

Educational Technology Market Analysis

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Abstract — Last time the educational technology market EdTech has shown significant growth, the dynamics of which exceed the growth of other markets attractive to startups. The article provides an analysis of EdTech market trends, primarily in terms of the development of promising technologies and their application for education and training, including new multimedia, VR, AR, IoT, AI, robotics, gamification, mobile learning, as well as new educational solutions: educational platforms, online educational services and applications, educational games, adaptive educational systems, educational social environments, new devices for learning, new techniques for knowledge evaluation and formative assessment, automation of learning processes, innovative techniques of functional literacy and competencies of the 21st century development, peer to peer learning (P2P), interactive educational projects and so on.

Keywords — *educational technology; EdTech; teaching; learning management system; marketing*

I. INTRODUCTION

The market of educational technologies EdTech, according to analysts, marketing agencies and scientists, is one of the most promising sectors of the global economy. The EdTech business is actively developing primarily due to the high-tech technological advances for education and training, which contribute to the emergence of innovative pedagogical techniques, new ways of delivering educational content and new communications in education. EdTech's market forecasts are based on statistics from previous years, trends and expert opinions, but they have all changed significantly due to limitations caused by the COVID-19 pandemic. This article attempts to identify new factors for the correction of existing forecasts by analyzing intermediate business results for the first half of 2020, the opinions of analysts and futurologists. The task is difficult due to the lack of relevant information and the ongoing limitations of the pandemic, but this work is extremely important precisely in times of crisis and limitations to identify new risks and opportunities. The interest of our research extends to the Russian Edtech market.

II. EdTECH CONCEPT AND FRAMEWORKS

A. EdTech as pedagogical phenomenon

Educational technology (instructional technology) in pedagogical theory referenced by UNESCO means ‘the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources’ [1]. The same meaning

was originally laid down in the abbreviation EdTech. Recently, however, the concept of EdTech is directly associated with the use of technical training tools, computer applications and Internet communications [2]. Another common understanding of EdTech is directly related to the market of technical training support and related business models, as well as the term EduNet, taken as the basis for the development one area of the National technological initiative project of the Russian Agency for Strategic Initiative [3]. Whereas 10 years ago simply providing computers with classrooms was called EdTech, today EdTech refers to an area of technology devoted to the development and application of tools (including software, hardware, and processes) intended to redesign traditional products and services in education [4].

In this study, we will focus on the prospects for the development of the education market based on technical and technological achievements.

B. EdTech Market Specification

EdTech market traditionally include the following technologies by marketing agencies (Frost & Sullivan, Reportlinker, Businesstat, MarketsandMarkets):

- by educational systems: learning management systems (LMS), learning content management systems (LCMS), learning content development systems (LCDS), student response systems (SRS), assessment systems, collaboration systems, classroom management systems, document management systems, content creation systems, proctoring systems;
- by educational hardware: smart classroom equipment, such as interactive whiteboards and screens, multimedia projectors, interactive displays, 3D-printers, interactive tables, audio systems, ICT equipment, others (document cameras, educational PC, digital ink-pens, electronic paper screens, mobile labs, docks replicators and so on);
- by educational purposes: educational gaming, educational analytics, educational enterprise resource planning (Ed ERP), educational security, educational dashboard, educational simulators & training apparatus;
- by innovative technologies: artificial intelligence (AI), virtual, additional & mixed reality (VR/AR/MR), neuro technology, quantum computing, robotics, IoT.

According to the Dmitry Voloshin [5] EdTech include such new educational solutions as educational applications, online learning platforms, educational games, adaptive educational systems, educational social environments, new devices for training, new forms for testing knowledge, automation of educational processes, innovative educational techniques, P2P (peer to peer) training, interactive educational projects, mobile learning, micro learning, just in time learning and personal assistance in education.

According to EdMarket.Digital [6] the entire global education market in 2019 was estimated at \$6.5 trillion with share of EdTech about 3%. Russian education market was estimated at \$31 billion (0.5% of the world) with share of EdTech about 1%. According to Interfax [7] the total annual EdTech market growth (CAGR) averages 14.0%, the growth of the Russian market is estimated at 20-25% and will be at least \$20 billion by 2035.

III. RESEARCH METHODS

Since the main sources of data for market research are statistical reports from previous periods, all existing reviews reflect trends before the coronavirus pandemic. Our study aims to make corrections to previously made forecasts, taking into account current factors and business results. To clarify the forecasts, we used information from the official websites of the education providers, manufacturers and suppliers of technological equipment for education, educational organizations, educational authorities, nongovernment institutions of development, as well as the results of foresights and the opinions of market experts, which were clarified by comparative analysis and generalization.

The polls conducted were intended to put forward new hypotheses, and not to confirm old one. Of particular interest are unusual points of view and insights, which can lead to ideas appearing for innovations and new businesses.

IV. MARKET RESULTS AND TRENDS

A. Global Market Results

According to HolonIQ [8] EdTech market showed a 14-fold increase in investments in venture capital from \$500 million in 2010 to \$7 billion in 2019. In the first half of 2020 EdTech raised \$4.5 billion, which is the highest decision in the sector. They are reconfirming their expectation that over \$87bn will be invested in EdTech over the next 10 years. As of July 2, 2020, there are 19 EdTech unicorns in the world that have collectively collected over \$9 billion in total funding over the past decade. Together, 42 market leaders received nearly \$16 billion in funding from investors (table 1).

TABLE I. GLOBAL EDTECH LEADERS

№	Global EdTech Leaders (unicorns)			
	Company	Country	Cluster	Valuation
1	ByJu's	India	Tutoring	~\$10.0B
2	Yuanfudao	China	Tutoring	\$7.8B
3	Zuoyebang	China	Tutoring	\$6.5B
4	VIPKid	China	Language	\$4.5B

№	Global EdTech Leaders (unicorns)			
	Company	Country	Cluster	Valuation
5	Udemy	United States	MOOC	\$2.0B
6	Coursera	United States	MOOC	\$1.7B
7	Duolingo	United States	Language	\$1.5B
8	ApplyBoard	Canada	International Recruitment	\$1.4B
9	Course Hero	United States	Study Notes	\$1.1B
10	Quizlet	United States	Study Notes	\$1.0B
11	Guild Education	United States	Upskilling	\$1.0B+
12	Knowbox	China	Tutoring	\$1.0B+
13	iTutorGroup	China	Language	\$1.0B
14	Zhangmen	China	Tutoring	\$1.0B+
15	Huik	China	OPM	\$1.0B
16	17zuoye	China	Tutoring	\$1.0B
17	Age of Learning	United States	Online Curriculum	\$1.0B
18	Udacity	United States	Proprietary Online	\$1.1B
19	Hujiang	China	Online Curriculum	\$1.0B

Source: HolonIQ

B. COVID-19 Global Impact

The COVID-19 crisis has had a significant impact on the earnings of many companies. All sectors of the economy are more or less affected. According to Moscow Agency of Innovations [9] forecasts, global GDP growth will decline from 2.5% to 1-1.5%. Many universities in the world are forecasting a sharp drop in income. More than 30% of public universities and almost 30% of private universities experience financial difficulties and a shortage of funds due to the need to refund money for shortened semesters (fees for living on campuses, etc.). The rating Moody's has lowered its outlook for higher education from "stable" to "negative". Most likely, this will lead to the closure of a number of universities in 2020.

According to 'Global EdTech Report 2020' [10] coronavirus had a multidirectional effect on the EdTech market. Negative results are GDP slowdown, a decrease in education income, especially in the corporate sector, and an increase in debts citizen and providers. Positive results include increased access to resources and digital acceleration. The first phase of the COVID-19 pandemic led to an immediate shift in supply chains and consumer demand, with various online reversal opportunities. Education was less disruptive than corporations, as the value proposition for training can be transmitted over the Internet. Government support has been expanded, but does not compensate for all losses. Education is undergoing a huge experiment in distance learning and will move into the second phase of the pandemic with a deeper use of EdTech platforms. A prolonged global economic downturn will reduce business costs for education and training, even more than the first wave of COVID-19. Education will be affected, but partially isolated by the government. The recession will increase the demand for retraining and extend the time in education. Private investment capital will migrate to educational and training organizations

with digital delivery capabilities. Significant capital remains uninvested and unclaimed. The government tax base will be reduced, but will seek to protect funding for education and training through direct financing and indirect incentives. COVID-19 required the massive introduction of digital technology, and for a significant part of the economy, virtual operation will continue and be improved to increase efficiency in times of crisis. Education is undergoing a similar digital transformation. However, unless used online to increase teacher productivity, financial constraints slow growth. A significant historical lack of investment in digital learning resources and skills has resulted in educational debt in both corporate and educational sectors hindering development opportunities. To ensure the development of the necessary workforce skills after COVID-19, attention will be shifted to next generation training tools.

EdTech global market is estimated at \$186 billion. Taking into account the impact of COVID-19, the market is expected to grow between 14.5% and 16.4% per year to a total value of \$ 368 billion to \$ 406 billion in 2025 (fig. 1). COVID-19 crisis fosters wider adoption of technology to replace, complement and improve teaching and learning in the context of social distancing. Throughout 2020, EdTech firms will focus on gaining market share and will therefore often give away their products for free. The additional revenue is likely to only become significant in 2021, as many of the tools tested in 2020 convert to paid subscriptions. This will lead to a gradual change in EdTech spending between 2020 and 2021. By 2025 EdTech is expected the change in usage to drive the market annual revenues from \$40 billion to \$90 billion in annual revenue. Therefore, EdTech is expected to increase its share of education and training spending from 3.1% in 2019 to 5-6% in 2025 [7].



Fig. 1. Global EdTech expenditure, \$bn. (Source: Global EdTech Report 2020)

C. EdTech Global Drivers

According to 'Global EdTech Report 2020' [7] there are several drivers of changes the EdTech market:

1) COVID-19 recovery:

- the path to recovery can have several periods of social constraints creating step-by-step returns that vary across sectors and regions;

- many providers have opened their educational resources for free access, which has allowed to increase the influx of new customers at times and provide growth in future;
- at the second stage, the quantity and quality of digital tools will increase to supply interaction and efficiency;
- the economic crisis will increase the emphasis on return on investment and financial performance;

2) deep learning:

- science of learning propels EdTech from simple digitization to digital transformation;
- artificial intelligence will improve education efficacy of human and machines;
- new wave of technology development will bring cobots to a wide range of education applications;

3) consolidation:

- supply-side pressures from COVID-19 and the ensuing recession will lead to increased consolidation based on established players and deep-pocketed shareholders;
- ratings will be split between those who demonstrate traction and scalability and those who are fighting for the new environment;
- markets in the United States and Asia will lead to consolidation thanks to a global launch in EdTech investments;

4) funding:

- institutional demand for digital resources and skills development will be limited due to limited government funding during the crisis;
- consumer behavior will be a key factor influencing supply-side business models; demand for retraining, additional training and advanced training, increased user universe;
- private equity to focus dry powder on models showing traction during COVID-19;

5) acceleration:

- there will be no return to the status quo; the next wave will see tests of the most effective pedagogical solutions and accelerated use of tools that use AI and deep learning;
- private education will see a surge in new online or hybrid educational solutions;
- geographic differences in infrastructure will affect opportunities for regional acceleration.

V. RUSSIAN EdTECH MARKET

A. Russian EdTech Market Insights

Moscow Agency of Innovations presented several insights of Russian EdTech market came from pandemic crisis:

1) online & face to face education: the basic model of education of the future is blended learning (online & face to

face), a widespread transition to which will take place in 5 years; polarization of formats: online (massive, cheaper) and face to face (elite & exclusive);

2) individual educational routes: the transition from unified curricula to individual educational trajectories based on Artificial Intelligence (AI);

3) new competencies: universal training to be stable, adaptive, ready for the “economy of unpredictability” & internal stability, entrepreneurial qualities, willingness to take risks and strategic uncertainty;

4) new school demands: moving away from the classroom system to project-based learning; new subjects - applied and probabilistic mathematics, engineering, psychology and sociology; gamification: computer games in the future may partially replace traditional lessons, teach socialization and cognitive skills; the changes will start with additional education;

5) transformation of universities: “university without walls”: networked and decentralized higher education; “study close to home”: reduced exports of educational services and “postponed diploma” in the short term; moving away from the model of 4-6 years of education towards more flexible principles of organizing the educational process; certification for non-formal education and short-term courses, use of blockchain to verify the authenticity of diplomas;

6) new role of vocational education and training: in the short term, the function of education as a tool for self-development will lose its relevance, pragmatism will increase, which is converted into income as a career building tool; in a five-year perspective, it will become mandatory for any industry (as for doctors) and will be certified by the state;

7) advanced technology-based solutions: digital educational profile of a person from childhood; artificial intelligence for building a personal educational track; automation of routine processes (such as checking of the exercises);

8) new professions: teacher as a mentor and consultant; content packer, online training methodologist, online course producer.

Thousands experts from all over of Russia during the time working for the new concept of the national EdTech market’s ecosystem under the leadership of the Russian Agency for Strategic Initiatives to Promote New Projects [3]. They predict that the share of Russian companies in the global educational technology market could rise from 0.5% to 4% by 2035.

B. Russian EdTech Market Facts and Figures

Coursera analyzed the level of training of IT professionals in various fields around the world. In the overall ranking, Russia is recognized as the country with the most highly qualified software developers [12]. This is due to the high quality of technical education at the universities of Moscow, St. Petersburg, Tomsk and Novosibirsk. The most trending skills in the field of Neural Networks, Data Science, Deep Learning and Natural Language Processing.

According to Edmarket.Digital [6] estimates at the end of 2019 the volume of the Russian b2c market for online education reached 38.5 billion RUR with an average annual growth rate

(CAGR) of 20%. According to the forecast its value will exceed 60 billion RUR per year by the 2023 at an average annual growth rate of 12-15%.

In the structure of the global EdTech industry, Russia occupies less than 1%, but the growth rate of the national market is higher than the global one (20-25% per year). If in 2019 the capacity of the Russian EdTech market can be estimated at 45-50 billion rubles, then in 2020 it should already reach 55-60 billion rubles. Now EdTech in Russia is implemented mainly in the segment of vocational education and training. The size of the EdTech market for preschool and adults amounted to about 22-25 billion RUR in 2019, which is 50% of the Russian EdTech market. It is expected that in 2020 the volume of this segment will reach 27-30 billion RUR [6]. The main segments of preschool and post-secondary education for adults are: training in digital professions, applied professions, learning foreign languages, a niche for developing methods and corporate training instruments.

Experts from the RBC evaluate the Russian EdTech market in 2019 amounted in RUB38.5 billion [14]. The market leaders in the first category are Skillbox online university (estimated market share $\approx 6.5\%$), GeekBrains and Netologia-group (5.3% of the market share in the segment each). In the segment of applied professions, the leaders are GetCourse (3.5-4%) and Infourok ($\approx 3\%$). The leaders of language learning are SkyEng ($\approx 19-21\%$), Lingualeo (4.3-5%) and PuzzleEnglish ($\approx 3\%$). The leader in the niche of programs that create software and platforms for corporate training is Mirapolis with a share of $\approx 7.2\%$, as well as eQueo and iSpring with a share of 5.3%.



Fig. 2. Investments in the Russian online education market, \$ million. (Source: Edmarket.Digital, 2020)

According to Edmarket.Digital [6] and GVA [15] estimates, the venture capital community in Russian online education generated at least \$80 million in the period from August 2017 to October 2019. In the 2019 Yandex announced investment of RUR5 billion to EdTech projects. Mail.ru Group at the beginning of 2019 became a co-owner of the Skillbox service and GeekBrains platform since 2016. At the beginning of 2018, Sberbank introduced School 21 project for training in IT development. The traffic on the Uchi.ru platform has grown to 3 million people per day in April 2020 (total 8 million students).

A platform for creating video content using an animated robot was presented by Mail.ru Group in June 2020 [17].

At the end of April, according to Similarweb, Uchi.ru ranked second in the education category among all platforms in the world (Forbes.ru).

According to Natalia Tsarevskaya-Dyakina, CEO in Ed2Tech Accelerator, the most financially capacious areas of the Russian market for technological projects in education are education for children amounting to 10 billion RUR and adults amounting to RUR15 billion per year [16].

Russian companies that are represented on the international market [3]:

- Algorithmika (more than 18 countries of presence, including Australia, India, China, Mexico, USA and Ecuador);
- Uchi.ru (operates in Brazil, India, Canada, China and the USA);
- Puzzle English (Spanish-speaking and French-speaking countries);
- StudyFree (emerging markets of Asia, Africa, the Middle East and Latin America);
- Yandex.Practicum (the service entered to the USA market);
- LingvoLeo is a language school initially focused on international business (more than 27 countries);
- Unicraft (corporate education and training platform has agreement with an Indian Recruiting Agency).

According to forecasts of the Moscow Innovation Agency [9], the greatest demand in Russia in the near future will be online educational programs and courses for various target audiences, as well as solutions for creating educational content.

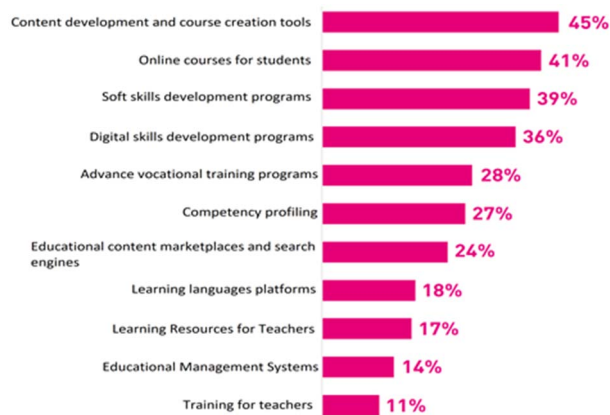


Fig. 3. Most demanded EdTech products forecast. (Source: Moscow Agency of Innovations, 2020)

VI. CONCLUSION

1. Education is undergoing a huge distance learning experiment and will move to the next stage of constraints with deeper use of EdTech's capabilities.

2. The prolonged global economic downturn will result in lower education and training costs for businesses, which will have a greater impact than the original COVID-19 pandemic. Education will be partially compensated by the government.

3. The recession will lead to an increase in demand for retraining and extension of time in education.

4. Private equity capital will migrate to education and training companies with digital delivery options. Significant capital remains uninvested and available.

5. Unless online is used to improve teacher productivity, financial constraints will slow growth.

6. A significant historical lack of investment in digital learning resources and skills has resulted in debt in both the corporate and education sectors hindering development opportunities.

7. To ensure that the necessary skills of the workforce are developed after COVID-19, there is a need to focus on next generation learning tools.

8. Technologies are developing at a revolutionary pace, it is necessary to update their application in education, both in terms of improving teaching and for creating new businesses.

9. The Russian government invests a lot in the development of digital technologies, digital educational resources and training programs within the national projects "Digital Educational Environment" and "Education". As a result of the activity the necessary infrastructure and intellectual environment are creating. On the other hand, in the case the state competes with entrepreneurs at the EdTech market. Nevertheless, the movement for the development of technological entrepreneurship is gaining strength in Russia, including involvement of schoolchildren and students to technical creativity and constructing of hundreds of coworking spaces, technology parks and business incubators in all regions and large cities of Russia. So the prospects for the development of the Russian market are positive, as confirmed by this review.

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