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

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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>
<thead>
<tr>
<th>Hygiene factors</th>
<th>Motivating factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditional</strong></td>
<td><strong>Adapted</strong></td>
</tr>
<tr>
<td>Company and administration policy</td>
<td>Policy of educational establishment regarding motivation to using ICT in educational process</td>
</tr>
<tr>
<td>Working conditions</td>
<td>Conditions and ease of access to resources (including option for free access)</td>
</tr>
<tr>
<td>Earnings</td>
<td>Cost of access (including time saved)</td>
</tr>
</tbody>
</table>

TABLE I. HYGIENE AND MOTIVATING FACTORS FOR STUDENTS USING ICT IN EDUCATIONAL PROCESS
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>
<thead>
<tr>
<th>No.</th>
<th>Use of online resources for learning, %</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Answers</td>
</tr>
<tr>
<td></td>
<td>St. Petersburg</td>
</tr>
<tr>
<td>1</td>
<td>Seems interesting and easy</td>
</tr>
<tr>
<td>2</td>
<td>Difficult</td>
</tr>
<tr>
<td>3</td>
<td>Not difficult but either uninteresting or time-consuming</td>
</tr>
</tbody>
</table>

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.

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Start of active use of online resources depending on willingness to use them, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Answers</td>
</tr>
<tr>
<td>1</td>
<td>Before school</td>
</tr>
<tr>
<td>2</td>
<td>In elementary school</td>
</tr>
<tr>
<td>3</td>
<td>In senior school</td>
</tr>
<tr>
<td>4</td>
<td>In specialized courses</td>
</tr>
<tr>
<td>5</td>
<td>At university</td>
</tr>
<tr>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

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.

Students’ attitudes towards personal communication with teachers are shown in Table 4.

<table>
<thead>
<tr>
<th>No.</th>
<th>Expectations for teachers’ presence in classes depending on willingness to use online resources, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Answers</td>
</tr>
<tr>
<td>1</td>
<td>I expect teachers to give lectures</td>
</tr>
<tr>
<td>2</td>
<td>I expect teachers to be available for practical classes and term papers</td>
</tr>
<tr>
<td>3</td>
<td>I do not need teachers to be present at all</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>No.</th>
<th>Use of online resources for study, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Answers</td>
</tr>
<tr>
<td>1</td>
<td>Hard to use (need special knowledge and skills)</td>
</tr>
<tr>
<td>2</td>
<td>Hard to access</td>
</tr>
<tr>
<td>3</td>
<td>Inconvenient (not user-friendly)</td>
</tr>
<tr>
<td>4</td>
<td>Expensive</td>
</tr>
</tbody>
</table>
Technologies providing students with the opportunity to mainly in practical classes. Therefore, hybrid learning most motivated students expect teachers to be present (75%) of students expect teachers to be present in classes; the discomfort if they have to use only ICT. The majority (about personal communication with teachers experience encourage students to use ICT.

Providing free access to information resources can of hygiene factors. This way, educational institutions make ICT more accessible, reducing the negative effect barriers, we can conclude that educational institutions need to make ICT more accessible, reducing the negative effect of hygiene factors in Russian higher education institutions, “person–virtual environment” and “person–symbol” pairs). 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).

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


**TABLE VIII** **Willingness to use online resources depending on financial barriers, %**

<table>
<thead>
<tr>
<th>No.</th>
<th>Answers</th>
<th>Interesting and easy</th>
<th>Difficult</th>
<th>Not interested</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes, money is an issue</td>
<td>61.82</td>
<td>15.47</td>
<td>22.68</td>
<td>100.00</td>
</tr>
<tr>
<td>2</td>
<td>No, money is not an issue</td>
<td>76.00</td>
<td>4.00</td>
<td>20.00</td>
<td>100.00</td>
</tr>
<tr>
<td>3</td>
<td>Money is somewhat of an issue</td>
<td>67.20</td>
<td>8.20</td>
<td>24.60</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Compiled by the authors


