

Computer vs Smartphone: How do Pupils Complete Educational Tasks that Involve Searching for Information on the Internet? *

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Abstract

This article presents the results of an empirical study aimed at analyzing the use of technological devices (smartphones, tablets and laptops/computers) by pupils of the 6th – 9th grades in the process of searching online for educational information. These pupils had varying levels of academic performance. The results show that a higher academic performance is associated with a preference for a laptop/computer and especially a tablet, whereas a lower academic performance is related to a preference for a smartphone.

Keywords: *smartphone, tablet, laptop/computer, pupils of the 6th – 9th grades, online searching, educational task*

1 Introduction

Online searches for educational information are firmly embedded in the daily educational activities of contemporary schoolchildren [Soldatova et al., 2017], [Sumitra, 2019]. This allows us to say that “gadgets go to school” [Bruder, 2013]. The use of the Internet in the classroom contributes to speeding up the receipt of information, promoting communication and providing a quick exchange of this information between pupils [Yasakci et al., 2019], so it is an important way to improve the educational process in today’s digital world.

Nevertheless, both teachers and parents are raising an alarming question: “To ban or not to ban?” [Elliott-Dorans, 2018]. In the United States, even within one state (Missouri), there is a huge diversity in approaches regarding the taking of gadgets to school [Bruder, 2013]. Psychological and pedagogical studies suggest that there is no simple answer, and sometimes banning the use of gadgets in classes can reduce students’ involvement in the learning process [Elliott-Dorans, 2018], [Wei et al., 2019]. On the other hand, teachers often consider gadgets as powerful distractors to this process. In addition, there is a widespread point of view that the quality of learning is lower in situations when gadgets are used than if knowledge is obtained by traditional methods (books, notebooks, pens).

In the context of this discussion, a special place is occupied by the question of whether all electronic devices have the same impact on the learning process, or whether the use of different devices (in particular, laptops or computers, tablets and smartphones) entails different effects. This issue is becoming more and more pertinent due to the trend in recent years to move from the use of

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computers to the use of mobile touch devices. Studies aimed at exploring the consequences of the increasingly widespread use of these devices in education show that this has led to various changes in educational activities. Russian schoolchildren often have several different electronic devices freely available (for example, a smartphone and a laptop) [Koroleva, 2016] and can choose which of them to use for completing educational tasks. It is not yet known, however, what impact a schoolchild's preference for one gadget or another has on the effectiveness of learning.

2 Literature Review

The growing use of electronic devices in the educational process is relevant to the reality of the digital world and to the challenges involved in developing pupils' digital competence, which is necessary in every sphere of contemporary life. However, the psychological and pedagogical effects of introducing electronic devices into the educational process have not been fully investigated. An additional problem is the rapid evolution of electronic devices, which requires the speed of these studies. As a result of rapid advances in mobile technology, Internet connectivity is increasingly moving from computers to wireless environments [Zickuhr et al., 2012]. Against the background of the increasing amount of technological equipment in schools, there is an active discussion about the advantages and disadvantages of pupils using personal electronic devices in the educational process. The advantages are seen to be the opportunity for diversification of educational content, video illustration and gamification, an intensification in the informational exchange between pupils and an increase in their cognitive activity. At the same time, it is noted that these advantages can be realized only if the use of electronic devices is strictly regulated so as to protect pupils from various risks (reduced concentration, violation of personal borders, cyber aggression, dangerous content, etc.) [Elmore, 2004], [Vigna-Taglianti et al., 2017].

Recently, special importance has been attached to empirical verification of the effectiveness of introducing new technologies into education, primarily technologies related to the inclusion of electronic devices in the educational process [Fajebe et al., 2013]. The available data, however, are contradictory.

Thus, today there is no clear answer to the question of how the use of electronic devices affects the cognitive and emotional development of a child. It is obvious that the Internet provides children with a more complex and constantly growing world, which increases its importance in their development [Greenfield et al., 2006]. Intensive interaction in networks probably has positive effects on children's development and improves their cognitive skills [Johnson et al., 2008], first of all for reading [Jackson et al., 2006]. The value of Internet communication is higher than other socio-economic factors [Johnson, 2010]. Similarly, this communication has a positive impact on the learning of foreign languages [Coniam et al., 2004]. Online games allow children to develop strategic skills, to speed up the processing of information and to improve visual attention [Johnson, 2006]. At the same time, the Internet can have negative impacts on development, such as reduced socialization skills [Schott et al., 2000], reduced available cognitive ability [Ward et al., 2017], impoverished fantasies, decreased concentration [Cordes et al., 2000], changes in values [Kiliçer et al., 2015], and the increased probability of academic deception [Coleman, 2012], [Al-Shehri, 2017], [Black et al., 2008], which together impair the assimilation of educational information.

The issue of the impact electronic devices have on the educational process is also debatable. For example, the One Laptop Per Child (OLPC) program, promoting a fundamental transformation of education in poor countries, has shown that children who receive cheap individual computers (sufficient for educational purposes) quickly learn how to use the computer for purposes other than those suggested by their teachers. A survey of teachers who work in this program in Rwanda showed that many of them were not ready to provide this kind of education [Fajebe et al., 2013].

Other research also confirms that schoolchildren regularly use their personal smartphones and laptops provided by the school for entertainment purposes Andrei. Although students' participation

and interest in courses increases thanks to the use of electronic devices (for example, laptops) if the device is used for specific tasks and integrated smoothly into a lesson, unstructured use of the devices correlates with an increase in distractions and a decrease in attention to educational tasks [Kay et al., 2011].

According to the results of other studies, the effective use of electronic devices (in particular, smartphones) during academic classes requires strict regulation and constant monitoring by the teacher [Moorleghe et al., 2019].

Another aspect of this issue is that different electronic devices can affect the educational process and its results in different ways. Thus, it has been found that a computer or a laptop contributes to involvement in the process more than a smartphone [Koroleva, 2016], [Andrei, 2019]. Students who use a smartphone are more likely to be distracted by extracurricular goals [Andrew et al., 2018]. There is also evidence that mobile devices are more often used to exchange educational information [Witecki et al., 2015], which is typical of Russian schoolchildren [Pecherskaya et al., 2013], while computers or laptops are used more often to search for educational information [Dahlstrom et al., 2012], [Vassilakaki et al. 2016], [Vazquez Cano et al., 2018]. Students assess computers and laptops as more convenient for searches because of the larger screens and greater keyboard functionality [Dashtestani, 2015].

A variety of researchers suggest that, when assessing the impact of electronic devices on the effectiveness of learning activities, we should take into account the capacity of the devices, the degree of regulation of their use and the character of the educational tasks. Today the data on electronic devices used by Russian schoolchildren in online searches and on their contribution to the effectiveness of educational activities are fragmentary. In our research, we focused on the problem of how effectively schoolchildren use different electronic devices (smartphones, tablets and laptops or computers) in the process of unregulated online searches for educational information, and we chose the indicator of academic performance as the criterion of effectiveness.

3 Materials and Methods

The empirical data were collected with the use of a questionnaire, which included the following points.

1. Availability of technological devices which provide access to the Internet (a laptop/computer, a tablet, or a smartphone): “Do you have an opportunity to freely use a laptop/computer, a tablet or a smartphone to do your schoolwork, both at home and at school?” (the value assigned to each item: 1 – no, 2 – seldom, 3 – sometimes, 4 – yes)
2. Preference for a laptop/ computer, smartphone or tablet when searching for educational information online: “When you need to find some information on the Internet to do your schoolwork, which do you usually use? Choose one: 1) a smartphone 2) a laptop/computer 3) a tablet.” and “What is the most convenient way for you to search for this information on the Internet? Choose one: 1) using your smartphone 2) using a laptop/computer 3) using a tablet”
3. Self-assessment of skills when using various technological devices to search for educational information online: “How good are you at using the learning opportunities which are provided by a laptop/computer, a tablet and a smartphone?” (the value assigned to each item: 1 – not as good as my schoolmates, 2 – as good as my schoolmates, 3 – better than my schoolmates)
4. Self-assessment of the effectiveness of searching for information online (for educational purposes): “How good are you at searching the Internet for information which you need to do schoolwork? Choose one: 1) I often cannot find the information 2) I usually find the information 3) I always find the information without any problems”
5. Information about the participant (grade, academic performance).

The study involved 447 pupils in the 6th–9th grades (53.0 % of them were girls). All participants study at different schools in Saint Petersburg, Russia.

The results were computed using the Statistica 12.0 software package. Statistical processing included frequency analysis, average value analysis, criteria analysis (Kruskal-Wallis H, Fischer φ^* criteria), and variance analysis (F).

4 Results

According to the empirical results, the most accessible technological device that allows schoolchildren to search for educational information on the Internet is a smartphone (see Figure 1).

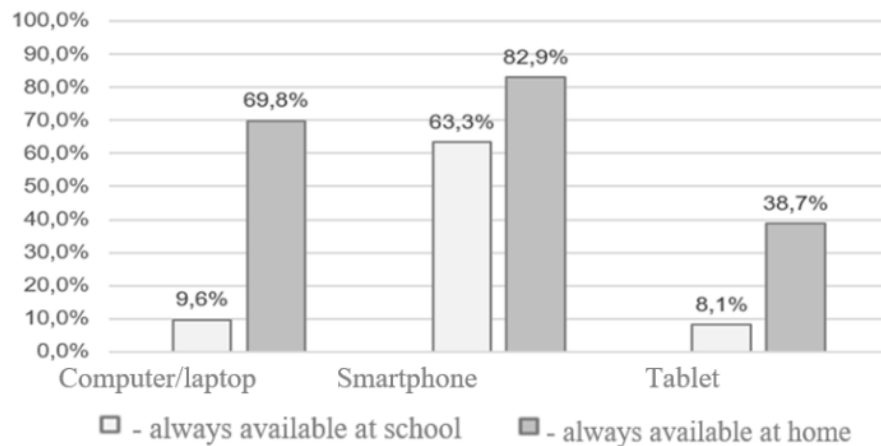


Figure 1: The availability of various technical devices for online search of educational information (the frequency of the response “I can always use this device”)

The higher availability of the smartphone as an online search tool for educational purposes is particularly evident in the school environment (φ^* , $p < 0.01$), while at home most pupils get a choice: more than one third of them always have access to a tablet and almost two thirds, to a laptop or desktop computer with Internet access. However, regardless of the availability of various devices, the pupils use their smartphone most frequently (φ^* , $p < 0.01$). Moreover, they subjectively assess a smartphone as the most convenient (φ^* , $p < 0.01$) tool for online searches when doing schoolwork (see Figure 2).



Figure 2: Usability of various technical devices for searching educational information

An analysis of pupils' own assessment of their skills for online searching shows that schoolchildren highly rate their capabilities. In addition, they give a high assessment to their skills in using different devices. Their "user confidence" consistently increases in secondary school up to the 9th grade. At this point, the rating of these skills begins to decline slightly. Most likely, this trend is a result of increasing educational requirements and their own developing reflexive potential at this stage of their education. Regardless of the grade, the highest rating of user skills is associated with smartphone use, and the lowest rating is related to the use of a tablet. At the same time, students who perform well academically score their skills in online searching and using various technological devices for educational purposes slightly higher in comparison with their less successful peers (see Table 1).

Table 1: Self-assessment of skills for educational online searches using various devices.

Note: φ^* - $p < 0.05$

Groups	Self-assessment of skills (min=0, max=3)			
	Online searching for information	Using a smartphone	Using a tablet	Using a laptop or desktop computer
6 th grade	1.84	2.20	1.78	1.92
7 th grade	2.14	2.25	1.79	2.11
8 th grade	2.18	2.29	1.73	2.12
9 th grade	2.14	2.14	1.81	2.02
<i>Difference (H)</i>	<i>7.77</i>	<i>4.67</i>	<i>0.44</i>	<i>5.25</i>
Honours pupils	2.26	2.21	1.74	2.15
Pupils with a higher academic performance	2.16	2.27	1.88	2.16
Pupils with an average academic performance	2.06	2.19	1.76	1.99
Pupils with a lower academic performance	2.09	2.18	1.40	1.89
<i>Difference (H)</i>	<i>3.16</i>	<i>3.56</i>	<i>8.61*</i>	<i>7.74*</i>

An analysis of variance did not reveal any relationship between the pupils' preference for a particular device for online educational searches and their own assessment of their skills in using it for this purpose. At the same time, it was found that students with a higher academic performance significantly more often prefer to use a computer/laptop and a tablet device when they go online to search for information, instead of a smartphone, which pupils with a lower academic performance more often opt for (see Figure 3).

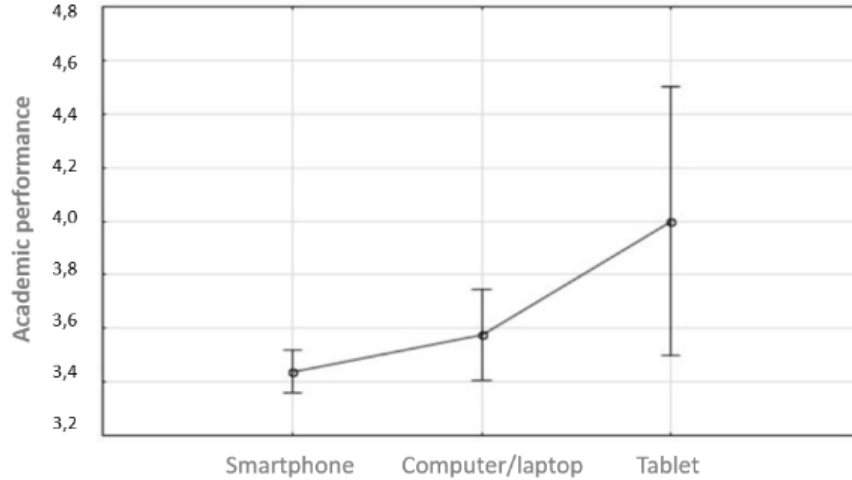


Figure 3: Frequency of using smartphone, tablet and computer/laptop for completing educational tasks by students with different academic performance. Note: $F(2.46)=3.19$, $p=0.04$

It is important to note that pupils with a higher academic performance have free access to tablets more often than their peers who exhibit a lower academic performance (φ^* , $p<0.01$). So, it is impossible to draw the conclusion that a tablet provides the best opportunities for effective online educational searches. At the same time, it is obvious that the preference for a smartphone is more common among pupils at the lower end of the academic spectrum.

5 Discussion

According to our findings, we can confidently assert that the smartphone occupies first place among the electronic devices which pupils in the 6th–9th grades use for educational online searching. The subjective preference for smartphones among Russian schoolchildren corresponds to the results of researchers from other countries [Archana et al., 2016]; [Sari et al., 2020]. This fact can probably be explained if we bear in mind that the smartphone is the most affordable device that provides Internet access both at school and at home. In today’s digital world, children most often get a smartphone as the first personal device which provides constant Internet access, and their familiarity with the Internet most often begins with this smartphone. So, pupils consider it to be the most convenient device to search for educational information, and when it comes to evaluating their skills in using one to complete educational tasks they give themselves the highest possible rating.

At the same time, we can assume that students overestimate how skilled they are at using a smartphone, as well as the other devices. A similar tendency was noted in Galina Soldatova’s study, which reports that excessive “user self-confidence” is a popular characteristic in adolescence [Soldatova et al., 2017]. We can see that they have overestimated their skills when they reach the 9th grade and begin to lose confidence in their ability to use various devices to carry out educational searches online. Their increasing self-assurance and estimation of their skills in the 6th–8th grades can be explained by the relevant experience that they have been accumulating. In the 9th grade, however, when pupils are faced with fundamentally new tasks related to preparing for exams, their confidence goes down. In addition to these stricter educational requirements, this decrease in “user self-confidence” in the 9th grade, can also be attributed to their development of self-awareness, which leads them to revise their self-esteem.

An interesting fact is that there is no correlation between the pupils’ preference for one device

or another to carry out educational online searches and their own assessment of their “user skills”. According to these results, we can suggest that they underestimate the contribution of “user competence” to the success of educational online activities. Similar results were previously obtained in other studies [Albo et al., 2019].

Our findings showed that pupils with different levels of academic performance prefer different devices for educational online searching. Those with a relatively low academic performance find a smartphone to be more preferable, the ones with a moderate academic performance demonstrate a preference for a laptop/computer, and pupils with a higher level of academic performance are more likely to prefer a tablet than their peers in the other two categories.

This empirical tendency may have different explanations. On the one hand, the correlation between a preference for a tablet and pupils’ academic performance may be related to the technical potential of this device, which combines the speed of access to information that is typical of a smartphone, and the extensive processing capabilities of a computer/laptop [Haßler et al., 2015]. On the other hand, some researchers have reported that the information from a smartphone involves a person in understanding less than the other devices, a computer in particular [Barque-Duran, 2017]. In addition, it is possible that this tendency reflects a higher level of parents’ interest in the educational affairs of their children (because parents ensure that they have access to various devices for learning). It is also possible that this demonstrates a gradual disappearance of functional differences between laptops and tablets due to technological progress, which has been noted elsewhere [Dahlstrom et al., 2012]. However, regardless of the interpretation, it is obvious that the use of a smartphone by schoolchildren for completing educational tasks related to searching for information is less preferable than the use of a laptop, a desktop computer or a tablet.

Conclusions

Secondary school pupils prefer their smartphones as electronic devices which allow them to access the Internet and provide an opportunity to search online for educational information. They highly appreciate the convenience of the smartphone and their own skills in using its capabilities. However, higher academic performance is associated with the use of tablets and laptops. These results call for further research aimed at determining the psychological features of online searches using different technological devices and analyzing their capabilities and limitations for solving different educational problems. The next stage of studying educational activity in a digital environment should be focused on the links between pupils’ preference for different devices and their styles of processing information.

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