

Motivating factors for university students to use digital technologies in educational process

Aleksandr Kozlov

*Peter the Great St.Petersburg
Polytechnic University;*

*Graduate School of Management and
Business for Scientific Research
St..Petersburg, Russian Federation
ORCID 0000-0001-9375-0262*

Alina Kankovskaya

*Peter the Great St.Petersburg
Polytechnic University;*

*Graduate School of Management and
Business for Scientific Research
St..Petersburg, Russian Federation
ORCID 0000-0003-0531-9005*

Anna Teslya

*Peter the Great St.Petersburg
Polytechnic University;*

*Graduate School of Management and
Business for Scientific Research
St..Petersburg, Russian Federation
ORCID 0000-0001-8395-6515*

Zarema Khasheva

*Southern Institute of Management;
Kuban State Technological University
Krasnodar, Russian Federation
ORCID 0000-0001-5354-4464*

Abstract— The study considers the formation of human capital in the transition to a digital economy that places new demands on the competences of future specialists working in new conditions. Educational programs of universities need to be modernized; in particular, this means adopting a broad range of information and communication technologies in the educational process. We have carried out a survey of students from 6 universities of the Northwestern and Southern Federal Districts. We have confirmed that forming a digital infrastructure in the educational environment of universities is a factor of key importance. Analyzing hygiene factors, we have found they were at a sufficient level. We have identified the motivating factors for using digital technologies in higher education and developed a set of recommendations aimed at improving the use of information and communication technologies by students.

Keywords— *human capital, information and communication technologies, digital competences, digital barriers, motivation, hygiene factors, motivating factors*

I. INTRODUCTION

Digital transformation has now become the key factor for staying competitive in the global economic space: this is equally true for enterprises and the Russian economy as a whole. The program “Digital Economy of the Russian Federation”, approved by the Government of the Russian Federation (Order No. 1632-p of July 28, 2017, referred to as the Program from now on) [1], includes personnel training for the digital economy among other conditions of digitization. The program states that there is currently a lack of personnel properly trained for working in the digital economy and a lack of educational programs answering the needs of the digital economy. Leading Russian universities are taking significant steps to improve existing educational programs and develop new ones in accordance with modern requirements; the universities are also upgrading their technical resources [2]. However, while it is well known from theory and practice of management that success of achieving the goals of any process largely depends on the motivation of all parties involved in this process, the motivation of students in using modern educational technologies is not considered in the Program and is largely ignored by the academic community of universities.

Exploring such topics as the degree to which students of modern Russian universities are prepared to use digital technologies in the educational process, how willingly students use the available information and communication technologies (ICT), what motives drive students in their choice of tools for acquiring knowledge and developing competences can provide insights for further improving personnel training for the digital economy, yet these issues are rather poorly understood. What's more, while Russian regions are technologically equipped to make a transition to digital economy, personnel training is seriously lagging behind [3].

II. LITERATURE REVIEW

A person's ability to effectively and safely use information and communication technologies, both in the learning process and in professional life, is an important part of modern culture. It is digital literacy that makes it possible for people to use the opportunities offered by the digital economy to fully participate in society's life, contributing to full social integration and ultimately generating human capital in the country, regions and economic entities. According to [4], a significant part of the planet's population is excluded from this process. Numerous studies by both Russian and foreign researchers have considered issues related to formation and development of human capital in the modern digital economy. For example, an innovative mechanism for organizing the system of personnel training and management using a learning resource based on the Triple Helix concept adapted to Russian conditions was offered in [5]. The problem of forming digital competences of students as a social group that is the most mobile, motivated and capable of learning new information was discussed in [6]. The actual state of digital culture of students was analyzed in [7] taking into account the students' competence in disseminating information using modern technologies.

A number of studies explored students' motivation to use digital technologies, finding that the need to acquire knowledge, the age of students and their loyalty to using digital technologies are some of the most important factors [8]. It was established in [9] that new opportunities are more

attractive for students with internal motivation to acquire new skills, while students who are primarily focused on receiving external validation from teachers are more likely to resist new technologies.

Considering the benefits of using digital technologies in the learning process, many educational establishments actively adopt fully interactive and hybrid courses that integrate information and communication technologies (ICT), offering flexible learning formats adapted to the needs and expectations of the students. Students' attitudes towards ICT were analyzed in [10] in three different formal learning environments: face-to-face classroom learning, hybrid and distance learning. The comparison took into account the digital skills of students, the impact of ICT on their learning, their perception of the educational potential of ICT. In general, students themselves recognized the positive effect of ICT on learning outcomes. The results confirmed the correlation between age, profession and use of technologies, as well as between use of technologies and high levels of digital literacy.

Notably, the emerging digital economy is gradually affecting society and the behavior of people, changing the ways of interaction and communication. There are currently diverse, increasingly available devices for interacting via the Internet allowing students to choose tools and services best adapted to their needs. Personal learning environments (PLE) created for students based on Web 2.0 services were studied in [11] in the context of higher education as a means for transforming the teaching and learning processes and for student training. Additionally, PLE can serve not only as a tool for learning and acquiring skills, but also for enhancing social interactions, managing content and learning resources, and identifying obstacles to using digital solutions in learning.

Digital technologies not only provide access to education at any level but also offer new tools, such as digital games. It was found in [12] based on empirical data that even though these educational tools are highly efficient, they are rarely used in general undergraduate courses. It was discovered that incentives to motivate and expand knowledge, using new learning tools (such as ICT) are low for teachers despite the advantages of these tools in the learning process. The authors argue that teachers do not perceive their own education as an integral part of the process of making managerial and business decisions.

The authors of [13] state that modern professions require highly qualified technical and engineering specialists with advanced mental abilities and recommend to develop the students' transdisciplinary skills.

The level of digital competence of teachers is not always sufficient to appropriately motivate students to use modern technologies for learning. This problem was considered in [14], presenting a curriculum for improving the digital competences of schoolteachers. The authors note that digitization of society, work and education is proceeding at a rapid pace, making it necessary to develop guidelines for improving the specific digital competences of teachers, compelling and forcing them to use new methods in education. A similar problem was discussed in [15-17], analyzing, instead of existing digital skills of students, the contents of curricula and programs from the standpoint of

official requirements to using information technologies, digital tools and platforms in the educational process.

Problem statement and methodology

Based on analysis of the literature and on our earlier studies, we can identify two main reasons that in our opinion hinder students from widely using ICT in education:

- digital barriers making it difficult for some groups of students to use ICT;
- insufficient motivation of both teachers and students to use ICT in the learning process and for self-study.

According to Herzberg's theory of personnel motivations [18,19], there are two groups of factors that have a motivational effect.

- hygiene factors are related to the environment where the work itself takes place.
- motivating factors are directly related to the specifics of the work and its character.

III. METHODOLOGY AND PROBLEM STATEMENT

It is the motivating factors that contribute to increasing the level of satisfaction with the work and act as an independent group of needs that are needs for growth. The motivational orientation of hygiene factors is predominantly negative. Lacking or insufficient hygiene factors can lead to dissatisfaction with the work. However, a sufficient level of hygiene factors does not motivate the personnel.

Notably, although motivating factors have a significant effect on the behavior of the personnel, their absence, as a rule, does not cause dissatisfaction with the work.

Table 1 shows the hygiene and motivating factors, both traditional and adapted for analysis of motivations to using ICT in the learning process.

TABLE I. HYGIENE AND MOTIVATING FACTORS FOR STUDENTS USING ICT IN EDUCATIONAL PROCESS

Hygiene factors		Motivating factors	
Traditional	Adapted	Traditional	Adapted
Company and administration policy	Policy of educational establishment regarding motivation to using ICT in educational process	Success	High level of proficiency in courses studied
Working conditions	Conditions and ease of access to resources (including option for free access)	Career advancement	Additional knowledge and opportunities for using it for future career growth
Earnings	Cost of access (including time saved)	Recognition and acclaim of work achievements	Recognition of study achievements by teachers, potential employers, external environment, etc.

Interpersonal relationships with superiors, colleagues, and subordinates	Intensity of use and options for interaction between teachers and students	Interesting job	Using ICT as interesting and challenging process
Degree of direct control over work	Degree of control over use of ICT by educational establishment	Opportunity for creative growth	Additional knowledge beyond courses studied and opportunities for using it in the future

Compiled by the authors based on [19]

In view of the above, we have defined the goal of the study as identification of motivational factors that facilitate the integration of digital technologies in the educational process for students of Russian universities.

To achieve the goal, we have solved the following tasks:

1. Identify target groups for the study;
2. Develop a questionnaire;
3. Carry out an interview of target groups;
4. Process the results obtained;
5. Analyze and interpret the results, determining the motivating factors.

IV. RESULTS

Students from 6 universities in the Northwestern and Southern Federal Districts took part in the survey. A total of 283 students were interviewed. The sample for the study was compiled taking into account the levels of education and the gender structure of students in each university.

TABLE II. The main goal of the study was to explore the nature of digital barriers in education and the reasons why they evolve, subsequently generating barriers to using new digital technologies in professional life. A significant part of the respondents were predictably willing to use online resources for learning (see Table 2), but a large segment found it either difficult (from 6.25% in the Murmansk Region to 15.15% in St. Petersburg) or uninteresting (from 11.57% in the Krasnodar Region to 22.72% in St. Petersburg).

TABLE III. USE OF ONLINE RESOURCES FOR LEARNING

No.	Use of online resources for learning, %			
	Answers	St. Petersburg	Murmansk Region	Krasnodar Region
1	Seems interesting and easy	62.12	76.56	74.38
2	Difficult	15.15	6.25	14.05
3	Not difficult but either uninteresting or time-consuming	22.72	17.19	11.57

Compiled by the authors

In view of this, we analyzed the distribution of the answers given by the respondents depending on their willingness to use online resources for learning. Because these characteristics have an attributive nature, we applied

Pearson’s correlation coefficient to analyze how closely correlated they were [20]. We found a rather weak correlation (in the range of 0.16–0.28) between difficulties in using online resources and the respondents’ assessment of different aspects of using traditional and digital educational technologies. At the same time, the dependence for students’ attitudes towards the BYOD concept (Bring Your Own Device, referring to using personal devices in the learning process) had one of the highest values with a correlation of 25%.

Students who have difficulties in using online resources for educational purposes are less aware of the opportunities offered by this approach than students who do not have this competence barrier. Students who are capable of using the Internet for learning regard using their own devices in the educational process as an opportunity to quickly get the information they need at the moment (58%). We should note that if this concept is actively used by both sides of the educational process, that is, by both students and teachers, this considerably improves the effectiveness of training, increasing the share of interactive practically oriented classes and reducing that of traditional routine tasks. The proportion of students positively inclined towards the BYOD concept was much lower among those who experience competence-based difficulties in accessing online resources, amounting to 36%.

The time when the respondents started to actively use online resources had a weak effect on their willingness to use online resources for learning: Pearson’s correlation coefficient was 0.28. Table 3 shows the distribution of responses. Interestingly, the proportion of respondents who think online learning technologies are difficult to use is the highest among those who started to actively use the Internet in elementary school. This result deserves more detailed investigation. We may tentatively hypothesize that if involvement of schoolchildren in using online resources starts at an early age, it is fragmented and disorganized. School education programs require students to use online resources but do not provide the skills and abilities necessary for that. Since motivation for self-study and self-growth has not yet been formed at this age, the Internet becomes primarily a means of entertainment and communication.

While 18% of all respondents began to master the Internet in elementary school, only 6% of current students were introduced to the Internet before starting school; 62% began to use online resources in senior school. Apparently, a high percentage of students who have effectively mastered the Internet at a preschool age (compared to those who started using the Internet in elementary school) is associated with personal characteristics of these students, which were noticed and nurtured by the family early on. A motivating factor for senior school is the need to obtain in-depth knowledge of the subjects that interest the students in a limited time, which implies mastering the opportunities and technologies of the Internet.

TABLE IV. START OF ACTIVE USE OF ONLINE RESOURCES DEPENDING

No.	Start of active use of online resources depending on willingness to use them, %			
	Answers	Interesting and easy	Difficult	Not interested
1	Before school	66.67	22.22	11.11
2	In elementary school	57.69	9.62	32.69
3	In senior school	68.39	9.20	22.41
4	In specialized courses	0.00	100	0.00
5	At university	69.44	8.33	22.22
Total		65.96	17.02	17.02

Compiled by the authors

It seems interesting to correlate the difficulties in using online resources with the assessment of attractiveness of traditional and distance forms of education. Notably, with Pearson's correlation coefficient equal to 0.22 (which corresponds to weak correlation by the Chaddock scale), half of the students finding it interesting to use online resources for educational purposes regard distance learning as complementary to traditional formats (Table 4). The group of respondents who are not interested in online education has the highest proportion of those who prefer traditional educational technologies. This allows us to hypothesize that willingness to use distance learning technologies depends on personality type. Individuals who are a social type (according to Holland's classification [21]) prefer person-to-person interaction in professional life (according to [22]) seeking direct contact with teachers and feeling discomfort from having to use distance learning and automated modes of interaction. This group of students makes up 10% of all respondents, which, in our opinion, should be taken into account in introducing distant technologies so that they do not fully replace traditional forms of education, serving as supplements instead.

TABLE V. ATTRACTIVENESS OF DISTANCE LEARNING

No.	Attractiveness of distance learning, %			
	Answers	Interesting and easy	Difficult	Not interested
1	More attractive than traditional learning	17.30	20.67	12.12
2	Complements traditional learning, expanding horizons and enhancing knowledge in certain topics	51.35	37.91	37.88
3	Can replace traditional learning of poor quality	5.41	3.44	6.06

4	Cannot completely replace traditional learning	25.95	31.03	42.42
5	Other	0	6.90	1.52
Total		100.0	100.0	100.0

Compiled by the authors

Students' attitudes towards personal communication with teachers are shown in Table 4. There are no statistically significant deviations from the distribution of preferences in general but the category of those not interested in online education stands out again. The proportion of students willing to communicate with teachers in practical classes is noticeably higher than the average in this group (88.68%). Furthermore, over 60% of respondents from this group expect teachers to be present for lectures, while the other groups are close to median values in their preferences. We should also note that almost half (48.04%) of the respondents expect to communicate with teachers at lectures even among the group willing to use online education.

TABLE VI. EXPECTATIONS FOR TEACHERS' PRESENCE IN CLASSES

No.	Expectations for teachers' presence in classes depending on willingness to use online resources, %				
	Answers	Interesting and easy	Difficult	Not interested	Total
1	I expect teachers to give lectures	48.04	45.16	60.38	47.14
2	I expect teachers to be available for practical classes and term papers	79.89	67.74	88.68	75.36
3	I do not need teachers to be present at all	2.79	6.45	7.55	3.93

Compiled by the authors

Students in all regions claimed financial matters were one of the most considerable barriers hindering access to online resources (Table 6).

TABLE VII. USE OF ONLINE RESOURCES FOR STUDY

No.	Use of online resources for study, %			
	Answers	St. Petersburg	Murmansk Region	Krasnodar Region
1	Hard to use (need special knowledge and skills)	1.00	0.78	1.11
2	Hard to access	1.63	1.36	1.59
3	Inconvenient (not user-friendly)	1.82	1.04	1.35
4	Expensive	1.91	1.80	2.15

5	See no reason to	1.17	0.89	1.24
6	Other (specify)	0.37	0.84	1.04

Compiled by the authors

Notably, willingness to use online resources for study does not depend on financial matters (Table 7).

TABLE VIII. WILLINGNESS TO USE ONLINE RESOURCES DEPENDING

No.	Willingness to use online resources depending on financial barriers, %				
	Answers	Interesting and easy	Difficult	Not interested	Total
1	Yes, money is an issue	61.82	15.47	22.68	100.00
2	No, money is not an issue	76.00	4.00	20.00	100.00
3	Money is somewhat of an issue	67.20	8.20	24.60	100.00

Compiled by the authors

Thus, we have managed to identify important motivating factors for using digital technologies in higher education, such as:

- opportunity for personal growth;
- desire to ensure future career advancement by gaining the competences required in the labor market; getting a degree;
- using ICT in the educational process is interesting in itself.

The factors affecting motivation include type of personality (personal characteristics, inclinations and preferences of interaction in the “person–technology”, “person–virtual environment” and “person–symbol” pairs).

V. RECOMMENDATIONS

We should note that we have found a sufficient level of hygiene factors in Russian higher education institutions, with no noticeable negative impact on using ICT in the learning process.

Evidently, digital infrastructure plays a key role in the educational environment of universities. Judging by the presence of a substantial proportion of students who are willing to use ICT in education but are hindered by financial barriers, we can conclude that educational institutions need to make ICT more accessible, reducing the negative effect of hygiene factors. This way, educational institutions providing free access to information resources can encourage students to use ICT.

About 10% of the total number of students expecting personal communication with teachers experience discomfort if they have to use only ICT. The majority (about 75%) of students expect teachers to be present in classes; the most motivated students expect teachers to be present mainly in practical classes. Therefore, hybrid learning technologies providing students with the opportunity to

discuss the results in direct communication with the teachers are the most attractive.

On the whole, more than 60% students are motivated to use ICT in education.

VI. CONCLUSION

Summarizing the results of the study that we have carried out, we can conclude, firstly, that university students had ambivalent attitudes towards digital technologies and ICT in the educational process, and secondly, that these attitudes were shaped by diverse motivating and demotivating factors. The important motivating factors found in the study include:

- desire for personal growth, expressed as the desire to gain access to additional knowledge;
- desire for career growth in future professional life, which means that digital technologies are used in order to obtain the knowledge and competences for future work;
- interest in the very process of using digital technologies.

Demotivating factors include financial aspects and money barriers that prevent students from using ICT.

Notably, there are only slight discrepancies in the answers of students from different regions of Russia. This indirectly confirms the existence of a common educational space in the country.

Our findings allowed us to offer a number of recommendations aimed at improving the approaches to introducing digital technologies in the educational process, in particular, using hybrid learning technologies, as most students need personal contact with teachers, expecting to be able to discuss the results obtained face-to-face, and improving the infrastructure for access to ICT, thus eliminating barriers and reducing the effect of demotivating factors.

We see one possible direction of further research in continued data collection in the target audiences based on the existing questionnaire, allowing to construct time series, to explore the dynamics of students’ attitudes towards ICT in the educational process and to identify the development trends. Another direction is to include new target groups by conducting surveys in universities in other regions of Russia and by expanding the database to obtain more generalized results and conclusions.

Studies on tracking the individual characteristics of students, their perceptions and attitudes towards digital technologies in the educational process using theories of personality typology based on response to various stimuli are another promising direction.

REFERENCES

[1] National Program “Digital Economy of the Russian Federation” <http://government.ru/rugovclassifier/614/events/> Date of the application 01.06.2019)

[2] Ministry of Science of Education of the Russian Federation. Official site. Electronic resource: access mode: <https://minobnauki.gov.ru/ru/activity/statan/stat/highed/>. The date of the application 17.06.2019

- [3] N.V. Kuznetsov, "State program «Digital economy of the Russian Federation: regional readiness analysis," *Regional economy and management: electronic scientific journal*, vol. (57), Art.№ 5709
- [4] K. Mossberger, C.J. Tolbert, R.S. McNeal, "Digital citizenship: The Internet, society, and participation," *Mit. Press*, 2007.
- [5] O.V. Kalinina, I.M. Zaychenko, S.S. Gutman, "Concept of creating innovative mechanism of human resource development in Russia," *Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 Vision 2020: Sustainable Economic development, Innovation Management, and Global Growth 2017-January, 2017*, pp. 2708-2719.
- [6] A. Kozlov, A. Kankovskaya, A. Teslya, "The investigation of the problems of the digital competences formation for Industry 4.0," *workforce 2019 IOP Conference Series: Materials Science and Engineering* 497 (1), 012011.
- [7] R. Fernandez-Pascual, "Communication of information in the digital age among social sciences students: Uncovering a synthetic indicator of performance", *Journal of Information Management*, 2018, vol. 70 (4), pp. 326
- [8] J. Castao-Muoz, J. .Duart, S. V. Teresa. "Determinants of Internet use for interactive learning: an exploratory study," *Journal of New Approaches in Educational Research (NAER Journal)*., 2015, vol. 4 (1), pp. 24-31
- [9] D.P.L.Tan, E.L. McWilliam, "COGNITIVE GAME SETTING, CREATIVITY AND GENERATION 'C' LEARNERS", *Continuing education: XXI century*, 2013, vol. 2 (2), pp. 100-108
- [10] M. Arrosagaray, M. González-Peiteado, M. Pino-Juste, B. Rodríguez-López, "A comparative study of Spanish adult students' attitudes to ICT in classroom, blended and distance language learning modes", 2019, *Computers and Education*, vol. 134, pp. 31-40
- [11] R Torres Kompen, P. Edirisingha, X. Canaleta, M. Alsina, J. M. Monguet, "Personal learning Environments based on Web 2.0 services in higher education," 2019, *Telematics and Informatics*, vol. 38, pp. 194-206
- [12] M.S. Calabor, A. Mora, S. Moya, "The future of 'serious games' in accounting education: A Delphi study," 2019, *Journal of Accounting Education*, vol. 46, pp. 43-52
- [13] E. Liventsova, T. Rumyantseva, E. Syryamkina, "A Competence-Based Approach to Training Specialists in the Digital Society", VIII International Scientific and Practical Conference "Information and Measuring Equipment and Technologies" MATEC Web of Conferences, 2018, 155, paper#01013
- [14] N. Z Hrustek, R. Mekovec, V. Kirinic. "Digital Competence Curriculum for Schools' Employees: Croatian e-Schools Project Example", 2019 5th International Conference on Information Management, ICIM 2019 8714705, p. 139-143
- [15] A. Kozlov, A. Kankovskaya, O. Miroliubova, "Digital skills in formation of professional competences of students studying Economics", *Proceedings of International Conference on ICT Management for Global Competitiveness and Economic Growth in Emerging Economies (ICTM2017)*, 2017, Wroclaw, Poland, October 23-24, p. 228-231
- [16] A. Kankovskaya, O. Kalinina, I. Ilin. Economics of transport and sustainable development: Problems of high education in Russia (2018) MATEC Web of Conferences, 239, 08008.
- [17] E. Razinkina, L. Pankova, I. Trostinskaya, E. Pozdeeva, I. Evseeva, A. Tanova. Student satisfaction as an element of education quality monitoring in innovative higher education institution (2018) 33, 03043.
- [18] F. Herzberg, M. U. Miner, "The motivation to work and production motivation", *Sociological studies*, 1990, vol 1
- [19] F. Herzberg, "The Motivation-Hygiene Concept and Problems of Manpower", 1964, *PersonnelAdministration*, vol. 27, pp. 3-7.
- [20] T. D.Little, "The Oxford Handbook of Quantitative Methods in Psychology: Vol.2: Statistical Analysis", N.Y. Oxford University Press, 2013, p. 56-58
- [21] J.L. Holland, "Exploring Careers with a Typology: What We Have Learned and Some New Directions", *American Psychologist*, 1996, vol. 51(4), pp. 397-406
- [22] O. Iljashenko, I. Bagaeva, A. Levina. Strategy for establishment of personnel KPI at health care organization digital transformation (2019) IOP Conference Series: Materials Science and Engineering, 497 (1), № 012029