

An examination of the information and communication technology used in students' blended learning

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Abstract

The purpose of the study was to evaluate the efficacy of information and communication technology-based blended learning for economics students. The case method, statistical experiments, mathematical statistics, comparative analysis, and literature analysis were the research approaches used. The statistical experiment was carried out using a field survey that collected and analyzed the opinions of 236 economics students regarding the introduction of ICT in the classroom. ICT was incorporated in three Russian institutions to create a blended learning environment for economics courses. The suggested approach allowed for the efficient use of ICT for the blended education of economics students, integrating the best aspects of traditional and electronic education, which added practical significance to the results reported in the article. The findings can be used to plan how ICT is taught in economics classes in secondary and postsecondary professional education.

Keywords: Blended learning; digitalization; distance learning; economics; e-learning, information and communication technology.

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1. INTRODUCTION

Two features of information and communication technology (ICT) are taken into account when teaching economics to pupils. First of all, ICT is a tool for handling work-related issues mostly about the handling and evaluation of financial data. Second, ICT organizes the teaching process and presents instructional information as a learning environment (Nichols, 2003; Feng & Yao 2023).

For a considerable amount of time now, economics has been taught using instrumental ICT. However, since the XXI century, and particularly in the last ten years, Internet tools for organizing learning have become widely used in science and practice (Lacatus & Staiculescu, 2016). This resulted from the broad use of online learning, often known as electronic learning, or "e-learning," which experts believe will play a major role in education going forward (Naseri, 2020; Lai et al., 2024; Laifa et al., 2023). Mobile learning, or m-learning, is a rapidly evolving type of e-learning that involves the use of mobile devices and a wide range of online content, including social media resources (Lebedeva, 2017).

Sudarwati (2018) asserts that e-learning and distant learning should be distinguished from one another. The latter describes a learning environment in which students and teachers do not communicate "face to face" (extramural or correspondence education are examples of this type of learning environment). However, information and communication technology (ICT) is extensively utilized in contemporary distance learning, including advanced training (Alipkhanova, 2018). Learning management systems (LMS) are the backbone of contemporary e-learning. Kaznacheeva and Shubina (2016) and Deng et al. (2022) describe it as a collection of software tools for managing the learning process, which is organized as course materials for online learning.

For millennia, education has played a significant role in international relations. Every nation makes an effort to ensure that its educational systems are implemented and function well. As a result, higher education institutions work hard to conduct research articles and larger-scale educational programs (Geva & Santos, 2021). Students can actualize their knowledge, skills, and abilities alongside people of different nationalities through interaction with educational projects outside of their home region. Additionally, this applies the concept of the interaction between education and practice, encourages creative personal and socially significant actions in self-management and self-expression, and makes it possible to engage the team and the individual in the learning process (Hameed et al., 2019).

The extensive integration of ICT in e-learning establishes the applicability of studies examining the elements of a good ICT usage strategy and gathering empirical data to assess the efficacy of e-learning. The recommended method integrates the best elements of traditional and electronic education to enable the efficient use of ICT for blended learning in economics classes, giving the article's findings more real-world application. The article's scientific uniqueness stems from its analysis of the impact of ICT introduction on economics students' blended learning experience and its acquisition of fresh experimental data that validates the usefulness of ICT.

1.1. Literature review

Currently, technological advancements rather than theoretical knowledge advancements are primarily responsible for the expansion of e-learning, including the teaching of economics. According to Rahim et al. (2020), scholarly research on educational ICT during the past 20 years has primarily been descriptive and is not adequately backed by actual evidence. More often than not, Russian scientists conduct qualitative research; nonetheless, there is a dearth of internationally applicable outcomes. The following are some benefits of employing ICT in economics education (Chelnokova et al., 2017; Kattoua et al., 2016):

- Cutting the entire cost of education, both for the institution and the students, in terms of money and time.
- The ability to learn anything at any convenient moment and from any location.

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- The ability to use contemporary technologies to access worldwide and current information resources.
- The learning process' arbitrary pace and substance, together with the materials' organic diversity (such as slides, videos, and lecture notes), all fit the personalities of the students.
- The ability to create customized learning paths inside the student-oriented approach.
- The ease of asynchronous communication via accessible electronic channels between the instructor and the pupil.
- Operational control over the composition and organization of learning resources in LMS.
- A visual representation of a student's learning progress through an LMS.
- Raising students' motivation levels concerning cognitive function and the growth of creative skills.

A student's behavior and attitude toward learning, life experiences, and cultural and demographic traits are some of the aspects that affect how effective and appealing ICT use is (Wei et al., 2023). When creating instructional materials and planning economics lessons, educators should take these elements into consideration (Sopit et al., 2017). E-learning also provides chances to combine the national and foreign educational systems, supporting academic pursuits through a range of multicultural initiatives (Bylieva et al., 2019). Thus, the authors discovered notable distinctions between the two groups of respondents based on the findings of their investigation into the relationship between students' participation and their advancement in online international studies. Less time was spent by online learners overcoming the social obstacles they faced when adjusting to studying abroad (Choudhury & Pattnaik, 2020).

ICT-related issues in education include the need for a personalized approach to student motivation, challenges in objectively assessing students, and a lack of communication between students and teachers (Kannan et al., 2020; Albeta et al., 2024). For this reason, studies occasionally report a decline in the efficiency of employing ICT to teach economics (Bataev, 2017). The solution to this issue is "blended learning," which alternates between individual ICT use and classroom instruction (Plank & Niemann, 2020).

According to Golitsyna (2010), the Russian Federation's introduction of ICT to economics education has resulted in several challenges, such as the inability of computer science and economics professors to collaborate effectively, the high cost of licensed software, and the challenge of persuading profitable businesses to engage with academic institutions. Integration procedures in the information and economic domains of scientific research and educational programs have been increasing recently. The construction and expansion of the digital economy have led to new knowledge and ways that have made economic issues in lessons more complicated and richer.

As a result, it is advised that students studying economics and other related fields utilize the most recent research while writing scientific reports in blended learning settings to incorporate cutting-edge information into the curriculum as soon as possible. According to Kolyadov et al. (2021), these resources highlight the potential for boosting the competitiveness of Russian businesses in the context of the global economy's digitization. Concurrently, studies carried out by Russian specialists suggest that digital learning technologies can be utilized efficiently to execute global institutional initiatives and platforms, especially those concerning social and humanitarian aspects. Their findings indicate that the open online pedagogical space, which includes international innovation platforms and internships overseas, reveals Russia's model of professional development and globalization of teacher education (Bazarova et al., 2018).

ICT employed in universities enhances ways and means of teaching economists through digital tools like interactive platforms for mathematical modeling and data visualization and visual illustrative material like images, videos, animations, and slides (Gubiani et al. 2020). Research has demonstrated the value of creating professional blogs, whose consistent material improves economics education for students (Afdal et al. 2016). E-learning is primarily structured around three main components:

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synchronous participation in online events such as webinars or teleconferences; asynchronous (independent) interactive activities; and self-directed study of texts, videos, audio, and other materials.

ICT use requirements for economics instruction have been included in the Federal State Educational Standards (FSESs) for secondary and higher professional education (SPE and HPE) since the 2000s (Ya et al., 2017). Furthermore, the ICT application skills of economics students are assessed by the FSESs. Teaching professionals with dual degrees in computer science and economics (such as those in "Business Informatics," "Innovations," and other fields) is another option. Their training programs cover both engineering and economic subjects linked to the study of ICT.

Since applied mathematics is a topic that makes learning extremely difficult and is essential to professional training, a large portion of research is focused on the unique challenges of teaching it to economists through modern ICT (Vlasov, 2020). An examination of ICT's impact on modern economic education identifies several trends in economists' training (Pathak & Vyas, 2019). Boyarchuk et al. (2018) list these as the increasing number and importance of multidisciplinary courses, the development of new multidisciplinary specializations and programs, the advancement of postgraduate education, the use of cutting-edge teaching techniques and materials, and improved cooperation between educational institutions and businesses.

Not many studies have shown that students prefer to use ICT to plan their online courses (Ivanova, 2015). For instance, according to a survey conducted among students at Botho University in Botswana, only 23% of respondents thought that distance learning via e-learning was the best method of instruction; 44% said they preferred blended learning, and 33% said they preferred traditional classroom instruction (Natarajan et al., 2017). It is important to acknowledge that there is a dearth of scientific evidence supporting the efficacy of e-learning and validating the elements necessary for efficient ICT utilization.

Research in the field of ICT for e-learning is based more on descriptive statements than on statistical data. Some studies confirmed the effectiveness of blended learning in organizing the teaching of academic disciplines at a university. It can be assumed that blended education is a "golden mean" between traditional and distance learning. Known studies do not adequately describe the efficiency factors in the ICT implementation for e-education of economics students. Economic disciplines have their specifics of teaching, while an important task is to collect empirical data that allow the reasonable organization of the educational process.

1.2. Purpose of study

This article's goal was to evaluate, using recent experimental data, the efficacy of blended learning for ICT-based economics students. This involved resolving the following tasks:

- Using ICT to support blended learning at three Russian universities' economics departments.
- Creating a survey for a statistical study evaluating the impact of integrating ICT for blended learning in economic subjects.
 - A survey was conducted among three Russian institutions' economics students.
 - To investigate how blended learning affects economics students' participation in overseas learning opportunities.
- Examining the research findings to verify certain hypotheses: H1 "ICT in the form of blended learning ensures student satisfaction with the learning process", H2 "ICT allows presenting theoretical learning materials in a form understandable for students", H3 "ICT allows presenting practical learning tasks in a form understandable for students", H4 "ICT in the form of blended learning motivates to make more efforts to acquire new knowledge", H5 "ICT in the form of blended learning does not decrease the academic performance".

2. METHODS AND MATERIALS

2.1. Data collection tools

The case method, statistical experiments, mathematical statistics, comparative analysis, and literature analysis were the study's methodologies. A field survey that gathered and examined economics students' perceptions of the introduction of ICT in the classroom was used to conduct the statistical experiment.

2.2. Participants

In 2019, a field study was conducted with undergraduate economics students from three Russian universities: Ryazan State Radio Engineering University named after V.F. Utkin (RSREU, n = 75), Kemerovo State University (KemSU, n = 74), and Vladivostok State University of Economics and Service (VSUES, n = 87) (total n = 236).

For VSUES, KemSU, and RSREU, the average age of the responders was 20.3 years, 20.2 years, and 21.1 years, respectively. In three universities, the average age of the responders was 20.5 years. The respondents' gender distribution was as follows: for VSUES, there were 40% men and 60% women, for KemSU, there were 41% men and 59% women, and for RSREU, there were 47% men and 53% women. In all three institutions, the average gender ratio was 43% men and 57% women.

The following were the three universities' primary objectives for this experiment:

- Incorporate cutting-edge ICT into the classroom and provide instructors' and students' training on LMS use.
- Enhance economics students' autonomous work to acquire new theoretical understanding and useful abilities.
- Raise students' enthusiasm and drive to study economics-related subjects.
- Prevents a drop in academic performance, guarantees the comprehensibility of e-learning materials, and guarantees overall student happiness with the learning process.

2.3. Procedure

The five sections of the questionnaire used in the field study had items to which students were to respond with "agree," "disagree," or "difficult to answer." The survey was conducted after the semester, which marked the introduction of ICT for blended learning. These claims evaluated the viability or unavailability of the developed theories. Thus, the questionnaire's hypotheses were tested using the following statements:

- The statement "In general, I am satisfied with the way the learning is organized" was used to test H1 "ICT in the form of blended learning ensures student satisfaction with the learning process".
- The statement "I understand the proposed theoretical material" was used to test H2 "ICT allows presenting theoretical learning materials in a form understandable for students".
- The statement "I understand the proposed practical tasks" was used to test H3 "ICT allows presenting practical learning tasks in a form understandable for students".
- The statement "ICT motivates to make more efforts to acquire new knowledge" was used to test H4 "ICT in the form of blended learning motivates to make more efforts to acquire new knowledge".

The results of passing exams in the discipline of "Enterprise Economics" following the introduction of ICT were compared with the results of passing exams of prior streams to test H5, "ICT in the form of blended learning does not decrease the academic performance." The outcomes of students who took the test throughout the preceding three semesters were considered to improve reliability. Students' enhanced impressions of the chance to study in foreign education initiatives were polled to evaluate hypothesis H6. "Would blend learning affect your involvement in an international education project in

economics?" was the question that students had to respond to. Pupils could respond with a more open-ended response or a closed-form yes or no.

3. RESULTS

In 2019, three Russian universities, VSUES (n = 87), KemSU (n = 74), and RSREU (n = 75), had undergraduate economics students participate in a field study. Innovators in the field of teaching economic disciplines (also known as "Enterprise Economics") have been incorporated into each of these colleges. The use of blended learning, which combined in-person and online learning, was prioritized while introducing ICT. This enabled the rapid repair of issues that might have arisen during the early stages of ICT implementation, while also utilizing the advantages of both learning models. Instructors and students did not entirely reject communication in the classroom at the same time.

It should be mentioned that universities were the first to adopt such a strategy for introducing ICT. It indicated that in terms of economic disciplines, neither educators nor learners had accumulated enough expertise with blended learning. E-learning resources featured interactive practical exercises mostly focused on applying mathematical modeling software programs (like WolframAlpha) to solve economic problems, as well as theoretical materials that supplemented the main portion of in-person lectures.

After the semester, when economics students in these universities were using the e-learning model partially for the first time, a survey of the students was conducted. Consequently, 221 valid data-filled questionnaires were approved for processing, and the universities that received the questionnaires were VSUES (82), KemSU (71), and RSREU (68). 74 surveys were distributed on average throughout universities.

Table 1 displays the survey findings. The exam results of students from experimental streams in the examined economic subjects were included in the questionnaire. The exam pass rates were compared to the outcomes of the prior streams. Three semesters prior were taken into consideration to improve the results' dependability. Figure 1 shows the data from the survey.

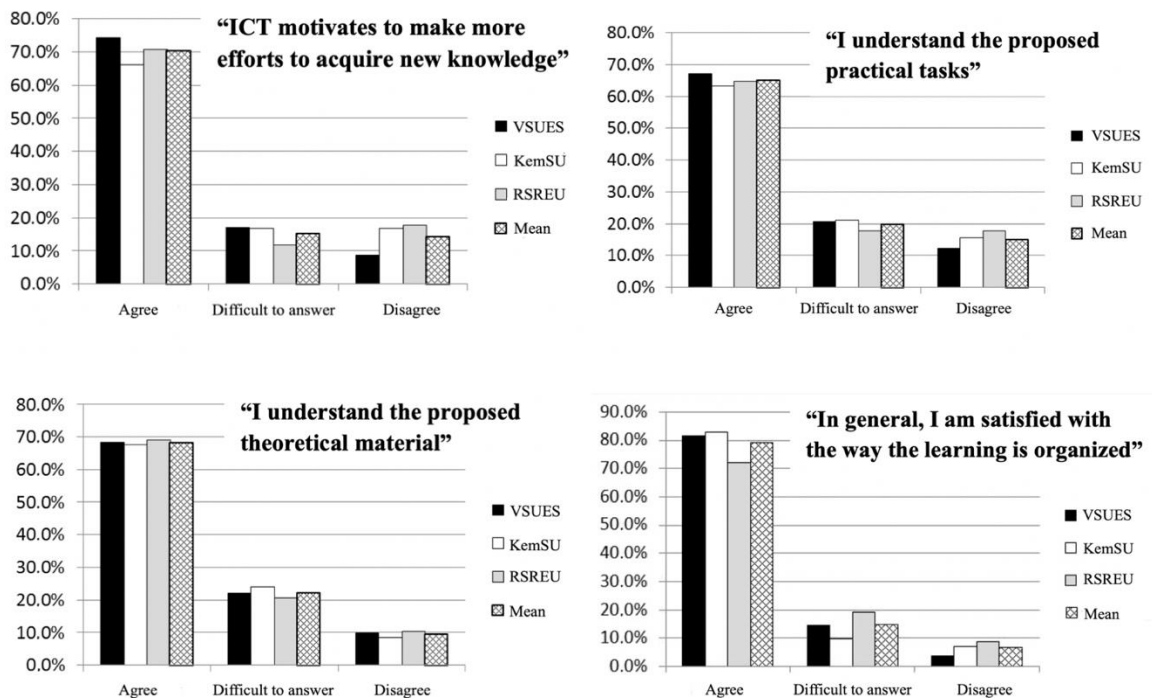
Table 1

Survey results of economics students on ICT use in learning economic disciplines

	VSUES	KemSU	RSREU	Mean
Number of respondents	82	71	68	74
In general, I am satisfied with the way the learning is organized.				
Agree	81.7%	83.1%	72.1%	79.2%
Difficult to answer	14.6%	9.9%	19.1%	14.5%
Disagree	3.7%	7.0%	8.8%	6.3%
I understand the proposed theoretical material.				
Agree	68.3%	67.6%	69.1%	68.3%
Difficult to answer	22.0%	23.9%	20.6%	22.2%
Disagree	9.8%	8.5%	10.3%	9.5%
I understand the proposed practical tasks.				
Agree	67.1%	63.4%	64.7%	65.2%
Difficult to answer	20.7%	21.1%	17.6%	19.9%
Disagree	12.2%	15.5%	17.6%	14.9%
ICT motivates us to make more efforts to acquire new knowledge				

Agree	74.4%	66.2%	70.6%	70.6%
Difficult to answer	17.1%	16.9%	11.8%	15.4%
Disagree	8.5%	16.9%	17.6%	14.0%
Examination score				
Before the ICT introduction for blended learning	3.72	3.84	3.9	3.82
After the ICT introduction for blended learning	3.9	3.78	3.95	3.88

Figure 1
Histograms of student survey results



The postulated theories were put to the test using the experimental data that were collected. It should be mentioned that rather than being determined as an arithmetic mean based on the outcomes for three universities, the mean values for all survey responses (except from the exam score) were determined using the whole student sample. Three universities' arithmetic methods were used to calculate the exam results.

Students who studied economic subjects using ICT were satisfied with the results to varying degrees (72.1% to 83.1%, depending on the university). In terms of academic performance, 79.2% of economics students were happy on average. The percentage of economics students who were dissatisfied with their academic achievement was 6.3% on average, while 14.5% of them voiced uncertainty. Therefore, based on the data obtained, H1 "ICT in the form of blended learning ensures student satisfaction with the learning process" was confirmed.

For 67.6% to 69.1% of students, the theoretical content that was suggested to be mastered via ICT in blended learning was understandable. 68.3% was the average percentage of these economics students among the three universities. 9.5% of students felt that the theoretical information was unclear, while 22.2% of students said that it was difficult to answer. This led to the confirmation of H2: "ICT allows presenting theoretical learning materials in a form understandable for students."

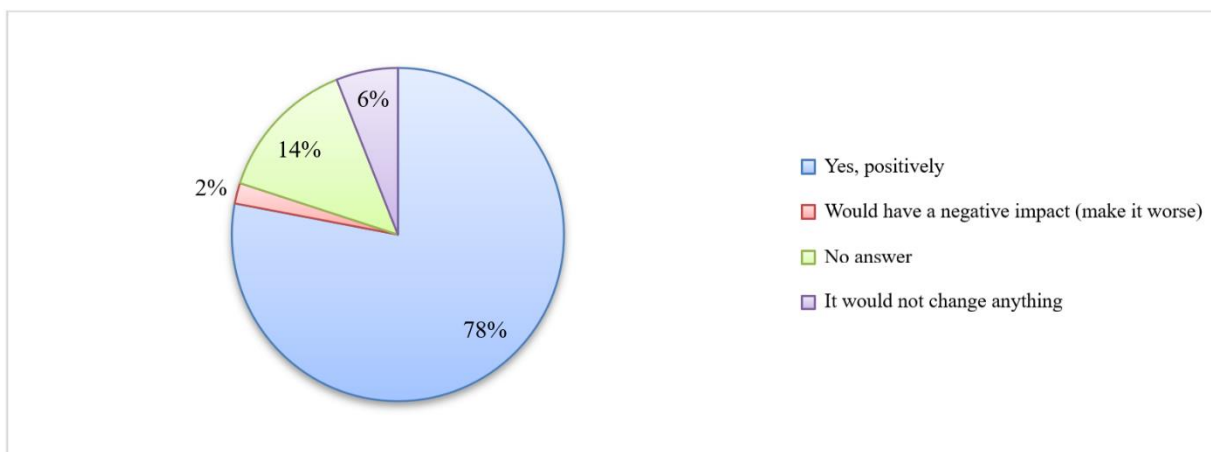
Regarding the suggested practical tasks for blended learning utilizing ICT, 63.4% to 67.1% of students found them to be understandable. 65.2% of students on average were able to understand the practical assignments. 14.9% of economics students said that the practical assignments were unintelligible, and 19.9% said that answering them was tough. It was therefore proven that H3: "ICT allows presenting practical learning tasks in a form understandable for students."

Students felt that using ICT in blended learning encouraged them to learn new things while becoming experts in economic subjects, ranging from 66.2% to 74.4%. 70.6% of students believed so on average. 14.0% of students said they had no desire to use ICT for their studies, and another 15.4% said they had trouble answering this question. As a result, H4, "ICT in blended learning encourages to make more efforts to acquire new knowledge", was validated.

After the advent of ICT, the mean score for three universities in the economic disciplines under consideration climbed marginally from 3.82 to 3.88. The mean exam score rose in two universities (from 3.72 to 3.9 and from 3.9 to 3.95), while it declined somewhat in one university (from 3.84 to 3.78). As a result, H5, "Blended learning using ICT does not lower academic performance," was validated.

Figure 2

Survey of students' involvement in international educational programs in blended (online) learning



According to the findings of the H6 student survey, 78% of participants saw e-learning as a means of achieving self-actualization through international collaborations. Simultaneously, nearly 86% of them said they wouldn't think twice about taking part in an online forum or conference on international economic issues. Just 22% of students paid attention to the two components' negative or neutral relationship (Figure 2).

4. DISCUSSION

Some international scholars focus on the qualitative and quantitative evaluation of ICT efficacy in economics education. In some countries, emphasis is placed on the opinions of economics teachers derived from their use of ICT, rather than only the opinions of pupils. One study, which involved 150 students from seven German universities and for which a common curriculum was created, found that teaching political science and economics was difficult due to the complexity of the interactions involved in scheduling synchronous online seminars between in-person conversations (Plank & Niemann, 2020).

According to Gubiani et al. (2020), a study carried out at the University of Nova Gorica in Slovenia also revealed certain ICT problems in the creation of instructional materials, the application of efficient techniques and resources for teaching economic subjects, and an improvement in communication

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quality. Students did, however, highlight a few benefits of online learning, including the ability to have all course materials in one location, constant access to all materials, consideration of assignment due dates, the simplicity of interactive resources, such as brief movies and tasks with only a partial solution, the possibility to connect with teachers and other practitioners via discussion boards, and the removal of the need to buy books.

The motivation behind the researchers' collection of quantitative data on ICT assessment by teachers included the following: the chance for students to have all course materials in one place (81.0%), the choice to convert course materials into an online format (52.4%), the university administration's support and motivation (52.4%), the desire to meet the needs of their students (28.6%), and the control over when and how students use online materials (28.6%). However, just 9.5% of university instructors had any prior e-learning course development expertise. Regarding the study's findings, it's necessary to highlight how crucial it is for management, which sometimes overlooks this, to assist teachers in implementing ICT.

Developing nations are also giving the advancement of e-learning a lot of attention. In India, for example, research involving 53 professors of economics and social science from three universities found that 64.2% of participants used e-learning. Only 24.5% of participants use e-learning techniques 1-3 days a week, and 30.2% of participants use them only once per month (Naseri, 2020). All participants (100%) concurred that ICT is crucial to education. Participants in the study said that e-learning was more effective than traditional schooling when comparing the two on a 5-point scale. As a result, the importance of ICT in e-learning rested not only in the model's availability but also in how frequently it was applied to the process of teaching and learning.

Furthermore, Russian academics highlight the inadequate assimilation of Russian business education into the global educational arena. Since innovation and business education are now prerequisites for the full development and competitive success of commercial companies, as well as the effectiveness of entrepreneurial activity on any scale, employees need to be continuously updated on new globalization knowledge about modern business strategies and tactics. However, not many Russian Federation universities allow their students to participate in full-fledged overseas exchange programs. Because of this, the nation's economic education system needs to be greatly improved, taking into consideration opportunities and trends throughout the world (Akhmetshin et al., 2018).

A study conducted in Indonesia with one hundred teachers sought to determine how well an e-learning approach worked for an economics course (Sudarwati, 2018). Based on a 4-point rating system (extremely effective, moderately effective, not effective, and very ineffective), regarding the use of ICT for economics students, 44% of teachers reported that e-learning was very effective, and 50% felt it was quite effective. The program of economic education included evaluations of the instructional materials' quality, the learning environment, how students interacted with the resources, and their level of activity. Teachers gave the quality ratings above 70% for each of these factors. It's interesting to note that the favorable findings of students' ICT assessments, which we found in this paper, typically matched the positive results of teachers' ICT assessments.

Research conducted in Togliatti among 60 students from nearby universities who are currently enrolled in distant education programs utilizing ICT is noteworthy for its appraisal of the possible postgraduate education audience (Ivanova, 2015). Only two (3.4%) of the respondents had begun their studies straight after graduating from high school; the remaining respondents had either completed or only partially completed their higher education. The majority of students (54.9%) selected specializations in economics, while the remaining students (45.1%) selected management and law. Furthermore, a survey was conducted in Togliatti with 1,200 city dwellers. Of all the respondents, 34% said that they would want to study remotely, with economics specializations being the most popular choice. Therefore, among the Russian Federation's residents who would choose to pursue higher education through a distance learning approach, economic specializations are in the lead.

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5. CONCLUSION

The purpose of the 2019 study, which is covered in this article, was to evaluate the efficacy of ICT-based blended learning for economics students. The following outcomes were reported in the article. ICT was used to teach economics courses in three Russian institutions (VSUES, KemsU, and RSREU) using a blended learning approach. This allowed for the rapid correction of issues that developed during the initial stages of ICT adoption, as well as the utilization of the advantages of both traditional classroom and remote learning electronic education. To achieve this, electronic educational materials were added to the current educational and methodological foundation. Together with theoretical information and most of the lectures from class, these materials contained interactive practical exercises connected to solving economic problems utilizing mathematical modeling software tools.

Two hundred and twenty-one (221) of the 236 undergraduate economics students from the three Russian institutions (VSUES, KemsU, and RSREU) that participated in the field study had their questionnaires accepted for processing. Students used certain electronic resources for their studies, and the survey was administered after the term. 63.4% to 83.1% of students reported having a positive experience with different aspects of using ICT in the classroom, depending on the university and the questionnaire component. The empirical data obtained confirmed the following hypotheses:

- H1 "ICT in the form of blended learning ensures student satisfaction with the learning process".
- H2 "ICT allows presenting theoretical learning materials in a form understandable for students".
- H3 "ICT allows presenting practical learning tasks in a form understandable for students".
- H4 "ICT in the form of blended learning motivates to make more efforts to acquire new knowledge".
- H5 "ICT in the form of blended learning does not decrease the academic performance".

The article's conclusions are applicable since the recommended methodology makes it possible to effectively integrate ICT to plan blended learning for students studying economics. The best features of both traditional and technological schooling are combined in this method. Furthermore, in the context of economic disciplines, nearly 80% of the H6 students questioned feel that blended learning expands their opportunities for integration into global educational programs.

The article's scientific uniqueness stems from its analysis of the impact of ICT introduction on economics students' blended learning experience and its acquisition of fresh experimental data that validates the usefulness of ICT. The outcomes can be used for ICT-based economics education in SPE and HPE institutions.

Conflict of Interest: The authors declare no conflict of interest.

Ethical Approval: The study adheres to the ethical guidelines for conducting research.

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