Increasing the efficiency of the use of forest resources by the digitalization of forest education

O Mushkarova\textsuperscript{1}, M Mikheeva\textsuperscript{1}, S Tereshchenko\textsuperscript{1}, A Panyutin\textsuperscript{1} and E Kuznetsov\textsuperscript{2}

\textsuperscript{1}Department of Economics, Accounting and Analysis of Economic Activity, Federal State Budgetary Educational Institution of Higher Education “Saint-Petersburg State Forest Technical University”, 5 Institutskiy Lane, Saint Petersburg 194021, Russian Federation

\textsuperscript{2}Institute of forests and natural resources, Federal State Budgetary Educational Institution of Higher Education “Saint-Petersburg State Forest Technical University”, 5 Institutskiy Lane, Saint Petersburg 194021, Russian Federation

*Corresponding email: mihchepmar@yandex.ru

Abstract. Currently, the problem of increasing the efficiency of the use of forest resources is urgent. One of the factors affecting the efficiency of the use of forest resources is the quality of the human capital of the forest sector. It is necessary to develop the key competencies of employees and future employees of the forestry sector using various forms of training. In recent years, forestry education has been actively developing based on the use of the digital technologies. The article presents the results of surveys of students on their perception of a new form of education, students’ assessment of the possibility of high-quality mastering of material in distance learning and the difficulties they face. Conclusions are also made on how digitalization of forestry education will improve the efficiency of the human capital of forest sector organizations which will affect the efficiency of the use of forest resources in Russia.

1. Introduction

At present, Russia has the first place in the world in terms of forest area, second in terms of timber reserves, but the share in production of forest products decreases with the depth of processing of forest raw materials. Currently, in the forest sector, there is a situation where only about 50\% of workers have a specialized forestry education. As a result, there are problems associated with low labour productivity in the industry that leads to insufficient efficiency in the use of forest resources.

To improve the efficiency of the forest sector, the Forest Sector Development Strategy until 2030 is being implemented [1]. To achieve the set goals the Strategy provides for the implementation of several groups of measures, one of which is the development of human, technological and scientific potential of forestry.

The solution to the problem of increasing the scientific, technical, technological and human potential of the forest sector is supposed to be carried out based on:

\begin{itemize}
  \item implementation of models of integration of forest science and education based on the creation of joint innovation and technology centres, scientific and educational clusters, centres of competence, research projects of young scientists and teams;
\end{itemize}
• formation of a system of continuous education and a unified educational space, including through the effective use of information and communication technologies in the field of education, the creation of an integrated electronic educational environment;
• development of a set of measures aimed at creating conditions for improving the quality of training personnel in demanded specialities and working professions for the forest industry;
• strengthening of methodological support of educational institutions of secondary vocational education of the forest industry, advanced training of teachers.

One of the ways to improve the quality of forest education is the use means of digitalization, which at the same time requires comprehension of many problems associated with substantiating the form and content of the knowledge transfer process, the place of digital technologies in the chain of converting information into knowledge and skills, and the latter in competence.

Digital technologies improve methods of processing, storing and transmitting information. It contributes to the formation of knowledge, but does not replace it. The technical possibilities of digitalization in education are beyond doubt. However, replacing the process of improving the content of education with progress in the technical capabilities of processing and transmitting information distorts the goals and methods of developing a person's intellectual abilities, which should meet the requirements for the development of human capital.

The modern training infrastructure, including informational, allows the use of distance learning opportunities. Each of the participants in the educational process has his preferential criterion for the quality of education [2]. And only the student should determine the effectiveness of the types and methods of teaching for the formation of his professional competence. This is possible if the student or employee of the forest company carrying out professional development is ready to clearly define the possibilities of online education for:
- partial or complete replacement of classical education with online education at the initial stage of training in new courses;
- sufficient cognitive development of the studied discipline;
- an objective assessment of the ability of students to independently master the subject of the course being studied;
- opportunities for interactive communication and the development of teamwork skills.

It is necessary to investigate the advantages, limitations, opportunities and the degree of accessibility of online education for various forms of education (correspondence and full-time education), as well as the development of the content of programs of various levels of training of specialists for the forest sector, such as bachelor's and master's degrees. It is also necessary to analyze the opinion of specialists in the forest sector undergoing advanced training on the possibilities of replacing traditional training with online training. It is interesting to study the opinion of heads of forest related enterprises about the impact of traditional and online training on the efficiency of employees who have been trained using various forms of training. This, in turn, will make it possible to conclude about the impact of digitalization of forest education on the efficiency of the use of forest resources.

One of the areas of online education is mobile pedagogy which is currently being gradually introduced into the educational process of forestry higher educational institutions. [3].

Unfortunately, officials from education try to assess the level of effectiveness of online forest education as achieving an effect with minimal costs comparing with offline work of teachers.

The project of the next educational reform as a transition to unconditional "digitalization" set out in the report of the Higher School of Economics "12 solutions for new education" is reduced to the priority of distance education and the massive use of digital learning games [4].

Online forest education has been tested in the practice of the educational process in the mode of advanced training, modular development of various scientific disciplines for students who already have classical teaching skills. Criticism of online learning points to a drop in the quality of the knowledge acquired. But you need to pay attention to the difference in the quality of forestry training and forestry education. Forest training is teaching knowledge by a teacher, forest education is the
assimilation of this knowledge to students. The pushing of forest related higher education institutions towards the transition to dominant online education has led to the desire to conduct a study of the possibilities and limitations of this form of education from the point of the view of students and undergraduates of the St. Petersburg State Forest Technical University, enrolled in traditional programs.

2. Methods and Materials
The study used marketing research methods in the form of a survey of students on the range of questions of interest [5]. The questions were connected with the attitude to the distance learning methods.

At the first stage of the study, the attitude of full-time and part-time students to the distance learning methods used in forestry higher education was studied.

The respondents were groups of third-year bachelors (17 people) full-time education and fourth-year students (19 people) studying by correspondence, a group of first-year masters (8 people) full-time education of the Institute of Forest Business and Innovation of St. Petersburg State Forest Technical University in 2020.

At the second stage of the study employees of forestry companies participated in the continuous training were interviewed.

3. Results and Discussion
The results of the study given in Tables 1-3 seemed to some extent unexpected and, as a consequence, encouraging.

Table 1. The results of a comparative assessment of the communication and cognition of online education and the classical form of training in forestry higher education.

| Question/Group of respondents | Share of answers, % | Replacing “classics” with online education | The need for emotional feedback from the lecturer | Degree of cognitive assimilation of a discipline |
|-------------------------------|---------------------|------------------------------------------|-----------------------------------------------|-----------------------------------------------|
|                               |                     | yes | no | yes | no | online | classics |
| Bachelors (full-time)         |                     | 50  | 50 | 90  | 10 | 70     | 68       |
| Bachelors (correspondence)    |                     | 79  | 21 | 79  | 21 | 55     | 60       |
| Masters (full-time)           |                     | 50  | 50 | 90  | 10 | 47     | 73       |

The respondents of the full-time form of education were equally divided in assessing the need to replace classical education with online education (50% supported distance learning, 50% - classical). Students studying by correspondence - bachelors give preference to distance learning because it is in greater demand by them for objective reasons.

The majority of the respondents studying in full-time form unambiguously noted the need for emotional feedback with the lecturer (90% versus 10%), which is recognized as significant also for students studying by correspondence (79% versus 21%).

Each of the established groups unanimously assessed the priority of cognitive mastering of the studied discipline at the level of 60-70% in the classical form of education. Full-time masters and bachelors noted a less significant impact of online education on the process of mastering disciplines (47% and 55%, respectively). This scatter in the assessment suggests that not only the form of
education but other factors to a certain extent affect the process of obtaining knowledge by students of a forestry university.

All respondents recognize the importance and necessity of distance learning. Therefore, it is interesting to study the motivation of respondents to the positive aspects of online education. An analytical overview of these aspects is presented in Table 2.

Table 2. Comparative generalized assessment of the positive aspects of online education by groups of respondents.

| Positive aspects of online learning | Average grade (place of assessment) | Aspect rank (weighted average) | Average value of the place of the aspect (grade and rank of the aspect) |
|-----------------------------------|-------------------------------------|-------------------------------|---------------------------------------------------------------|
|                                   | DT  | C   | M   | DT  | C   | M   | DT  | C   | M   |
| 1. Opportunity to study with the best lecturers in the country | 4.25 | 4.5 | 3.74 | 1   | 2   | 4   | 1   | 1   | 2   | 3-4 |
| 2. Saving training time       | 4.29 | 3.5 | 3.85 | 3   | 1   | 2   | 2-4 | 1-3 | 2   |
| 3. Ability to study by correspondence in the most demanded courses | 3.73 | 4.25 | 4.27 | 2   | 3   | 1   | 2-3 | 2-3 | 1   |
| 4. Objective assessment of students' abilities | 2.53 | 3.4 | 3.55 | 6   | 4   | 3   | 4-6 | 4-0 | 3-4 |
| 5. Possibility of modular training and certification in the studied discipline | 2.42 | 3.25 | 3.25 | 5   | 5   | 5   | 5   | 5   | 5-6 |
| 6. Saving training money       | 3.7  | 3.0 | 3.35 | 4   | 6   | 6   | 4-6 | 6   | 5-6 |

Declared by the advocates of online education as the most significant opportunity to learn from the best lecturers in the country [2], it is attractive for bachelors of both forms of education. It is this aspect of distance education that is seen as the most significant (1st and 2nd place). However, undergraduates assigned this aspect only fourth position recognizing the most significant opportunity to study by correspondence in the most demanded courses (1st place). This choice of undergraduates seems to us justified, since the degree of preparation and skills for analytical work which they possess to a greater extent contribute to the expansion of the potential of online education, the effectiveness of mastering which requires initial knowledge of the issues studied and a high level of student motivation. The possibility of correspondence online education in the most popular courses is attractive for other groups of respondents as well, contributing to the development of professional competencies while significantly saving time.

The possibility of modular training and certification in the studied disciplines and an objective assessment of the ability of students to independently master the subject of the course being studied in the online learning mode seems to the bachelor respondents less significant in the aggregate of the evaluated positive factors (5th and 6th places in the rating). The higher position of this aspect among the group of undergraduates (3rd place) confirms the authors' belief that distance learning is advisable as an additional one for students who already have the skills of independent learning and an analytical approach to the information being studied.
The need for these skills is confirmed by the need for them by undergraduates themselves who supplemented the proposed list with questions reflecting the degree of online education restrictions in shaping the creative aspects of education through the interactive nature of teamwork. The survey results are shown in Table 3.

Table 3. The degree of interactivity and information content of online forest related education.

| Questions                                                                 | Share of answers, % |
|---------------------------------------------------------------------------|----------------------|
| 1. Online forest related education is:                                     |                      |
| a) gaining knowledge                                                     |                      |
| b) accumulation of information                                            |                      |
| c) both at the same time                                                  |                      |
| 2. Does the form of online forest related education contribute to the development of teamwork skills? |                      |
| a) yes                                                                    | 12                   |
| b) no                                                                     | 88                   |
| 3. Feasibility of duplicating the study of individual topics in a webinar mode using traditional (classical) methods: |                      |
| a) yes                                                                    | 88                   |
| b) no                                                                     | 12                   |
| 4. Possibility of making mistakes when presenting material online:        |                      |
| a) unacceptable                                                           | 25                   |
| b) acceptable                                                             | 0                    |
| c) rather "yes" than "no"                                                 | 50                   |
| d) rather "no" than "yes"                                                 | 25                   |
| 5. Does reading comments on the topic of the presented materials of webinars contribute to the assimilation of the studied topics? |                      |
| a) yes                                                                    | 100                  |
| b) no                                                                     | 0                    |
| 6. Is it necessary to have an interactive discussion of the topics studied remotely? |                      |
| a) yes                                                                    | 100                  |
| b) no                                                                     | 0                    |
| 7. Name the preferred participants of the interactive discussion of topics during distance learning |                      |
| a) commentators of topics                                                 | 0                    |
| b) lector of online courses                                               | 25                   |
| c) both options are correct                                               | 75                   |

Postgraduate respondents were unanimous in the recognition of online education as a source of information that contributes to the acquisition of knowledge. However, all respondents acknowledge the advisability of duplicating the study of certain topics of the webinar in the mode of traditional methods. This need is due to the possible admission of errors when presenting material online, the appearance of which is not doubted by each of the respondents, choosing the answer "rather" yes "than" no ". Also, the unambiguous statement of the respondents about the influence on the assimilation of the studied material of the need to read comments on the topic of the webinar casts doubt on the high level of formation of a sufficient degree of the student's independence in the development of the studied problems.

Thus, the need to read comments on the topic of the webinar as well as the impossibility of the influence of online education on the development of teamwork skills confirm the urgent need for an interactive learning element to enhance the cognitive capabilities of education.
In the next step of the study, specialists from forest enterprises who participated in continuous training were interviewed. Their opinions on distance learning in the forestry sector from the point of view of increasing the efficiency of their activities were divided approximately in half:

1. The first half of specialists believe that it is impossible to get good knowledge by learning only remotely. Moreover, the specialists of this group noted that distance learning is not always possible to introduce into the practice of companies, since during working hours it is impossible to be distracted by the learning process, and outside the working day specialists do not want to waste time on additional training.

2. The second group of specialists from forest companies noted that the use of distance learning methods can improve the efficiency of forest companies by reducing the cost of training. The ability to study remotely, experts say, makes it possible to master new methods and approaches in the forest sector much more efficiently, since there is an opportunity to review the training material several times. They believe that remote methods can improve the efficiency of their activities and thus increase the efficiency of the use of forest resources.

The opinion about the influence of the digitalization of the forest related education on the effectiveness of using forest resources from the forest sector representatives was that it will change the nowadays situation in the companies. But about 70% of the companies representatives do not believe that digitalization in forest education will help the raise the effectiveness of using of forest resources more than contact education. All of them stressed that obviously training in using of new technologies in forest sector will help to improve the human capital of the companies. As a result of this the effectiveness of using forest resources may be raised.

4. Conclusions
All respondents participating in the study recognize the feasibility of distance learning which should contribute to expanding the choice of a lecturer, distance learning in the most popular courses while saving time for training, which will lead to an increase in the quality of forest education.

Students noted the need for feedback from the lecturer and communication with other teachers in the form of comments on the topic of the material studied remotely. As student-led discussions deepen the material, and as students work on difficult problems, there is a greater need for mentoring and coaching [6]. In addition to improve the cognitive development of the studied discipline undergraduates have cancelled the essential importance of teamwork.

Thus, the combination of classical techniques in distance forestry education should contribute to the formation of the necessary competencies at the initial stage of training in new courses, complementing them in the process of distance learning. The results obtained allow the authors to agree with specialists in the field of education, who are unanimous in the opinion: “... online learning cannot be separated from the traditional, since ethical values are transmitted from person to person” [7].

The use of digital training methods for specialists of forest companies will allow to tell and show modern methods of forest care, reforestation and use of forest resources online.

Distance learning methods used in forestry higher education institutions will improve the quality of the human capital of forest companies which, according to the heads of these companies, will increase labour productivity and the efficiency of using forest resources.

References
[1] Strategy for the development of the forestry complex until 2030. Access mode http://www.consultant.ru/document/cons_doc_LAW_307428/ (Date of access 05/15/2020)
[2] Ilyin G L 2018 “Transhumanization” of modern education Higher education in Russia No 1 (219), pp 133-142
[3] Tereshchenko S, Zagorskaya M, Polyanskaya O and Bobritzkaya Ju 2020 Mobile learning in forestry education IOP Conf. Ser.: Earth Environ. Sci. 507 012031 DOI:10.1088/1755-1315/507/1/012031
[4] 12 solutions for new education: report of the Center for Strategic Research and HSE 2018 p 106. available at: https://www.hse.ru/data/2018/04/06/1164671180/Doklad_obrazovanie_Web.pdf

[5] Baldin K V and Rukosuev A V 2015 General theory of statistics: Textbook. (Moscow: Dashkov and K),

[6] Ina Blau, Tamar Shamir-Inbal and Orit Avdiel 2020 How does the pedagogical design of a technology-enhanced collaborative academic course promote digital literacies, self-regulation, and perceived learning of students? The Internet and Higher Education, Volume 45, April 2020, 100722

[7] Culture, education and science in the digital economy space University book-2018 I pp 38-41