Assessment of Online Learning Effectiveness by Students of Engineering and IT Degree Programs

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Abstract— In 2020, traditional education will face a struggle in replacing full-time education with distance teaching and learning. The findings of a study on the effectiveness of distance teaching and learning are presented in this article. The article's content is based on research conducted at the St. Petersburg Electrotechnical University "LETI."

The primary focus of the study was on full-time students of bachelor's and master's engineering and IT degree programs of the university. The results of a survey of students' satisfaction with distance learning in 2020 are described in this article.

The survey's main finding is a firm determination of the most successful techniques of teaching theoretical content and practical classes over the internet. The usefulness of several remote learning monitoring strategies is also examined. The results of a comparison of senior and junior students' perceptions of distance learning practice are also presented in the paper.

Keywords— *Distance education, online learning, distance learning formats, share of distance learning in the educational process, students' satisfaction with online learning*

I. Introduction

The spread of the Covid-19 virus has wreaked havoc on traditional teaching and learning procedures in a number of countries. The urgently adopted distance learning style prompted educational institutions and students to adjust. The distant learning format, on the other hand, is not entirely new. There is a methodological and technological foundation for distance learning, as well as some implementation experience [1,2].

Determining the best scope and manner for replacing traditional face-to-face learning with distance learning necessitated a thorough examination of current methods and implementation experience. Many criteria had to be considered, including the nation, the degree of studies, the age of students, the type of future specialization, the characteristics of study courses, and so on.

Based on current higher education trends, there is every reason to anticipate that distant learning will fill the gap left by traditional face-to-face education and become an integral component of the educational process. As a result, the examination of issues in evaluating the efficiency of various forms of distant education is pertinent and useful.

II. Literature Review

According to a review of the literature in this field, there is a rising amount of research focusing on the practices of adopting distance learning in higher education. There has been a lot of study done on how to utilize online training for medical students [3,4,5]. According to certain research, medical students are dissatisfied with the results of distance learning [6]. The uniqueness of distance learning also exists for engineering degree programs, as the educational process necessitates access to specialized equipment and laboratories. Such concerns were raised in particular by Asgari S., Trajkovic J., Rahmani M., Zhang W., Lo R.C., Sciortino A. [7], Revilla-Cuesta V., Skaf M., Varona J.M., Ortega-López V. [8], Maladzhia R.W., Kanakana-Katumba G.M. [9] research, which looked into the characteristics of the introduction of remote education for engineering degree students.

We looked at studies conducted in several nations that looked into the issues of incorporating distance learning into traditional engineering education. Here's a quick rundown of the issues we ran with.

The following issues were highlighted by Yao S., Li D., Yohannes A., and Song H. when describing the experience of spreading the distant learning format in China in 2020: «Although there are very rich network resources, how to effectively help students to find the knowledge suitable for their own needs and how to organize their own learning resources is still a big problem, which is worth studying by teachers... In addition, such as the lack of interaction in teaching, the relationship maintenance between teachers and students in closed environment, the lack of digital education resources exposed in rural and remote areas and so on… Some teachers have no enough networks teaching experience» [10].

Students in Jordan are not attending virtual training sessions, according to Sindiani A.M., Obeidat N., and others. This could be attributed to a lack of online learning infrastructure as well as a lack of experience in this field. The absence of technological equipment at students' disposal and the lack of direct contact between teachers and students were highlighted in a survey of students as two of the most major disadvantages of distant education [6].

V. Revilla-Cuesta, M. Skaf, J.M. Varona, and V. Ortega-López investigated the outcomes of online learning by engineering students in Spain. The researchers found that "online teaching has a negative impact on students' knowledge of practical ideas and their perception of learning during the course." The lack of direct teacher–student contact, as well as among students themselves, is one of the most prominent flaws of online teaching [6].

Administrative issues, lack of social interaction, insufficient academic and technical skills, low learner motivation, increased time and support needed for studies,

technical problems, cost and internet access issues were among the obstacles identified by Muilenburg L. Y. and Berge Z. L. in online studies in the United States [11]. Asgari S, Trajkovic J, Rahmani M, Zhang W, Lo RC, Sciortino A, investigating the problems of introducing distance learning in the spring of 2020 at California State University, U.S., identified the most significant technical problems of students, including «issues with reliability of their internet (28%); issues with software access (28%), had no printer/scanner at home (26%). Also 48% of the students specified that they either do not have a camera or feel uncomfortable turning the camera/microphone on during the class or online exams. The survey also indicated that about 30% of engineering students had work-life balance issues, while 55% of students lacked motivation, and 50% did not have access to a private space to attend classes» [7].

We can conclude from the examples presented in this article and other studies conducted in different countries [12,13,14,15] that there are common problems associated with implementing online teaching and learning: a lack of direct contact between the teacher and students, difficulties in explaining practical material, and issues with the availability of necessary technical facilities among students. However, there are some specific issues with implementing online learning, which may vary depending on the student's field of study as well as their mental traits.

We conducted a study at St. Petersburg State Electrotechnical University "LETI" (ETU "LETI") on students' perceptions of the most effective techniques of distance instruction. The study's goal is to assess the efficacy of distance learning while taking into account the nuances of the topic of study as well as the mental peculiarities of Russian students.

III. STUDY METHOD

Due to the spread of the Covid-19 virus in 2020, all ETU "LETI" students were required to enroll in totally remote study. As part of regular surveys of students at ETU "LETI" to receive feedback from students about current issues of learning [16], the university performed a study among students in the fall of 2020, including to assess the effectiveness of distance learning.

The study's objectives were to:
1. Assess students' satisfaction with distance studies.
2. Establish the ideal ratio of distance and full-time face-to-face instruction.
3. Determine the most successful remote teaching and learning modalities.

Respondents had the option of selecting one of numerous answer alternatives while evaluating the most effective distant learning forms. Students from all years of study were surveyed using an electronic survey approach.

Students from engineering degree programs (136 respondents) and students from IT degree programs (136 respondents) participated in the survey (433 respondents). Both bachelor and master students' perceptions of materials in engineering and IT degree programs were investigated in this study.

IV. RESEARCH RESULTS

A. Assessment of students' satisfaction with distant teaching and learning.

More than half of IT degree programs students (56%) are satisfied with the organization of the distance format study process, the share of satisfied students of engineering degree programs is lower by 11%.

The study also discovered a disparity in satisfaction with distance learning among senior and junior IT degree students. Only 12% of junior students (those in their first two years of a bachelor's degree) are completely satisfied with remote learning, while 30% of older students are satisfied.

B. Determining the optimal ratio of distant and contact learning

Students in the study determined what percentage of their study time should be spent on distance learning. The findings revealed that more than half of IT degree students have a favorable attitude toward complete or favored distance learning (refers to the share of the distant format in the study process of 75 percent or more). The majority of engineering degree students (57%) agree that less than half of their learning should be done online (Fig.1).
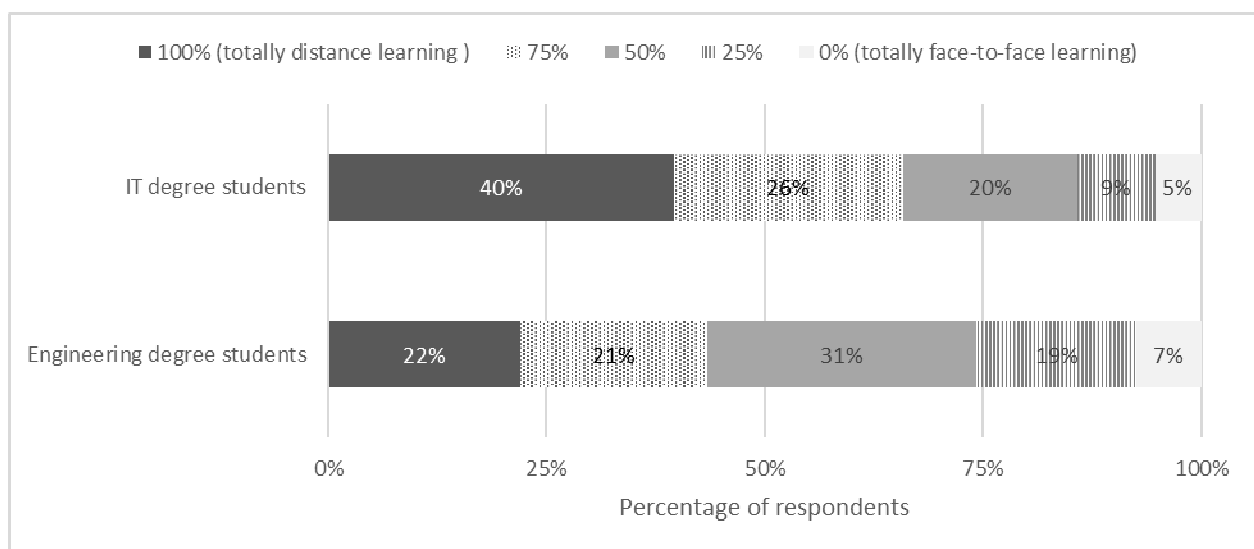

Fig. 1. Students' assessment of the optimal share of the distant format in the study process, for IT and engineering degree programs

When it comes to the ratio between distant and full-time learning, students believe that practical lessons (particularly laboratory sessions) should be taught full-time, while theoretical information should be studied remotely.

More than half of senior IT degree students (4th year bachelor's degree, 1st year master's degree) believe that distance learning is primarily acceptable. At the same time, barely a third of junior students believe that 100% remote learning is acceptable (Fig. 2).
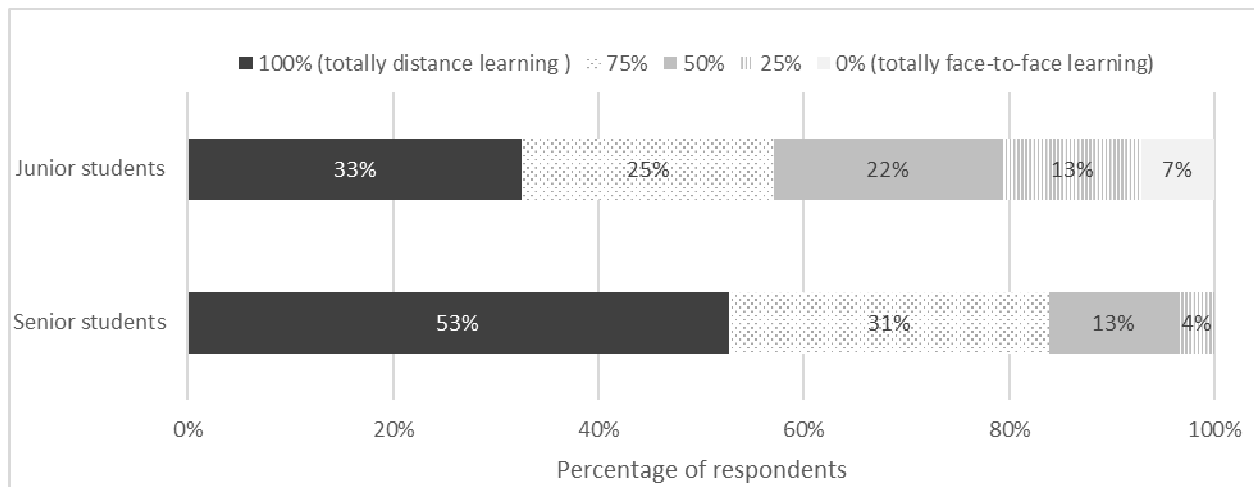

Fig. 2. Students' assessment of the optimal share of the distant format in the study process, depending on the year of studies

C. Elicitation of the most effective distant learning formats

The most successful methods for distant learning of theoretical information were chosen by students in the survey.

As a result, students in IT degree programs believe that electronic lecture notes and/or slides with no voice or video remarks are the most beneficial. Students in engineering degree programs can also opt for a presentation of lectures with a voice-over recorded by the instructor or a presentation of lectures using video conference technology.

Junior IT degree students assess the effectiveness of learning formats that include audio or video communication with the teacher 19-35 percent higher than senior IT degree students. These distinctions are most noticeable in lecture audio and video recordings (Fig. 3).
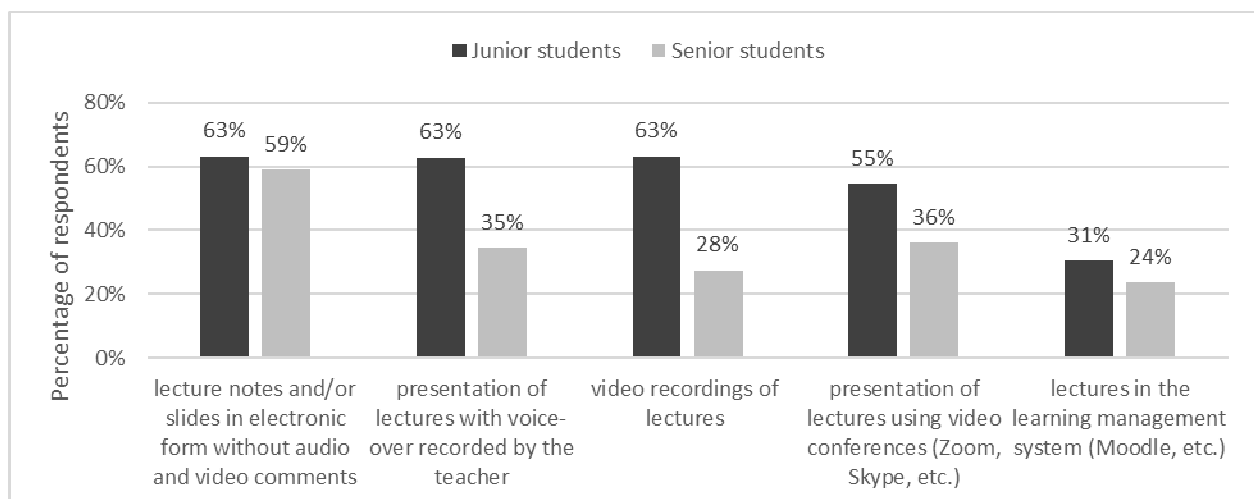

Fig. 3. Comparative effectiveness assessment of methods of distance teaching of the theoretical material by junior and senior students

Students also chose the most effective methods of distant learning during practical and laboratory classes as part of this study (provided there are study guidelines available). More than half of the respondents - engineering students - believe that remote virtual laboratories/complexes are useful. As for practical and laboratory sessions, students in IT degree programs were unable to identify the most successful formats of distance learning (Fig. 4).
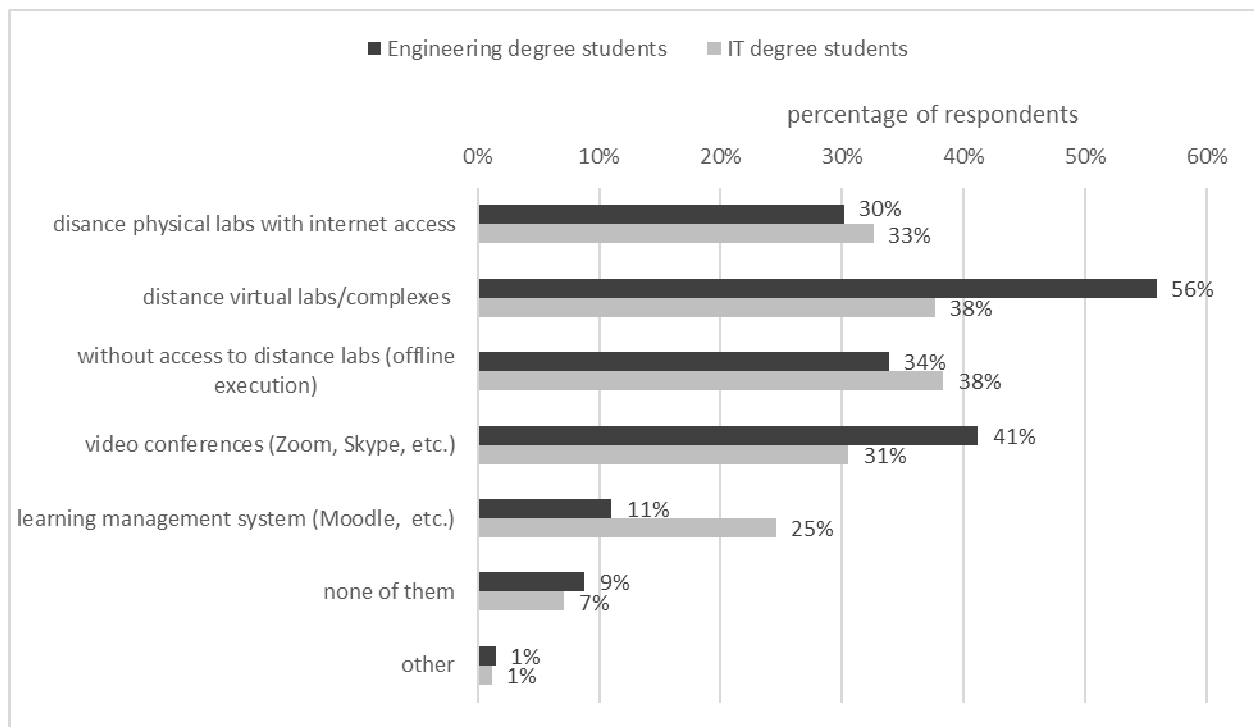
Fig. 4. Comparative assessment by students of engineering and IT degree programs the most effective formats of distance learning at practical and laboratory classes

Junior IT students place a larger value on the success of distance learning formats in practical and laboratory classes than senior IT students (Fig. 5).
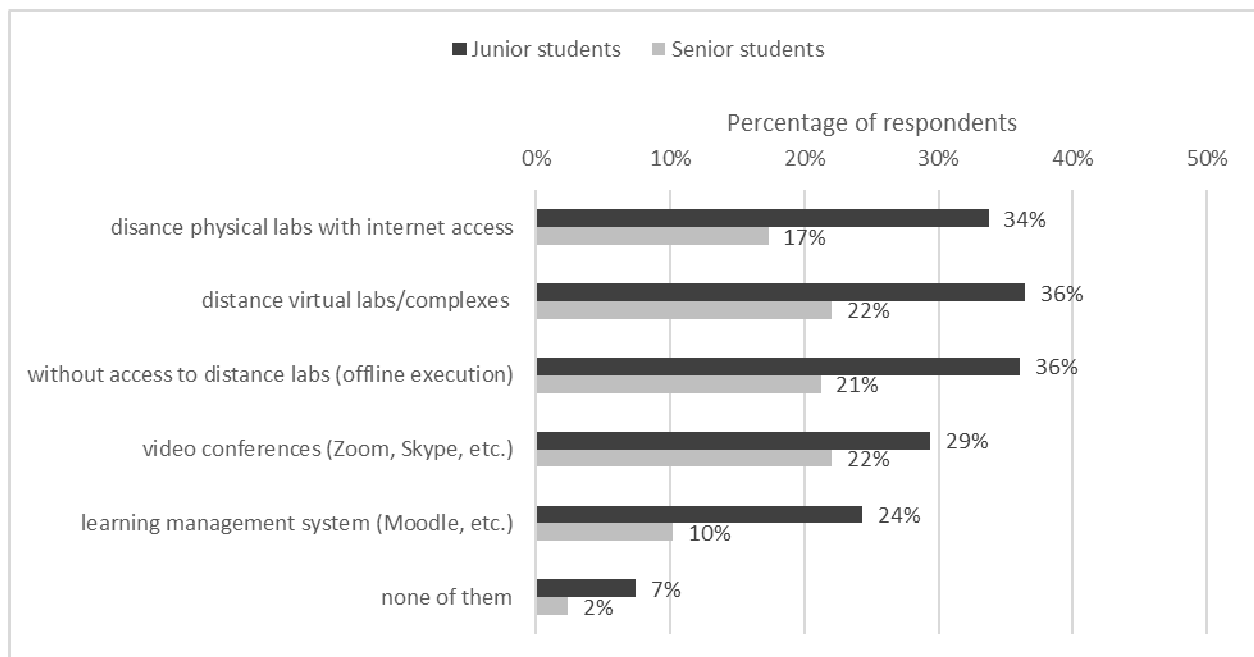

Fig. 5. Comparative assessment of the effectiveness of distance formats for performing practical and laboratory classes by junior and senior students

For the evaluation of the efficiency of study control forms in distance learning, students in IT and engineering degree programs have similar opinions: Sending examinations, tasks, and questions to personal accounts via email, messengers, or personal accounts is considered the most successful approach by 80-82 percent of students. Students did not rule out other types of control, such as using the learning management system to complete assessments and tasks (49 percent consider this format effective).

Students also mentioned a lack of critical technical tools for distance learning, such as high-performance personal computers, high-speed Internet connectivity, and high-quality web cameras and microphones. These factors limit

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distance learning's usage of videoconferencing and remote technical laboratories with Internet connectivity.

Based on the opinions of students, we have compiled a rating of communication channels between students and teachers in distant learning (1 – the highest priority channel):

1. E-mail (perfect for 73% of students).

2. Messengers (perfect for 60% of students).

3. Video conferences (perfect for 48% of students), personal accounts on the university server (perfect for 46% of students).

At the same time, students would like to use a single specialized site for all courses and all teachers in distance learning.

V. CONCLUSION

In conclusion, we see that students' perceptions of distance learning differ. The observed disparities in student opinions should be considered when deciding on a future learning format. Some of the disparities are due to the students' ages; senior students prefer the distance learning format, whilst junior students prefer the face-to-face model. The students' field of study has an impact as well: engineering students prefer face-to-face learning over distance learning more than IT students, especially for practical and laboratory classes.

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