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Potential for Using Mobile and Networking Technologies in Teaching

The article investigates the accessibility of mobile and networking technologies to schoolchildren of different ages living in various areas and how they use these technologies. The author considers the potential ways in which modern technologies can be used in education. The potential benefits of such technologies are particularly promising for rural schools. The article comments on the modern trend to create a seamless educational environment on the basis of e-learning.

Introduction

In recent decades, bringing education into the information age has been one of the main goals of the Russian education system. In the early 1980s, discussions centered on bringing computers into the schools; in the 1990s, we talked about connecting schools to the Internet; and in the 2000s, the focus was on updating aging

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computer hardware and using such interactive technologies as, for example, bulletin boards, etc. Currently, most of the legal acts of the Russian Federation that regulate education feature such concepts as implementing information technologies, distance education, and e-learning. By e-learning we mean the practice of conducting educational activities using information that is stored in databases and that is suited to educational goals as well as the provision of the information technologies, equipment, and information and telecommunications networks that are needed to process and transmit this information among over communication lines and that facilitate interactions among students and teachers.

By distance communication technologies we mean educational technologies that are based on the use of information and telecommunications networks that allow students and teachers to communicate with each other remotely (Federal Law No. 273-FZ dated December 29, 2012, "On Education in the Russian Federation," Article 16, p. 6, www.consultant.ru/document/cons_doc_LAW_140174). At the same time, computer and Internet technologies are developing at an exponential rate: personal computers are being replaced by more portable and mobile devices, such as laptops and tablets.[1] More and more powerful smartphones, or mobile phones that offer computer functions, are appearing on the consumer market. The information and communication technology (ICT) landscape of the modern school system is also changing.[2] Students are using various mobile devices as well as social networks and instant messengers to communicate as well as to search for and store information.

One challenging dilemma that has increasingly confronted Russian education in recent years is whether the educational system should in fact join the digital age by harnessing the potential that modern ICT afford, or if it should rather stick to more traditional, legacy teaching tools. It is quite likely that there are multiple answers to these questions. Innovators and conventionalists will be justified to defend their opposite positions. Nevertheless, both sides as well as others would benefit from a

comprehensive analysis that could support a discussion that is grounded in empirical data that extends up to the present.

This article presents and discusses research results that complement the findings of a project that was conducted in 2014 as part of the large-scale panel longitudinal study "Monitoring Study of Educational and Labor Trajectories." Then, a survey of a sample of 3,194 respondents between the ages of 16 and 18 was conducted to determine how they use e-learning in class, when completing homework assignments, and for self-study. The research revealed a new, third wave of computerization of Russian education. This one is not being conducted from the top down (in response to state directives to computerize schools), like the two previous ones in the 1980s and 1990s. Rather, it is being initiated from below by schoolchildren who use devices and bring them to school [1]. We discovered that a significant number of schoolchildren bring mobile phones and pocket computers with high-speed Internet access to school. Only three percent of respondents did not have a personal portable device at the time of the survey. Mobile phones were the most commonly reported device: 91 percent of respondents reported having one. According to survey data, schoolchildren do not turn off their mobile phone, including when they are at school and in class. In addition, they do not use smartphones just for having fun, but also to search for information related to their schoolwork. It is important to note that our analysis of the connection between the intensity of the use of gadgets during class without the teacher's permission and academic performance showed no statistically significant correlations, either in the case when gadgets were used for entertainment or in cases when students used their personal pocket computers to find information related to their studies. In other words, the widespread fear of teachers that using mobile devices would harm academic achievement was unjustified.

School computers are mainly used by students in computer science classes (56% of respondents stated that they were restricted to these classes), and special assignments that require the use of them are extremely rare in other courses. Despite the

Internet filters that are used on the school computer network to block restricted websites one of the new communication channels that teachers and students use to communicate with each other are social networks. Thirty-three percent of the respondents indicated that they commonly write to their teachers on social networks, and 41% of respondents indicated that they can contact their teachers on their cell phone.

Thus, whether teachers like it or not, the education system is already changing from within due to the viral spread of new technologies. This situation is not limited only to Russian education. It is a worldwide trend. An increasing number of educational innovations have been introduced to transform this "virus" into a "vaccine." They seek to take advantage of the mass use of the Internet and mobile devices by modern schoolchildren. However, it is still unclear whether this change in the ICT landscape is characteristic of just metropolises and major cities, or whether it has evenly affected the entire country. In addition, the existing data are also unclear about the specific age at which children and adolescents become active users of digital technologies. Thus, when discussing the use of mobile and networking technologies for designing mixed and distance learning practices,[3] it is important to understand for which groups of students this is possible.

The purpose of this research project is to study how social networks and mobile technologies are used by representatives of different strata (schoolchildren from different regions and representing different ages) as well as to discuss the use of modern technologies for designing a seamless learning environment based on e-learning.

The international trend to create a seamless learning environment based on e-learning

Previous generation educational standards failed to address the extracurricular activities of schoolchildren. According to the new federal education standards (FGOS), the educational process goes beyond class work. It also includes the mastery of material that makes up the basic educational curriculum through additional

activities outside of class.[4] Despite the division between "class" and "extracurricular work" that continues to persist, these standards are consistent with the modern understanding of how a seamless learning environment is created [3].

> The use of the term "seamless" implies that domains that were previously considered to be separate and independent (for example, in the classroom and outside it, the teaching and extracurricular environments, in school and outside it) are now considered to make up a single space. The components are linked together in such a way that they create a "seamless" connection. Students are encouraged to use learning resources that exist both inside and outside the classroom in seamless learning environments. Students learn material not only in the classroom, but also outside of it. [5]

Today, the seamless learning concept has been newly reinterpreted in connection with the emergence of mobile and networking technologies as part of the e-learning process [9]. The use of mobile technologies in teaching enables students to move simultaneously between physical, digital, and communication spaces on an individual basis, in pairs, in groups, or as a whole class [8]. The ability to access the Internet from mobile devices allows instant learning without interruptions. It expands boundaries and eliminates the mental construct that "the classroom is the only place where I learn" [10]. Seamless learning also makes education less stressful for learning participants. Students receive information gradually, which is consistent with the concept of lifelong learning.

Empirical studies of mobile and networking technologies in education have shown that such practices have a positive impact on student motivation. They allow for the creation of favorable learning conditions where students can boost their educational outcomes [7]. Mobile and networking technologies make it possible to significantly enrich the learning process for schoolchildren. They provide them with opportunities to apply knowledge in practical situations [6]. Pocket personal computers allow students to learn how to more effectively manage their own learning outside the classroom and to obtain academic information in

whatever form they find most convenient (through video resources, articles, chat rooms, etc.). This is particularly critical and relevant for students with learning disabilities [6].

Returning to the Russian education standard for K-11 education, it is important to note that it is focused on activities. The learning outcomes of students who have completed the education program are broken down by personal, metasubject, and subject results. An important outcome of the standard is the ability of students to use ICT to solve cognitive, communications, and organizational tasks, which, according to the standard, may include: the planning and implementation of educational activities, communication with other participants in the educational process, mental reflection, project activities, etc.[5] The issue of which tools and teaching practices help students learn these competencies remains unsolved. According to the e-learning concept, mobile and networking technologies may act as such a tool when applied to the idea of seamless learning. The data from empirical studies that is presented above confirm the effectiveness of using such modern educational tools.

Today, the use of mobile technologies and social networks in Russian education is more of an innovation than a habitual practice. However, topics of more cohesively and effectively applying modern ICT means in education have recently been emphasized both by the innovative teacher community[6] and at the state agency level Thus, a presentation on the use of "bring your own device" (BYOD) mobile learning technologies in particular was given at a seminar held by the Department of Education of the City of Moscow (http://video.dogm.mos.ru/online/it/page/video487.html?start=64). For example, the video seminar considered the experience of Gymnasium No. 45, where schoolchildren used their own devices to take 10-minute tests, maintain blogs, and work on group projects. Participants in the experiment noted that an important prerequisite for being able to deploy mobile technologies in the learning process is that all students must have their own devices (students who are not able to bring their own must be given school devices), Wi-Fi coverage

to enable quick access to the Internet, and technical support for teachers and students.

If schools in Moscow are able to partially or fully satisfy these requirements and almost 100 percent of school students in the capital have their own devices, then it is somewhat less clear what the situation is like in the regions. It is important that we also understand the specific situation in the regions to enable a broad discussion of the use of modern technologies and to design a seamless learning environment based on e-learning.

Thus, the basic goal of this stage of the study was to survey the ICT landscape in modern schools while taking into account the specific situation in the regions. We focused our research on the following issues:

- the availability and ownership of mobile devices by schoolchildren from various socioeconomic groups (broken down by region and age);
- the specific features of how schoolchildren from various socioeconomic groups use mobile and networking technologies (broken down by region and age); and
- interactions between students and teachers on the Internet (broken down by region and age).

Methodology

The sample included 252 respondents (152 girls and 97 boys) from various localities (villages, small cities, medium-sized cities, and metropolises). The sample included 105 sixth graders (as representatives of the younger adolescent group) and 147 ninth graders (as representatives of the older adolescent group). We collected data by surveying.

Sample parameters:

- Village of Bolshaya Murta, Krasnoyarsk Region (population > 10,000): 21 sixth graders (of whom 10 took the study electronically and 11 filled out a paper form) and 27 ninth graders who filled out the surveys electronically.

- Achinsk, Krasnoyarsk Region (population < 100,000): 41 sixth graders and 45 ninth graders who all filled out the surveys electronically.
- The city of Krasnoyarsk (population < 1,000,000): 43 sixth graders and 42 ninth graders who all filled out the surveys electronically.
- The city of Moscow (population < 10,000,000): 0 sixth graders and 33 ninth graders who all filled out the surveys electronically.

Results

The vast majority of modern ninth graders, regardless of where they live, own personal mobile phones that can function as personal computers. Teenagers use their personal devices to search for information on the Internet, communicate on social networks, and play computer games. The sixth-grade respondents who live in various regions indicated that they use various devices to access the Internet. Most of the students (71 percent) who live in a rural area connect to the Internet using a computer that stays at home (personal computer or laptop). A total of 23 percent of sixth graders from Krasnoyarsk reported accessing the Internet in this way, while 35 percent of sixth graders in Achinsk indicated this. Less than half of sixth-grade respondents from

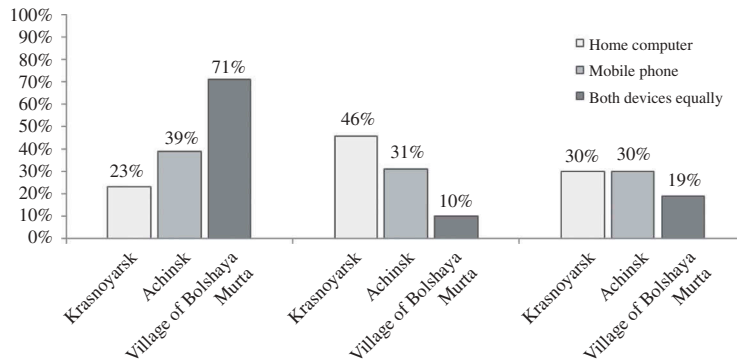

Figure 1. **Devices that Sixth-Graders Living in Three Localities Use to Connect to the Internet (*N* = 105)**

Krasnoyarsk (46 percent) and Achinsk (30 percent) and only 10 percent of sixth-grade students from the Village of Bolshaya Murta use a mobile phone to access the Internet. A total of 30 percent of sixth graders from Krasnoyarsk and Achinsk and 19 percent of schoolchildren from rural areas use home computers and mobile devices equally frequently to access the Internet. It should be noted that the answers to the questions that were designed to ascertain the type of device that is used to access the Internet were concentrated between the following two responses: "home computer" and "personal mobile device." An insignificant number of respondents chose the following answer options: "school computer," "computer at the workplace of one of my relatives," "home computer belonging to one of my friends," "mobile phone belonging to one of my friends," and "mobile phone belonging to my parents."

The vast majority of the survey participants use social networks. Only three percent of sixth graders and four percent of ninth graders (three people out of 102 and four people out of 144) answered that they do not have an account on any social network.

Sixth graders who participated in the survey had registered on 3.5 social networks on average, whereas ninth graders had registered on 2.5 social networks. The most popular platform for socializing is the social network VKontakte: 97 percent of sixth graders and ninth graders had signed up for it. The social network Odnoklassniki was the next most popular for sixth graders followed by Instagram, Moy mir, Facebook, Google+, and Twitter. Ninth-grade students expressed different preferences from the sixth graders. Thus, their second most popular social network was Instagram followed by Moy mir, Facebook, Twitter, Google+, and Odnoklassniki. When considered geographically, we did not discover any differences in the choice of social platform between teenagers living in Moscow and those in the Village of Bolshaya Murta.

We obtained the following distribution of ages when students register for a social network: the average age specified by sixth graders was nine and the average age at which they started actively using social networks to communicate was nine years

and six months; whereas the average age of social network registration for ninth graders was 10 years and eight months, and the average age at which they started actively using social networks to communicate was 11 years and four months. For schoolchildren living in various places, the average age when they registered for social networks and when they started using these services to communicate differed. These differences are not statistically significant. However, they demonstrate that schoolchildren living in the village start using social network services to communicate with others 1 to 1.5 years later than their peers living in a metropolis (see Table 1).

In all likelihood, the differences in the age when schoolchildren begin to use social networks can be attributed to the fact that virtual communication has only gained widespread popularity in recent years. In other words, it is not an age, but a cohort difference.

Around 90 percent of respondents from both groups (sixth graders and ninth graders) replied that they use their real first and last names as handles on these social networks. A total of 57 percent of sixth graders and 73 percent of ninth graders posted their real photo on their profile page. Those who chose to use the image of some other figure or character (such as, for example, the hero of a film or cartoon, musician, actor, etc.) made up 27 percent of sixth graders and 11 percent of ninth graders. During

Table 1.

Average Age When Sixth-Graders and Ninth-Graders in Four Localities Sign Up for and Start to Actively Use Social Networks

Locality	Sixth-grade registration	Sixth-grade start of use	Ninth-grade registration	Ninth-grade start of use
Moscow	—	—	10.5	11.3
Krasnoyarsk	9	9.8	10.9	11.7
Achinsk	9	9.2	11.1	11.6
Village of Bolshaya Murta	9.8	10.2	11.6	12.0

the last 3 months, 73 percent of sixth graders and 68 percent of ninth graders uploaded a new avatar image/photo to their profile page at least once. Sixth graders on average had changed their profile image about 6.5 times, whereas ninth graders had changed it about 2.5 times over the same period.

Fifty percent of schoolchildren responded that they posted original content over the last two weeks. The same percentage had reposted someone else's content by placing it on their wall, group, etc. A third of respondents indicated that during the specified period of time they had posted nothing on their page. However, a cursory content analysis of the pages of survey respondents who left links to their accounts showed that their pages contained both original and reposted content.

As far as the type of published content was concerned, the answers of the sixth graders were evenly distributed among the following main options: photos or videos with you in them (selfies); text notes (status updates, poems, anecdotes, opinions, etc.), including ones with attached multimedia such as pictures, videos or music; images or videos (pictures, photos, videos); and music. At the same time ninth graders reported that their favorite kind of content was the selfie (44 percent of respondents) followed by music (40 percent) and images or videos (36 percent).

Most students (80 percent) indicated that their parents (or at least one of them) also had accounts on social media. There were no statistically significant differences concerning this question between the students in different places. In addition, 65 percent of sixth and ninth graders answered that they were aware of what their parents post on their accounts (profile information, photos, music or video, news feed posts, and status updates), whereas 28 percent said they were not aware.

Teenagers described the presence of teachers on social networks in the following way: Fifty-five percent of respondents who are ninth graders indicated that less than half of their teachers had accounts on social media. However, at the same time sixth graders noted that they were able to find more than half of their teachers on social media. According to the survey data, fewer teachers at rural schools have social media accounts than

those at urban schools. Thus, 25 percent of teenagers from villages indicated that their teachers did not have accounts. Schoolchildren living in other places reported a lower percentage. About half of the respondents, regardless of their place of residence (Moscow, Krasnoyarsk, Achinsk, and the Village of Bolshaya Murta), indicated that they know what has been posted on the accounts of school teachers (profile information, photos, music or videos, news feed posts, and status updates). Fifty-seven percent of sixth graders and 45 percent of ninth graders "are friends" with their teachers on VKontakte, whereas 42 percent of sixth graders and 55 percent of ninth graders are not friends with their teachers on social networks.

Around 20 percent of respondents answered that they had unfriended parents or teachers. The most commonly cited reason for doing so was their desire not to show the adults their published content. Other reported reasons included the following: "Mom posted photos of me from when I was 10 years old;" "Because we have nothing more to say to each other outside of school;" "The teacher scolded me for information that I posted on my page;" and "The teacher wrote a bad comment under my photo."

Discussion

The conducted study showed that the differences that characterize the ICT landscape of sixth graders who live in different places level out by the ninth grade. Modern ninth graders, regardless of where they live (Moscow, Krasnoyarsk, Achinsk, and the Village of Bolshaya Murta), are autonomous (independent) users of mobile devices. In fact, they do not need to use school and home computers. They are always online from their portable devices. Surveyed sixth graders from the village, small town, and metropolis reported differences in the device that they choose to access the Internet. Adolescents from the Village of Bolshaya Murta mainly use a home personal computer to access the Internet. Schoolchildren from Achinsk were equally likely to use mobile devices and desktop computers, whereas students

from Krasnoyarsk prefer to use mobile phones. It is important to note the fact that respondent data indicate that even in the village every teenager has Internet access. Respondents did not indicate in their responses that they borrowed electronic devices and computers belonging to others ("School computer," "Computer at the workplace of one of my relatives," "Mobile phone belonging to one of my friends," or "Mobile phone belonging to my parents"). Modern teenagers indicated that they have two basic ways of accessing the Internet: a home computer or laptop or their own mobile device.

Both urban and rural teenagers socialize on social networks. Schoolchildren prefer the VKontakte social platform for communication. The average age at which students start using social networks is 9 or 10. Most of the study participants noted a gap of about half a year to a year between when they started to actively use social networks and when they first learned about them and signed up for them. It is worth noting that the gap between the age of registration and the start of use of social media is narrower for schoolchildren living in large cities. Thus, rural teenagers register on social media almost a year later than schoolchildren from Moscow.

The overwhelming majority of respondents from the two cohorts responded that they use their real first and last names as their handles. Respondents indicated that they did not change their handles very frequently. At the same time teenagers change their user photos (avatars) quite frequently.

Teenagers who use social networks did not distinguish between the concept of a "post," i.e., publishing original content, and a "repost," i.e., posting someone else's material, in their survey responses. On the one hand, this might be attributed to the fact that the question was framed incorrectly or that definitions that were presented in the survey were misunderstood. On the other hand, it may speak to the fact that when teenagers select content that they find attractive on social media, they appropriate it and make it their own.

Sixth graders have registered for an average of 3.5 social networks. Ninth graders participate on an average of 2.5 social

networks. The difference between the cohorts can be explained by the need to experiment. Sixth graders are only using such services for the first time. They choose networks where they feel most at ease and that they find the most interesting. It is very laborious and time-consuming to maintain several accounts at the same time. We would hypothesize that over time teenagers tend to abandon those social media accounts that do not satisfy their needs. The distribution of the preferences of users belonging to the same age cohort between the platforms is interesting in light of our assumption. For example, the social network Odnoklassniki turned out to be the second most popular among the surveyed sixth graders, though according to statistics this social network is the most popular among users between the ages of 35 and 44 or, in other words, among users belonging to the age group of their parents and teachers. For ninth graders, by contrast, this social network is the seventh most popular, perhaps because it is frequented by adults.

Most of the respondents answered that their parents have accounts on social networks. A smaller percentage of children are aware of the profiles of their teachers on social media. According to the survey data, fewer teachers at rural schools have social media accounts than those at urban schools. About half of all survey participants from the cohort of sixth graders indicated that they are "friends" with their parents or teachers on social networks and that they monitor updates on their accounts. This percentage is slightly lower for ninth graders. About one quarter of respondents noted that they had unfriended parents or teachers. Most of the answers indicated that they did so because they did not want to share their posted content with these adults.

Conclusion

Mobile technologies are currently universally accessible to teenagers living in various places. If there are differences in how sixth graders access the Internet, then these differences level out by the ninth grade. By the time that they complete the second stage of their K–11 education, Russian teenagers from Moscow,

Krasnoyarsk, Achinsk, and the Village of Bolshaya Murta own mobile phones and actively use social networks.

The VKontakte social network is the most popular communication platform regardless of age cohort. The first age at which schoolchildren express interest in social media services is younger than the minimum age that the developers of these platforms stipulate for membership (age 13). This is at the age of nine to 10, which corresponds to the lower bound of adolescence formulated by D. B. Elkonin [2]. Teenagers are already registered on social networks.

Social networks are rather weakly monitored by adults. Currently these resources are more dominated by teenagers. The study results demonstrate how the different age cohorts (sixth and ninth graders) apply different privacy controls with regard to parents and peers on social networks as a way of establishing control over their own profiles. Teenagers are particularly sensitive to violations of "boundaries." They ban parents and teachers from their pages in response to any negative feedback from them on the content that they post. When we consider external factors, then if it is theoretically possible to enable parental controls on the mobile devices and desktop computers that are used by sixth graders, then such parental controls that would allow an adult to completely monitor resource use are no longer possible for fully autonomous ninth graders. The only available punishment at this age level is confiscating the teenager's gadget.

We noted that the percentage of teachers at rural schools with social media accounts is much lower than for their colleagues at urban schools. This means that the digital divide between students and teachers on the periphery is much wider.

Though online communication presents many risks and limitations, mobile and networking technologies can function as effective learning tools given the importance of these technologies to the lives of teenagers. As the study shows, modern schools regardless of where they are located have the necessary infrastructure to support the use of these technologies. At the same time, this situation is not the result of any program initiated by the state. Rather, it is a phenomenon produced by the third wave of computerization that has saturated the school space with computer equipment thanks to the adolescent users

of these devices [1]. Currently teachers and students have access to an extensive number of mobile devices and applications, which can be used to organize group work, to solve learning problems, and to plan projects.

The use of mobile and networking technologies in rural schools may produce even better results and prove to be more effective than at schools in large cities. First of all, this is because these technologies expand boundaries: they allow students in the same age cohort and attending various schools to remotely collaborate with each other. Secondly, social networks could function as an e-learning platform and provide an alternative way for students to attend school who cannot make it to class (when this is necessary). Thirdly, these resources can help compensate for the weak technical infrastructure at the school.

To realize these goals, we will have to focus on working with teachers and to incorporate such innovative components into continuing education courses for teachers as well as new teacher training programs. We will also have to supplement the current set of computer equipment at schools with necessary additional devices. Given that there are affordably priced smartphones currently available on the market, significant allocations from the budget will not be required to purchase devices that can be used by schoolchildren from low-income families.

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Notes

1. According to data provided by the International Data Corporation (IDC), sales of personal computers have been steadily declining since 2010 while over the same period mobile phone sales have continued to grow.

2. The working concept of the "ICT landscape" was coined by borrowing the archaeological term "landscape," which offers an activity model that has

been transformed into a spatial arrangement of elements and reflects the external forms of human activity models [12]. The abbreviation "ICT" indicates that our study is focused on information-communication technologies that shape the modern school landscape.

3. "Federal'nyy zakon ot 29.12.2012 no. 273-FZ 'Ob obrazovanii v Rossiyskoy Federatsii'."

4. "Federal'nyy gosudarstvennyy obrazovatel'nyy standart osnovnogo obshchego obrazovaniya. Prikaz Minobrnauki Rossii ot 17.12.2010 no. 1897."

5. "Federal'nyy gosudarstvennyy obrazovatel'nyy standart osnovnogo obshchego obrazovaniya. Prikaz Minobrnauki Rossii ot 17.12.2010 no. 1897."

6. The "eLearning Industry" page on the Facebook social network (171,000 people), "eLearning Industry," https://www.facebook.com/eLearningIndustry; the "Blended-learning" forum on Pedsovet.org, "Smeshannoye obucheniye," http://pedsovet.org/forum/topic11274.html; the "Education Innovators" page on the Facebook social network (3,000 people), "Innovatory obrazovaniya," https://www.facebook.com/groups/ed-innovators.

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