The educational technology landscape in Ukraine

Maryna V. Nehrey[1,2], Larysa M. Zomchak[3]

[1]*National University of Life and Environmental Sciences of Ukraine, 15 Heroyiv Oborony Str., Kyiv, 03041, Ukraine*
[2]*Eidgenössische Technische Hochschule Zürich, Main building, Rämistrasse 101, 8092 Zurich, Switzerland*
[2]*Ivan Franko National University of Lviv, 1 Universytetska Str., Lviv, 79001, Ukraine*

Abstract

The adoption of digital technologies in education has accelerated rapidly in recent times, driven by technological progress and catalyzed by the global COVID-19 pandemic. This article analyzes the present landscape and future prospects for Educational Technology (EdTech) in Ukraine. Efficiency analyses using Data Envelopment Analysis methodology reveal substantial opportunities for Ukraine to enhance educational outcomes via increased investment and technology integration. Ukraine's EdTech startup ecosystem has expanded to over 80 companies delivering solutions spanning tutoring, language instruction, MOOCs, K-12 education, STEM fields, robotics, learning management platforms, and more. However, a strategic assessment indicates the ecosystem currently faces more challenges and risks relative to advantages and possibilities. Major obstacles include high financial costs, regulatory impediments, underdeveloped technical infrastructure, resistance to change among educators, and limited data on the impact of EdTech. For Ukraine to fully realize the potential of EdTech, concerted efforts are needed to boost public and private investment, fast-track digitalization initiatives, foster an enabling environment for EdTech enterprises, and develop educators' capacity to effectively incorporate technology. With focused strategic interventions, EdTech can serve as a key engine for expanding access, elevating quality and driving efficiency gains in Ukraine's education system.

Keywords

educational technology, Ukraine, digitalization, efficiency, COVID-19, startups, technology integration, government policy, teacher professional development

1. Introduction

Innovation in technology is swiftly reshaping all facets of society, and the education sector is no exception. However, the speed of digitalization in education has traditionally trailed other industries due to elevated costs, sophisticated functionality of solutions, and inertia in evolving pedagogical methods [1, 2]. The COVID-19 pandemic marked a turning point, compelling educational institutions globally to rapidly transition to distance learning modalities and spurring investment and adoption of educational technologies [3, 4].

In Ukraine, the EdTech sector was already expanding before the pandemic but has since experienced a boom. By 2020, the Ukrainian EdTech ecosystem encompassed over 80 startups offering products and services targeting learners across age groups. This paper aims to evaluate the existing landscape and future outlook for EdTech in Ukraine, exploring key trends, prominent companies, opportunities and challenges.

2. Education efficiency analysis

The evaluation of the effectiveness of education in Europe and Central Asia by the Data Envelopment Analysis (DEA) method, where the input – Expenditure on education, output – GDP per capita (figure 1).

The results of the analysis showed that effective education (efficiency coefficient equal 1) in Greece, Italy, Ireland, and Switzerland. Norway, France, Austria, Germany, Finland, the Netherlands, and Iceland

AREdu 2023: 6th International Workshop on Augmented Reality in Education, May 17, 2023, Kryvyi Rih, Ukraine
marina.nehrey@gmail.com (M. V. Nehrey); lzomchak@gmail.com (L. M. Zomchak)
https://scholar.google.com.ua/citations?user=NkrrNKAAAAAJ (M. V. Nehrey);
https://econom.lnu.edu.ua/employee/zomchak-l-m (L. M. Zomchak)
0000-0001-9243-1534 (M. V. Nehrey); 0000-0002-4959-3922 (L. M. Zomchak)

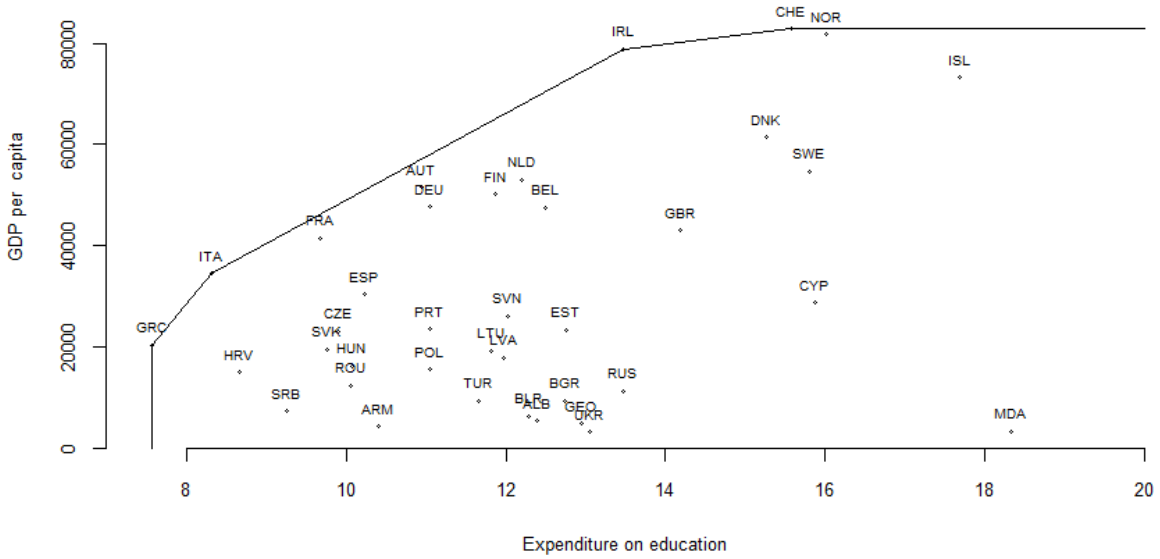

Figure 1: Data Envelopment Analysis of expenditure on education.

are close to the efficiency curve. That is, European countries, in general, have experience in the effective expenditure on education. As for Ukraine, the expenditure on education is extremely inefficient, a similar situation in Georgia, the Russian Federation, and Moldova (ie in the countries of the former USSR).

Employee education is the key to a company's success. That is why companies try to get highly educated employees and maintain their qualifications at a high level. To assess the effectiveness of education in Europe and Central Asia, built a model of DEA, where inputs – GDP per capita, Internet users (per 100 people), Expenditure on education as (% School-age population, output – Labor force with advanced education (% of the total labor force). The simulation results are shown in the table 1.

Table 1
Data Envelopment Analysis of education effectiveness.

Efficiencies range	Number of countries	%	Countries
$0.7 \leq E < 0.8$	5	11.4	Belgium, Denmark, Germany, Netherlands, United Kingdom
$0.8 \leq E < 0.9$	10	22.7	Austria, Czech Republic, Finland, France, Ireland, Norway, Russian Federation, Spain, Sweden, Switzerland
$0.9 \leq E < 1$	8	18.2	Albania, Belarus, Bulgaria, Hungary, Italy, Poland, Slovak Republic, Slovenia
$E = 1$	21	47.7	Croatia, Cyprus, Estonia, Georgia, Greece, Iceland, Latvia, Lithuania, Luxembourg, Moldova, Portugal, Romania, Serbia, Turkey, Ukraine

DEA model analyzing efficiencies by VRS technology and input orientated efficiency. A number of countries with efficiency equal 1 are 21 out of 44, mean efficiency: 0.922.

The results show that efficiency is lower in those countries that incur significant expenditures on education. Conversely, countries with low spending on education have shown high efficiency. For

example, Ukraine has an efficiency of 1, Labor force with advanced education – 72.15, GDP per capita – 3095.17, Internet users (per 100 people) – 89.74, Expenditure on education – 13.05, School-age population – 3.9 million. Germany, the efficiency of which is 0.72, has Labor force with advanced education – 73.56, GDP per capita – 47603, Internet users (per 100 people) – 71.13, Expenditure on education – 11.04, School-age population – 2.5 mln.

Analysis of education efficiency in different countries has shown that there is great potential for productivity increases. Therefore, the implementation of innovations in education is promising.

3. Investing in educational startups

Holon IQ is an international analytical agency founded in 2018 [5]. Initially, the company invested in educational startups but switched to market analysis to help more projects. According to the Holon IQ estimates (figure 2), global education venture capital funding in 2022 decreased to $10.58 billion, which is more than twice lower that in 2021. Logically, this is a direct consequence of the COVID-19 pandemic and the quarantine that forced everyone around the world to go online. In the context of expected changes in the structure of the labor market, EdTech tools will continue to be in demand for the acquisition of new skills and retraining of employees. Note that China invests the most in educational programs, for example, US funding is 2 times less than China, and European funding is 10 times less (in total for the last 10 years).

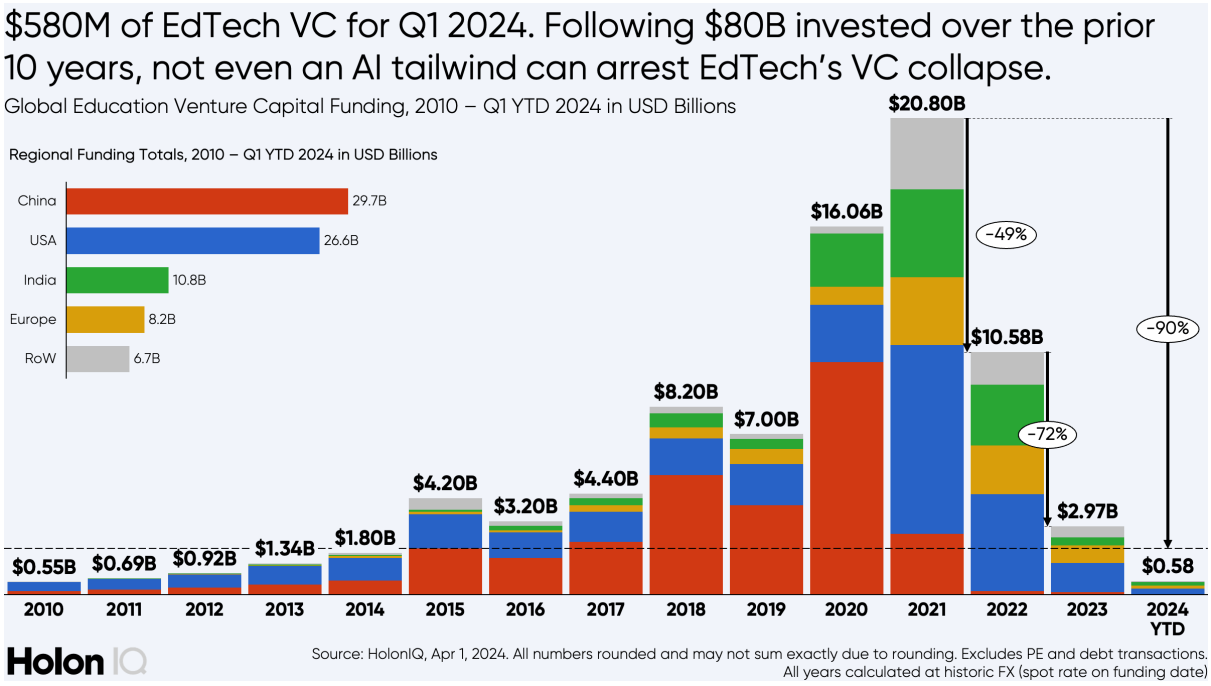

Figure 2: Global education venture capital funding, 2010–2023 in USD Billions [6].

Globally, most major markets have followed a similar trajectory with steady climbs into the pandemic, followed by 2-3 year surges in investment before falling back to investment levels not seen for around 7 years in Europe, 10 years for the US and nearly 15 years in China.

HolonIQ listed the 200 best EdTech companies in Europe, where 11 projects from Ukraine are included. The rating is based in:

- companies market positions;
- demand and quality of products;
- financial stability;
- attractiveness for investment;

- development progress and dynamics;
- project team.

Ukrainian EdTech projects listed in the HolonIQ rating:

- Basenji Apps – applications for English learning;
- EnglishDom – online school of English learning;
- Enguide – service for choosing English courses in Kyiv;
- Speechyard – service for learning English by movies;
- Besmart – preparation courses for final exams at school;
- SkillUp – training courses for IT specialists;
- Skyworker – service for finding IT vacancies;
- Jooble – job search service;
- Parta – educational portal;
- Studway – media about education;
- Vseosvita – service for continuing education.

As we can see, the most popular are services for learning English. But there are nearly 80 digital education projects in the Ukrainian EdTech landscape. EdTech Landscape map of Ukraine for 2020 (figure 3) was proposed by Vadym Synzheretskyi (CEO and co-founder of BUKI online platform for tutors).

4. Ukraine EdTech ecosystems analysis

Synzheretskyi [8] proposed to cluster EdTech ecosystem of Ukraine in such a way: Tutoring; Language learning; MOOC; School Education (K-12); STEM & coding, Robotics; Information platforms; For teachers; LMS (learning management system); IT Education; Upskilling; Tools; Talent. Let's look at the examples from each group.

Preply [9] is an online educational platform that connects tutors and teachers (from 185 countries) with students, locally or virtually via Skype. In March 2020, the Ukrainian EdTech marketplace for the study of foreign languages Preply got $ 10 million, almost twice the amount of all previous investments ($ 5.6 million). The service uses machine learning algorithms to match tutors. The company plans to launch new tools for teachers that will help assess homework, monitor progress, and help students more effectively. The company also plans to develop a mobile application for Android and iOS.

EnglishDom [10] is an online English school and at the same time an IT company that inspires to learn English through technology. The company is one of the leaders in the field of EdTech in Eastern Europe. The EnglishDom platform includes 5 innovative services for learning English, including mobile applications and an interactive digital textbook. The service unites more than 500 English teachers and 50,000 users.

Prometheus [11] is a mass online courses platform called "Ukrainian Coursera". The main goal of the project is to provide free online access to university-level courses to anyone, as well as to provide opportunities to publish and distribute such courses to leading professors, universities, and companies. Upon completion of the course, the student receives a certificate signed by the best teachers of Ukrainian universities. Today the platform has more than 300 thousand active users. Prometheus has organized its free online in-service training courses for educators in accordance with the requirements of the Procedure for in-service training of pedagogical and research and teaching staff. Prometheus online course certificates for educators can be officially credited as advanced training.

EdPro [12] is one of the few Edtech solutions for school education. This interactive panel can replace several objects in the classroom at once – a blackboard, a projector, an interactive screen, and a computer. In such panels, teachers can show students presentations, videos, graphics, or images during lessons. Instead, students can solve learning tasks, count, or edit texts right away. Along with the board, they also developed an interactive software solution for education with illustrations and

Figure 3: EdTech Landscape of Ukraine [7].

animations. Apparently, the next interesting area of EdTech will be the use of augmented and virtual reality technologies. The development of this area will lead to the fact that students will increasingly move from passive to active learning and will be able to interact in real-time with educational material, which will stimulate their motivation and increase the level of interest. This opens up exciting prospects for teaching new generations.

Osvitoria [13] propose interesting and up-to-date news about modern education and stories on how to change the system of education in any conditions and become a better version of yourself every day. They create a user-friendly platform for teachers and parents to help them find answers to their children's education and upbringing and to involve parents in the learning process. They try to give teachers effective tools for communication, the opportunity to learn about the best practices of teaching abroad, the latest news on education reform.

In addition to quality analytics, there are many different selections, articles about the needs of students and teachers with options for proposals that can be done in a particular situation. Teachers

can take great advice to improve their work, and parents - to improve the well-being or performance of their children.

The educational project **Na Urok** [14] aims to objectively cover the modern educational process and bring it to a qualitatively new level. This became possible due to the implementation of versatile and thorough work: writing informative articles related to school and extracurricular life; conducting thematic webinars; introduction of various educational competitions; attracting the best developments in school subjects from teachers from all over Ukraine. The project aims to help teachers feel their own significance because each teacher in the project will be able to publish their own professional achievements or use the work of colleagues. The project is set up to work closely with educators who want to share their experiences on the Internet. The Na Urok team makes a significant effort to ensure that teachers, parents, and students can find the maximum amount of useful theoretical and practical materials for the school on the portal.

The **eTutorium** [15] project aims to organize distance learning through the implementation of effective IT solutions. The project arose in 2008 from attempts to create their own webinar platform to conduct online events. After analyzing the needs of the eLearning market, in 2010 the team moved on to developing solutions for online tutors. Today, the platform hosts between 3,200 and 5,000 webinars per month. In 2015, we launched the eTutorium project, combining an updated platform for eTutorium Webinars and eTutor Academy – the Academy of Tutors, where we share our experience and knowledge in the field of online learning. In 2019, they created eTutorium LMS – a system of distance learning, with which you can not only collect courses but also fully organize the learning process online.

Mate academy [16] is an online platform for learning programming and finding your first job in IT.

Table 2
Comparative study of the EdTech projects.

EdTech project	Type	Advantages	Disadvantages
Preply	Tutoring	Reaching a large audience. The use of machine learning in management.	Communication local or Skype. Absents of mobile applications.
EnglishDom	Language learning	Use innovative services and mobile applications. Reaching a large audience.	Lack of offline support.
Prometheus	MOOC	Use mobile applications. Reaching a large audience.	The audience is limited to Ukrainian-speaking users.
EdPro	School Education	Use innovation technologies. Good motivation for students. Opportunities for different applications.	High cost of the product
Osvitoria. Media	LMS	A large amount of information about various aspects of the educational process	Lack of mobile application
Na Urok	Information platforms	A good motivational approach. Coverage of a large number of educational topics.	No mobile application. A small audience of parents and students.
eTutorium	For teachers	A successful solution for organizing online learning. Great prospects for further development.	Having strong competitors with free solutions.
Mate academy	IT Education	Opportunities to expand the audience. Large set of programming courses.	Risks of non-payment for training.
Grammarly	Tools	Ease of use. Wide audience of users. Constant demand for products.	English spelling only.

The training lasts 4-5 months and takes place online. Now in the portfolio of Mate academy courses includes Java, Front-end, Full Stack Web, UI / UX Design. The peculiarity of the platform is that students pay for their studies only in case of employment, giving a percentage of the new salary. During the existence of Mate academy, more than 200 students got jobs. In 2020 the company was planning to open a business in new markets; They looked at the country, where there is a great demand for engineers and the road, for no worse than the knowledge. The aim of the company in 2022 there were a number of thousands of engineers in Ukraine and the English regions – for example, Great Britain and India.

Grammarly [17] is one of the most famous Ukrainian startups. This is a service for checking written texts. It helps to correct grammatical and stylistic errors. A free version is available, as well as Premium, which expands access to additional features. The company's head office is now located in Silicon Valley, and the service was founded by three Ukrainians. In 2019, it became known that the total amount of investment in Grammarly is about $ 200 million (5 billion hryvnias). This funding has raised the company's total value to more than $ 1 billion. So from now on the Ukrainian startup can be officially called a "unicorn". Grammarly services are now used by millions of regular users around the world. We are talking only about English-speaking users, the developers do not plan to expand the number of languages for testing yet. As of 2020, 30 million people use Grammarly services every day.

5. SWOT analysis on EdTech system of Ukraine

The key task of education in modern conditions is to change, adapt to new conditions, and develop. The analog world is becoming increasingly fragile, and the digital world is becoming antifragile. COVID-19 not only posed threats to agriculture but also opened up new opportunities, in particular in digitalization and the introduction of innovative technologies. In our opinion, education in Ukraine needs the introduction of a significant number of EdTech, which will accelerate the development of education and increase its efficiency. SWOT analysis of the EdTech startup ecosystem is presented in table 3.

Table 3
SWOT analysis on EdTech system.

INTERNAL FACTORS	
Strengths	**Weakness**
The government starts to implement digital technology in education. There is a demand for digital education and innovative technologies in education from both business and private. Effective solutions that promise an increase in productivity	The high cost of innovative technologies. Problems with finding financing. The delayed effect of digital technologies implementation can decrease the effect of its realization. Unreadiness for change. The established habits of teachers and the lack of new skills and abilities. Bureaucratic hurdles for starting a business. Underdeveloped IT infrastructure Lack of information on the effectiveness of EdTech.
EXTERNAL FACTORS	
Opportunities	**Threats**
Education is a big area with a lot of students and pupils, which can demand many EdTech projects. The application of EdTech produces a lot of data that can be used for agriculture development. EdTech can significantly reduce the need for teachers and administrated staff.	If the EdTech is not reliable enough and accessible to attackers, the danger may arise for education. The probability of different EdTech results in different conditions. Access to data can increase inequalities, impede competition, and create economic barriers.

6. Conclusion and future work

Nowadays education needs to improve and increase efficiency. EdTech can become exactly the direction that will promote the active development of education, increase its accessibility and improve its quality. Analysis of the effectiveness of education has shown that the countries of Europe and Central Asia have significant potential for the development of education.

The EdTech startup ecosystem is characterized by more weaknesses and threats than strengths and opportunities. Ukrainian education has significant potential for increasing efficiency and development. To ensure the realization of this potential, it is necessary to do the following:

- increase government spending on education, in particular on the development of innovative technologies;
- ensure access of EdTech to financing;
- accelerate the process of digitalization of education, in particular, to promote the spread of affordable ICT and introduce e-government;
- increase the interest of non-governmental organizations in the introduction of innovative technologies in education;
- create favorable conditions for the development of EdTech ecosystems.

Further development of the EdTech startup ecosystem can be a key solution for the development not only in Ukraine but also around the world.

References

[1] O. V. Bondarenko, O. V. Hanchuk, O. V. Pakhomova, I. M. Varfolomyeyeva, Digitalization of geographic higher education: Problems and prospects, Journal of Physics: Conference Series 2611 (2023) 012015. doi:10.1088/1742-6596/2611/1/012015.

[2] A. V. Morozov, T. A. Vakaliuk, I. A. Tolstoy, Y. O. Kubrak, M. G. Medvediev, Digitalization of thesis preparation life cycle: a case of Zhytomyr Polytechnic State University, in: T. A. Vakaliuk, V. V. Osadchyi, O. P. Pinchuk (Eds.), Proceedings of the 2nd Workshop on Digital Transformation of Education (DigiTransfEd 2023) co-located with 18th International Conference on ICT in Education, Research and Industrial Applications (ICTERI 2023), Ivano-Frankivsk, Ukraine, September 18-22, 2023, volume 3553 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2023, pp. 142–154. URL: https://ceur-ws.org/Vol-3553/paper14.pdf.

[3] S. O. Semerikov, T. A. Vakaliuk, I. S. Mintii, V. A. Hamaniuk, V. N. Soloviev, O. V. Bondarenko, P. P. Nechypurenko, S. V. Shokaliuk, N. V. Moiseienko, V. R. Ruban, Mask and Emotion: Computer Vision in the Age of COVID-19, in: Digital Humanities Workshop, DHW 2021, Association for Computing Machinery, New York, NY, USA, 2022, p. 103–124. doi:10.1145/3526242.3526263.

[4] S. G. Fashoto, Y. A. Faremi, E. Mbunge, O. Owolabi, Exploring structural equations modelling on the use of modified UTAUT model for evaluating online learning, Educational Technology Quarterly 2024 (2024) 319–336. doi:10.55056/etq.734.

[5] HolonIQ. Global Impact Intelligence, 2024. URL: https://www.holoniq.com/.

[6] EdTech VC collapse at $580M for Q1. Not even an AI tailwind could hold up this 10 year low, 2024. URL: https://www.holoniq.com/notes/edtech-vc-collapse-at-580m-for-q1-not-even-an-ai-tailwind-could-hold-up-the-10-year-low.

[7] T. Gritcyk, Predstavlena vtoraia versiia karty ukrainskikh obrazovatelnykh proektov — EdTech Landscape 2.0 (The second version of the map of Ukrainian educational projects is presented – EdTech Landscape 2.0), 2020. URL: https://ain.ua/2020/09/16/edtech-landscape-2-0/.

[8] V. Synzheretskyi, [TechUkraine news] EdTech Landscape of Ukraine 2020, 2020. URL: https://techukraine.org/2020/04/16/techukraine-news-vadym-synzheretskyi-ceo-of-%D1%80%D0%B5/.

[9] Learn languages with expert online tutors. Book your lesson today!, 2021. URL: https://preply.com/.

[10] Anhliiska po Skaipu - navchannia anhliiskii movi po Skype v EnglishDom, 2021. URL: https://www.englishdom.com/.
[11] Prometheus – Naikrashchi onlain-kursy Ukrainy ta svitu, 2021. URL: https://prometheus.org.ua/.
[12] Interaktyvna panel EdPro, 2021. URL: https://edpro.ua/.
[13] Osvitoria, 2021. URL: https://osvitoria.org/en.
[14] Osvitnii proekt "Na Urok" dlia vchyteliv, 2021. URL: https://naurok.com.ua/.
[15] Platforma eTutorium Webinar — maidanchyk dlia provedennia vebinariv ta treninhiv, 2021. URL: https://etutorium.com.ua/.
[16] Kursy Prohramuvannia i Dyzainu onlain z pratsevlashtuvanniam v Kyievi | Mate academy, 2021. URL: https://mate.academy/.
[17] Grammarly: Free Online Writing Assistant, 2021. URL: https://www.grammarly.com/.