Self-Assessment of Educational Results in Students who Prefer Computers, Laptops or Smartphones as Educational Tools for Distance Learning (in the Situation of Forced Transition to Distance Learning due to the COVID-19 Pandemic)*

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Abstract. The article presents the results of a longitudinal study aimed at a comparative assessment of university students' attitudes to various aspects of the educational process, depending on their preference for a computers/laptops or smartphones as an educational tools. The study involved 94 full-time 1st–4th year students who had been transferred to distance learning (by the Moodle course management system) in March 2020 due to the spread of COVID-19 coronavirus infection. The empirical study was conducted with the use of Google forms tool. Students answered such questions as (1) What technical devices do they prefer for completing educational tasks? (2) How has the quality of knowledge and skills forming changed due to the transition to distance learning? (3) How has the degree of involvement in the educational process changed after transition to distance learning? The survey was conducted twice: at the end of the first week and after five weeks of distance learning. The results of the study showed that students who prefer computers/laptops as the main tool for distance learning highly estimated the ratings of the quality of knowledge and skills as well as their involvement in the educational process, in comparison with students who mainly use smartphones. At the same time, students who prefer smartphones demonstrated a relative increase in the assessment of knowledge and skill quality but significant decrease the indicators of involvement in the educational process, while among students who prefer to use laptops or computers these indicators were more stable for first weeks of distance learning.

Keywords: distance learning, university students, computer, laptop, smartphone, quality of knowledge, quality of skills forming, involvement in the educational process, longitudinal study.

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1 Introduction

It is impossible to imagine modern education without various electronic devices that provide access to the Internet. These devices became particularly important during the period of forced transition of schoolchildren and students to learning with the use of distance education technologies, which was associated with the spread of COVID-19 coronavirus infection in the spring of 2020. At that time, electronic devices turned to the main tools of educational activities. Even before the start of the COVID-19 pandemic, it was found that schoolchildren and students use a wide range of technical devices in their educational activities (computers, laptops, tablets and smartphones), and mobile devices are becoming more common due to the fact that they allow users to provide a higher degree of mobility in comparison with stationary computers. In particular, schoolchildren and students often use tablets and smartphones along with computers and laptops) to complete various educational tasks, such as searching for additional information, performing tests, writing texts, etc. [14]. However, it is obvious that dissimilar electronic devices have different characteristics and different purposes, so the use of each type of electronic devices in the educational process accompanies by their unique opportunities and limitations. Taking these characteristics and purposes into account is an important factor in improving the quality of the educational process organization. However, the information about the role of electronic devices in the educational process (and, in particular, their impact on procedural and resultative aspects of educational activities) is fragmentary by present time. In addition, this information was obtained in terms of full-time educational process, when electronic devices were used as auxiliary tools. Therefore, today it becomes relevant to study the opportunities and limitations of using various electronic devices in distance education, which causes the status of these devices as the main tools of students' educational activities.

2 Psychological Effects of Various Electronic Devices as Tools for Educational Activities: Literature Review

Current research suggests that the opportunities and limitations associated with the use of various electronic devices as educational tools are largely determined by their functional characteristics. Thus, research has found that mobile devices are more often used by students for communication on educational issues, in particular, for the exchange of educational information [5], while computers, laptops or tablets are frequently preferred for informational search or completing other types of educational tasks [4]. This functional distribution is caused by the convenience of computers and tablets for working with information due to the larger size of the screens and the greater functionality of the keyboard, in comparison with smartphones, which, in turn, provide more efficient communication because of the high speed of information exchange [3].

The greatest amount of empirical data is available on the psychological effects of the educational use such electronic devices as computers and laptops in the

educational process, on the one hand, and smartphones, on the other hand. For example, there is empirical evidence that computers and laptops contribute to the involvement in the educational process to a greater extent than smartphones [1]. In turn, the use of smartphones is associated with a decrease in the quality of analyzing information which is obtained by them [2]. The small size of mobile devices, the ability to view only one window at a time, and distraction from messages contribute to the development of the skill of switching and distributing attention but at the same time these features of smartphones affect the ability to focus on one thing for a long time, which is essential for deep knowledge and purposeful cognitive activity. Thus, attention productivity decreases [6]. According to some authors, a person who is distracted by messaging takes up to four times longer to complete an educational or working task [11], as well as on breaks between tasks that are used for checking personal messages or surfing the Internet [7]. Working in the "multitasking" mode quickly overloads the students' memory resources [8-10]. Research also shows that the availability of a smartphone can reduce the productivity of cognitive activity [12].

In general, empirical research suggest that computer or laptop look more preferable than a smartphone as a tool for completing educational tasks related to the search for additional information, its understanding and use in learning activity, and this fact applies to both the procedural (involvement) and resultative (quality of knowledge and skills) aspects of educational process. At the same time, it is necessary to highlight that relevant empirical evidences were obtained mainly from the analysis of the use of electronic devices in terms of full-time education, when distance learning technologies complement "live" learning in classrooms. Thus, they reflect the features of everyday use of computers, laptops, smartphones and tablet devices in situations where they are an auxiliary educational tools. However, we can posit the relevance of studying psychological and pedagogical effects of various electronic devices as educational tools in terms of distance learning to analyze the influence of preferred electronic devices on the procedural and resulting characteristics of students' educational activities.

3 Current Study

3.1 The purpose of study

The purpose of our study was to analyze the dynamics of assessing the procedural and resultative characteristics of educational activities by university students in terms of forced transition to distance learning during the period of adaptation to new educational conditions. The transition from full-time to distance learning was determined by the pandemic of the new coronavirus infection COVID- 19 and took place in March 2020 in accordance with the order of Russian government.

The research program involved following research questions:

1) What are students' preferences for electronic devices used as the main learning tools in distance learning, and how stable are these preferences?

2) What is the dynamics of students' attitudes to learning in terms of forced transition to distance learning, and what is the contribution of preferred electronic devices to this dynamics?

3.2 Materials and methods

The study was conducted in March-April 2020, during the temporary transition of higher educational institutions in Russia to implementing educational programs in the e-learning format with the use of distance learning technologies. 94 full-time students of Herzen State Pedagogical University of Russia (from 1st–4th university years) were invited to participate in the study. During this period the educational process was organized on the basis of the Moodle course management system. The study was implemented in longitudinal design; empirical data were collected with the use of questionnaire by online service Google forms. The first stage of the survey was realized at the end of the first week of distance learning, the second – after five weeks of distance learning.

The questionnaire included several blocks, which, in particular, allowed getting information about electronic devices which are available for students' educational activity, about their preferences related to the use of certain devices for completing educational tasks, as well as about some aspects of students' attitudes to the educational process and its effectiveness. Students were asked to assess the changes in the quality of knowledge and skills (the result aspect of educational process) and the degree of their involvement in learning (the procedural aspect of educational process). Students used a 5-point scale to assess the quality of knowledge and skills, as well as the degree of involvement in the learning (-2 – "significantly decreased", -1 – "slightly decreased", 0 – "did not change", +1 – "slightly increased", +2 - "significantly increased").

Processing the results was performed with calculating descriptive statistics and analyzing of variance (F) by the statistical software package Statistica 12.0.

4 Results

The results of the survey showed that 100 % of respondents have the opportunity to use both a computer/laptop and a smartphone with Internet access in their educational activities. 26.6 % of students also have the option to use a tablet device. Thus, all respondents who took part in the study had the opportunity to choose the electronic devices that is more preferable for them for completing educational tasks. The distribution of students' preferences at the end of the first week of distance learning and after five weeks of learning activities in this format is presented in Figure 1.

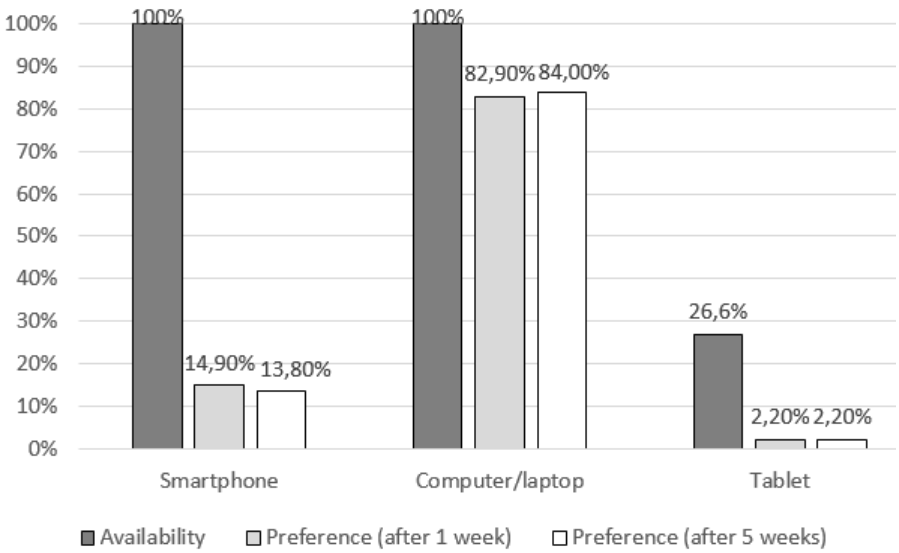

Fig. 1. Availability of electronic devices and their preference by students at different stages of transition to distance learning

The results of the survey indicate that students' preferences were extremely stable. Most students gave priority to use computers or laptops (n=78), the others – smartphones (n=13), and only two of them – tablets. Changes in preferences were fixed only in one case: a first-year student started to use a computer instead of a smartphone after a month of distance learning.

According to these results, the sample was divided into two subgroups: the first subgroup incorporated students who prefer computers or laptops as educational tools, the second subgroup were students with preference for smartphones. As a number of students who preferred a tablet was extremely small, this subgroup was not included in the further analysis.

The results of comparative analysis suggest that the dynamics of attitudes to various aspects of educational process in subgroups significantly differs in the first and the second stages of survey (see Fig. 2).

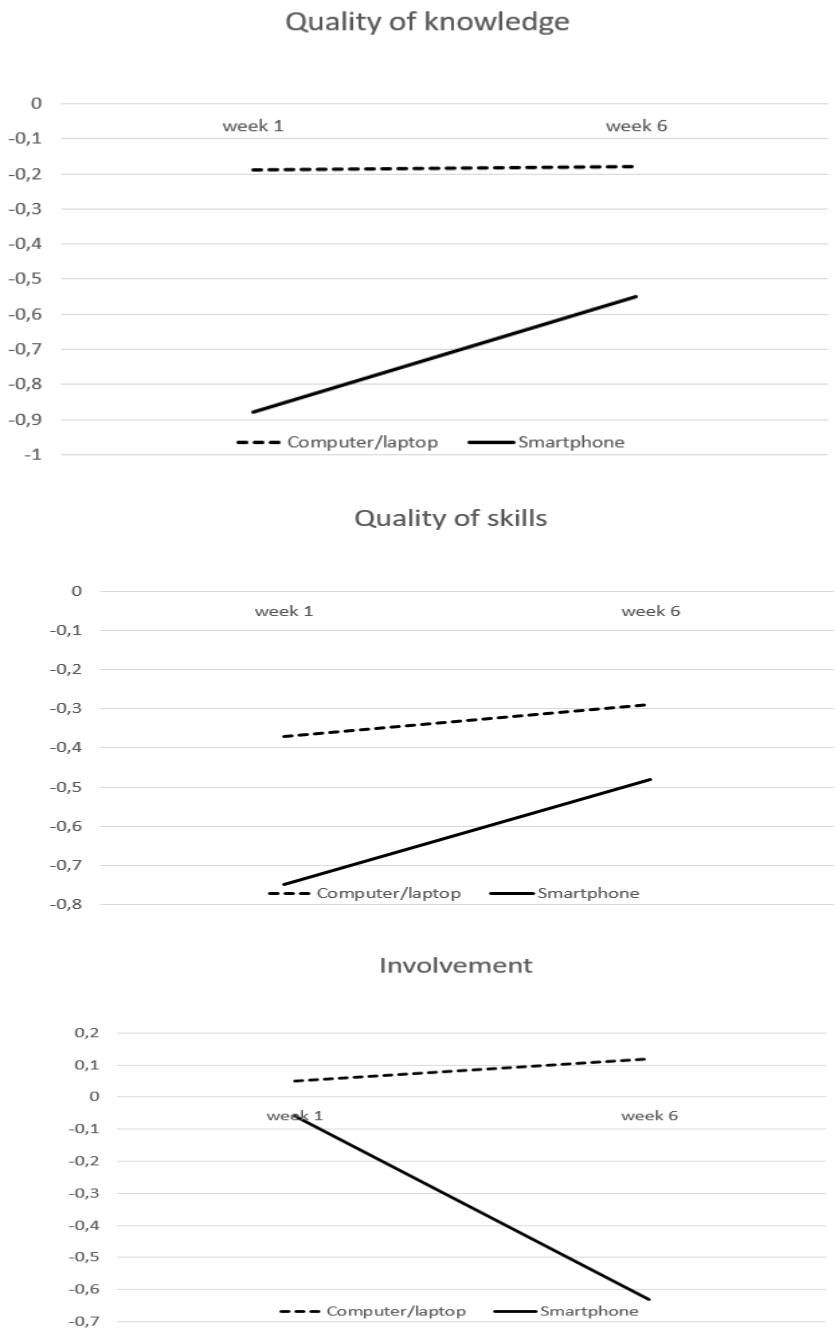

Fig. 2. Dynamics of attitudes to various aspects of the educational process in subgroups of students who prefer to use computers/laptops or smartphones

Students generally note that the quality of knowledge and skills was decreasing with transition to distance learning. At the same time, the most obvious decrease in the quality of knowledge and skills at the beginning of distant learning was indicated by the students who preferred smartphones as the main educational tools, while students who gave preference to use computers/laptops felt similar changes to a much lesser extent ($F=3.41$ at $p=0.04$ for the parameter “quality of knowledge”; differences at the level of a strong statistical trend, $p<0.10$ for the parameter “quality of skills”). Five weeks after the start of distance learning these differences between subgroups were generally preserved, but became less expressed.

The parameter "involvement in the educational process" showed another dynamic. Assessments of the involvement were focused on the “no changes” position in both subgroups at the first stage of survey. However, after five weeks, the situation transformed. In the subgroup of students who used computers or laptops as educational tools, the assessment of the involvement in the educational process generally remained at the same level, while in the case of students who gave preference for smartphones this assessment significantly decreased ($F=3.58$ at $p=0.03$).

5 Discussion

The results of our empirical study showed that students, as a rule, have the opportunity to choose the electronic device for completing the educational tasks. All respondents had smartphones and laptops or computers with free access to the Internet, in addition, about a quarter can also use tablets. More than 80 % of respondents noted that the most convenient tool for them to complete training tasks is a computer or laptop, and the preference for a smartphone is four times less common. A longitudinal study has demonstrated the stability of preferences in the use of electronic devices as educational tools. So we can conclude that these preferences reflect the stylistic features of the organizing the students’ educational activities that have been developed in full-time learning, and the transition to distance learning probably did not have a significant impact on them. Thus, the answer to the first research question states that students’ preference for one or another electronic device as an educational tool is a stable characteristic of their educational activities which is integrated into the system of their educational actions.

According to the second research question, we found that students note a decrease in the quality of knowledge and skills in distance learning, regardless of preferred electronic device. At the first week of distance learning students who prefer to use smartphones most acutely reflected a deterioration in the effectiveness of the educational process, while students who prefer computers and laptops felt a decrease in the effectiveness of education to a lesser extent. This result generally corresponds to other studies [4]. Over next weeks, in line of adaptation to distance learning, these differences smoothed out, but the overall trend was preserved. Nevertheless, we can

establish that the self-assessment of quality of education in students who use smartphones for educational activities in terms of distance education was more vulnerable in comparison with students who preferred computers/laptops.

The dynamics of the parameter “involvement in the educational process” turned out to be different. At the beginning of distance learning, students usually did not notice any changes, regardless of preferred electronic devices. However, after five weeks, the subgroups showed fundamentally different dynamics in assessing their involvement in the educational process. In the group of students who use computers or laptops, the overall assessment remained “no changes”, while among students who use smartphones, a significant decrease in this assessment was identified. Thus, answering the second research question, we can be state that using a smartphone as an educational tool can contribute to decrease in subjective involvement in the educational process, in comparison with using a computer/laptop. Similar findings were obtained in other studies [1]. However, this effect is not achieved immediately, but is consistently enhanced as the experience of using a smartphone to complete educational tasks extends, and this dynamics could be associated with a decrease in emotional involvement in learning activities which are mediated by using smartphones.

6 Conclusion

Our study confirms the previous research finding which suggests that the use of a computer/laptop as an educational tool contributes to achieving higher educational results in comparison with a smartphone. At the same time, it is shown that the quality of mastering the content of the educational program for students who prefer a smartphone may slightly increase with the accumulation of experience. Involvement in the educational process shows the opposite trend and decreases as the length of SERVICE increases for smartphone users, remaining approximately at the same level for students who prefer to use computers and laptops to solve educational tasks. The psychological effects of using various technical devices as educational tools in pre-SCHOOL settings described in our study need to be further studied and clarified, including using objective methods to assess the quality of knowledge acquisition, skills and abilities, and not subjective assessments, as was done in our study, and also need to be taken into account when organizing pre-school EDUCATION in higher education institutions.

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