150 billion was allocated. The funds for such support were allocated to various areas. The state directed all these financial resources to the local level to create conditions for the dynamic and balanced development of the territories.

## THE USE OF INNOVATIVE TECHNOLOGIES IN TRADE

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L.V. Hnapovska – E L Adviser

Innovations constitute a powerful economic development mechanism because they improve the quality of goods and ensure the competitiveness of all branches of the national economy, including the sphere of trade. Introducing innovations allows enterprises to increase their competitiveness due to better satisfaction of consumer needs. The development of technology worldwide promotes the development of trade and technological innovations in this area. Accordingly, the study of the content and nature of the impact of innovative technologies on the development of commercial enterprises is timely. This study can lay the foundation for further research in determining the features of innovative technologies application and their impact on consumer behaviour in shopping malls. Hence, the prospect of further implementing the scientific research results in the working practices of domestic trade enterprises appears feasible.

To determine the actual state of application of innovations in trade and the level of their perception by consumers, as well as the presence/absence of prospects for introducing innovative trade technologies, particularly in the city of Sumy, a survey of the city's consumers was conducted. The sample included people of different age segments, different sexes, and social statuses. In total, 70 people were interviewed.

Respondents were asked to answer 20 questions related to introducing innovations in trade. In particular, the degree of public acceptance of novelties, their willingness to buy new products and the prospects of the Ukrainian market for introducing technologies in trade were determined. The respondents' answers formed diagrams for the most critical questions (See Fig. 1 below). The obtained results made it possible to draw the following conclusions.

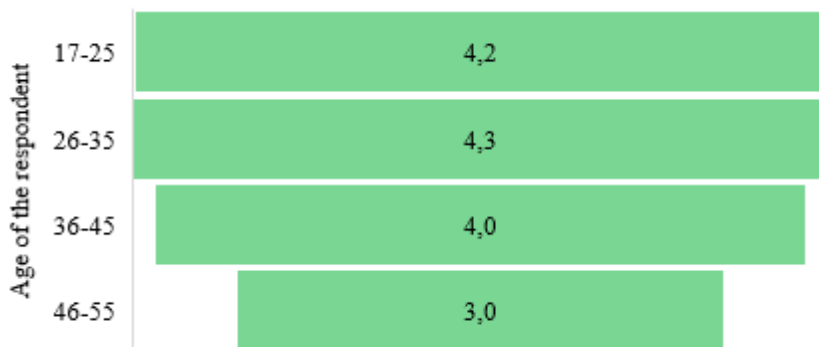


Figure 1 – Determining the level of consumer readiness to introduce innovations in trade

The study showed that people aged 26 to 35 are most willing to implement trade innovations (level 4.3), people aged 17 to 25 go second (4.2), and people from 46 to 55 are the least ready layer of respondents (3.0). However, their number was the smallest of all those questioned. Therefore, it can be concluded that the population is prepared to implement innovations. On average, their answers can be attributed to level 4 out of 5.

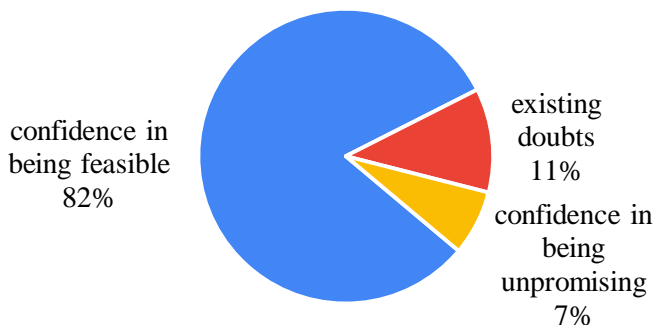


Figure 2 – Confidence in the prospects for the domestic market to introduce innovations in retail trade

In conclusion, it should be highlighted that the most significant part of respondents feels confident about the feasibility of innovations implementation (82%), some have doubts (11%), and a few interviewees claim that it is impossible to introduce

innovations (7%). Therefore, most of the population believes that innovations in retail trade are promising and appropriate in the Ukrainian market. Such a positive attitude is a driving force for developing trade in Ukraine.

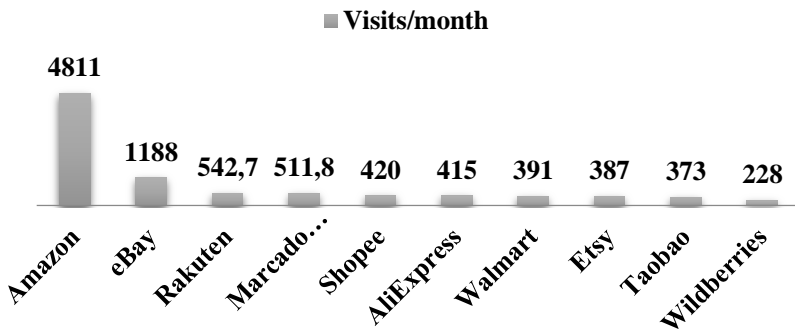
## THE PRESENT AND FUTURE OF 'MARKETPLACE' IN THE ERA OF RAPID TRADE DIGITALISATION

A. Yurchenko – Sumy State University, group ME-92a.en

L.V. Hnapovska – E L Adviser

Marketplaces currently play a key role in product integration and implementation in digital markets. Introducing a store on a foreign site requires minimal investment in terms of organising listing, creating an interface, and designing a strategy of notable visualisation for customers. However, it also requires a forced SEO promotion strategy and the usage of special optimisation software. To effectively promote products on international marketplaces, a more detailed strategy for improving keyword search listings should be applied.

Picture 1 below represents the current ranking of marketplaces worldwide [1].



Picture 1 - The world's top 10 online marketplaces by millions of visits per month

Statistics clearly demonstrate that currently the most popular e-commerce marketplaces are eBay and Amazon. This is quite logical because they have steadily strengthened their position as

the most guaranteed marketplaces in terms of resilience and unforeseen fluctuations in sales. The promotion policies of both companies have much in common. However, unlike Amazon, eBay has a more straightforward implementation strategy in this marketplace. Besides, verification on Amazon takes a longer time.

In case the company deals with handmade goods, the best option for it to integrate into an international marketplace would be to start selling on eBay and Etsy. As can be seen from Picture 1 above, Etsy is ranked 7th, being a marketplace selling only creative handmade products. This is a significant indicator of strengthened popularity in a specific industry, which in the context of digital sales can stand intense competition with high-tech goods.

To outstandingly increase the conversion rate, it is necessary to use all the optimisation tools to list the products, fill in their details, add categories of products for the buyers' convenience, respond to the buyers' communities within 24 hours, improve the product's outlook and create a competitive visual both in listings and in the store directly, optimise the discount policy and encourage customers to provide positive reviews.

A timely quality customer service is also considered an essential detail of any sales management strategy. This concept includes a transparent and competent description of listings; smart and polite communication with sellers; setting up store navigation by introducing the concept of categories for buyers' convenience; ensuring proper service to get positive customer feedback.

In general, basic forecasts for e-commerce and marketplaces are trending upward. Marketplaces are the concepts of the future, and hence, the development of commercial enterprises via collaboration with marketplaces will only increase revenue growth and enhance the company's market position.

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## SECTION 5 PRESERVATION OF A HEALTHY ECOLOGICAL ENVIRONMENT FOR FUTURE GENERATIONS

### ALTERNATIVE SOURCES OF ENERGY

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L.S. Otroshchenko – Ass. Professor

Undoubtedly, the role of alternative energy sources cannot be overestimated, and it is gaining momentum throughout civilized society. Alternative energy sources are becoming increasingly important as the world faces pressing environmental challenges, including climate change, air pollution, and the depletion of natural resources. Alternative energy sources do not use traditional methods of energy production, such as coal, oil, and gas. The main types of alternative energy sources include:

**Solar energy:** Solar energy uses the sun's energy to generate electricity or heat. Solar panels can be installed on rooftops, ground, or water.

**Wind energy:** Wind energy generates electricity produced by rotating wind turbines. Wind turbines can be installed on land or at sea.

**Hydro energy:** Hydro energy generates electricity produced by water movement. Hydroelectric power plants can be installed in rivers, lakes, or seas.

**Geothermal energy:** Geothermal energy is used to generate electricity produced by the heat from the earth's core. Geothermal power plants can be installed in areas with high volcanic activity or hot springs.

**Biomass:** Biomass is used to generate electricity or heat produced by burning plant and animal biomass.

**Hydraulic energy:** Hydraulic energy is used to generate electricity (hydroelectric, tidal, and wave power, pumped-storage hydroelectricity).

We want to present the exciting product of a small company called Pavegen. Employees of this organization have been

conducting research in the field of alternative energy for many years. Recently presented to the scientific world, the company's innovative invention is a high-tech tile for sidewalks. This development may seem strange to an ordinary observer, but experts in the energy field appreciated this innovation. The inventors made more than just the usual tiles covering the sidewalks of parks, squares, sidewalks, shopping malls, and train stations. As a rule, these tiles are made from piezoelectric crystals, which generate an electric current when subjected to mechanical impact.

The world community already had the opportunity to get acquainted with such a development in 2009. The functional component of that invention was also energy generation. The London firm has advanced much further in creating a new type of tile – harvested kinetic energy is also produced due to impact. The tiles have already been installed in almost 40 countries; they can generate up to five joules of energy per footstep.

It should be noted that Pavegen's energy-generating paving tiles are triangular. Small devices are installed on each of the device corners, which convert the energy of steps into electricity. One tile can produce up to around 3 joules of energy per footstep or up to 5 watts of power while someone is walking,

An essential indicator of the use of this invention is its multi-functionality. Paving tiles that generate energy can be installed in open spaces: parks, squares, pedestrian areas, bicycle paths, etc., and in various premises with high traffic: supermarkets, large shopping centers, and many others. The creators assure that the tiles can take various configurations; they can be hard or soft, depending on the field of application. With the help of paving tiles, for example, one can completely cover the field for playing football, basketball, or volleyball.

However, the technology is still in the early stages of development, and challenges such as durability, cost-effectiveness, and scalability are to be addressed. In the future, energy-generating tiles that generate energy through the steps could safely increase the scale of use. High-tech kinetic tiles, due



to their most minor environmental damage, represent an appealing opportunity. Overall, the importance of such alternative energy sources cannot be overstated. By transitioning towards cleaner and more sustainable energy sources, we can help protect the planet, improve human health, and create a more stable and prosperous future for future generations.

## DIGESTATE AS A BYPRODUCT OF METHANOGENESIS AND ITS COMPOSITION

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Biogas is formed as a result of the methanogenic fermentation of organic matter. However, gas is only 10% of the total biomass from which it is produced. The residue of biogas production from organic matter is called digestate.

It should be noted that the commonly accepted term for fermented slurry in domestic and foreign literature is denoted by different terms: effluent [1], biofertilizer [2], digestate [3], biogas sludge [4], biological sludge [4], and so on.

When digestate is separated, solid (sludge) and liquid (concentrate) fractions are formed.

The liquid fraction contains less than 5% dry matter and the majority of nitrogen and potassium [2]. It is either sprayed on fields or sent for reprocessing in an anaerobic reactor by mixing it with solid raw materials.

The solid fraction is composted with other organic waste [2] or mixed with sorbents such as peat, sawdust, soil, etc. [1]. The sludge is more convenient for storage and transportation in this form.

After additional dehydration, the solid waste is used for soil cultivation and mulching, as well as for preparing soil mixtures. In Western European countries, the solid fraction is used in the production of composite and energy materials.

Digestate is an organic mass (with a moisture content of 87-98% and a pH of 7.3-9.0) with an improved structure and practically no unpleasant odor. The value of such a mass lies in

the fact that nitrogen is stored in an ammoniacal (up to 50-75%) and organic form.

After the process of anaerobic fermentation, there is a significantly lower amount of pathogens, larvae, and eggs of worms compared to regular manure. It has been established that a higher disinfecting effect occurs with higher temperatures and longer substrate retention times in the reactor. The destruction of pathogenic microflora and parasites begins during mesophilic fermentation (33-38°C) and reaches its maximum in the case of thermophilic fermentation (53-55°C) [2].

M. P. Kuchynskyi, S. S. Lypnytskyi, A. V. Kaminskyi (Institute of Experimental Veterinary Medicine) have noticed a radical reduction in the overall amount of microbiological contamination by approximately 50-65% [2].

Scientists from other foreign countries also report the destruction of 90% of animal pathogens during anaerobic processing and complete or partial destruction of plant pathogens under mesophilic conditions [5].

Anaerobic fermentation contributes to reducing the amount and spread of pathogens and the occurrence of diseases in agricultural animals. Agricultural waste contains a large amount of weed seeds that greatly affect the effectiveness of effluent.

Therefore, digestate is a highly effective organic fertilizer that undergoes stages of fermentation, destruction of harmful substances, and contains elements beneficial to plants and soil.

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## LIGNOCELULOSE AS A RAW MATERIAL FOR PRODUCTION OF BIOFERTILIZER

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The development of modern technology has led not only to the appearance of new products and materials, but also to the waste of various composition, which is still difficult to include in cycles for further use. This important aspect can be illustrated with the example of methane fermentation in biogas plants, the gas that emerges in this process makes up about 10% of the total biomass. The rest is organic matter, which is called digestate and can be used as biofertilizer. Its use increases fertility and maintains a high content of organic substances in the soil and gradually releases trace elements. The composition of the digestate depends on the origin of the raw material for fermentation in the biogas plant. Agricultural and food waste, sewage, sludge, etc. can be used.

For example, the use of lignocellulose in the production of biogas is quite practical, since there are many sources of its formation and its use as a substrate for fermentation will reduce environmental pollution. Lignocellulose is the main carbon source for solid agricultural waste in anaerobic digestion, but it is difficult to biodegrade due to the stable structure of the biomass.

Lignocellulosic includes waste from grain harvesting, processing of corn, wheat, rice, soybeans, processing of

vegetables and fruit, sugar cane, wood harvesting, production of lumber and plywood, activities of pulp and paper mills, etc.

However, application of digestate in its pure form would be a mistake, as it can lead to the secondary environment with heavy metals, fungal spores, microorganisms, chemicals, weed seeds, etc. Such recklessness may cost additional economic costs and additional measures, and it will take some time for the geosphere to resume its natural cycles. Therefore, the use of effluent requires preliminary treatment.

In the study the following research methods are used: physical (mechanical), chemical, biological.

Further disinfection of the digestate is needed to prevent contamination of the environment with substances and microorganisms that have proven resistant to fermentation processes.

Thus, the use of digestate as a biofertilizer allows to increase the yield and maintain a high content of organic substances in the soil. Its composition and effectiveness depends on the substrate. The use of biological sludge requires preliminary treatment and subsequent disinfection in order to minimize the possible pollution of the environment by pollutants. As a possible substrate, lignocellulose was considered, since it is quite accessible for research and difficult to biodegrade, and therefore accumulates in significant volumes of waste, which makes it an object of interest.

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## THE IMPACT OF ASH AND SLAG WASTE FROM THERMAL POWER PLANTS ON THE ENVIRONMENT

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The usage of energy resources is one of the essential conditions for the existence and development of human civilization. The development of society leads to an increase in the energy needs of society, particularly in electricity and heat energy. Currently, thermal power plants are the most common producers of heat and electrical energy in Ukraine. Approximately 40% of electricity in our country is generated by thermal power plants [1].

At the same time, they are the most powerful anthropogenic impact on the natural environment. The impact is multifaceted, i.e., it affects all components of the biosphere simultaneously: the atmosphere, hydrosphere, lithosphere, and is also wide-scale, which means that it manifests itself not only at the local but also at the regional and global levels [2].

An increase in consumption leads to an increase in the amount of solid fuel burned. Meanwhile, the number of solid ash and slag wastes stored in ash dumps also increases.

Ash dumps are hydro-technical structures designed to store ash and slag waste, the territory of which is limited by enclosing dams and the relief of the area [3].

There are two constant processes in the ash dump. The first is the evaporation of water, which forms so-called "beaches" - dry areas with dust particles due to the wind. The second process is

the infiltration of water (illuminated or even partially uncleaned), which carries dissolved toxic components of ash and slag waste into groundwater and reservoirs outside the ash dump [4]. Thus, ash dumps, despite their enclosed territory, are open systems [5]. Transporting ash and slag in a dry state to ash dumps requires additional measures to suppress dust formation. The application of such technologies also rises the amount of ash output [6].

Ash dumps, prone to dust formation, worsen the sanitary and hygienic situation in the adjacent areas, reduce the production resources of machines and mechanisms, and sometimes have a negative impact on the products from adjacent agricultural land [4].

According to environmental laws, it is impossible to create completely "zero-waste" thermal power plants. However, thermal power plants can be classified as environmentally safe (or low-waste) if their negative impact on the environment during operation is minimal and within the limits of the biosphere's self-purification ability [1].

Therefore, ash dumps of thermal power plants have a comprehensive impact on the environment: they cause disruption in the geological environment, contribute to soil contamination during filtration and aeration transfer of pollutants from the surface of the dump, and are potential sources of pollution of natural waters.

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Наукове видання

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