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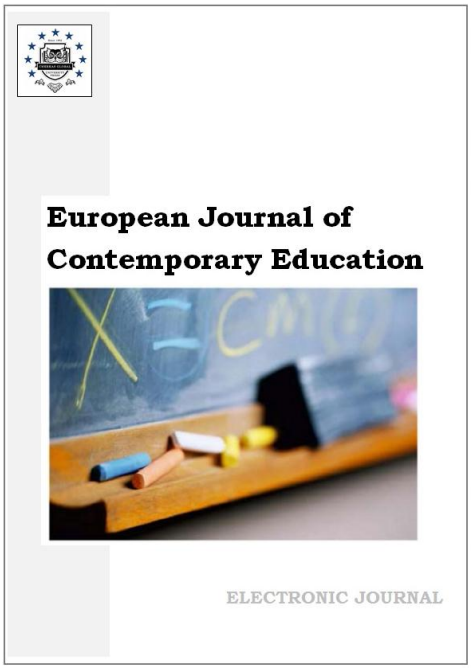

Factors Affecting Bachelors of Engineering and Technology Academic Performance in Teaching English for Special Purposes: Corpus Approach and Terminological Units

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Abstract

The widespread use of modern information technology in the educational process of the Russian education system forces the need to develop new educational standards and approaches focused on consideration of the individual characteristics of students. This leads to a need to consider the individual characteristics of students that can influence the acquisition of necessary knowledge and skills. This study involved the task to consider the influence of factors such as sex, age and academic year on the introductory and final testing results of bachelors of mineral resources, who took training courses in English for special purposes on the basis of the corpus-based approach model in teaching and determination of its efficiency. The experimental training is presented in three stages: introductory, operational and final. These stages included learning English for special purposes based on the corpus analysis model of the grammatical environment of terminological units, introductory and final testing with subsequent statistical processing of the data obtained. The experimental training outcome obtained demonstrated that the degree of the influence of sex and academic year on academic performance was less pronounced at the introductory testing stage, while it was more pronounced at the final testing stage. The influence of the age groups of students on the data was noted at both stages of testing. It was expressed in the simple average values of the age groups of 17 and 21 years, indicating a downward value in accordance with the age of students. The paired samples T-test data helped us reveal the learning efficiency. Such samples demonstrated sufficient statistical significance of the differences in the average values of the final and introductory testing data.

Keywords: engineering education, corpus approach, academic performance, English for special purposes.

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1. Introduction

The widespread use and constant development of digital technology in most areas of our life leads to the manufacturing transformation, new economic sectors development, thereby increasing the demand for knowledge in the field of engineering disciplines and contributing to transformations, including those relating to higher education. Thus, in last decades, the government demand for engineers in general and mineral resources specialists in particular grew significantly in Russia. This is due to their important role in ensuring the competitiveness and science and technology progress of the state industry and economy (Zhdaneev, 2022; Mikeshin, 2022; Kretschmann et al., 2020; Litvinenko et al., 2023). Bearing these changes in Russian engineering education in mind, there is a need to improve existing programs and develop new ones in order to upgrade the quality of engineering training (Almetov et al., 2020; Gerasimova et al., 2022; Kharlamova et al., 2023; Sveshnikova et al., 2022). It is worth mentioning that currently many foreign and Russian higher education systems are developing and applying educational standards and approaches to learning, including English, with due account for the widespread use of modern information technology that can influence the acquisition of the necessary knowledge and skills (Aleryani et al., 2019; Rus, 2019; Nikonova et al., 2023; Varlakova et al., 2023). Thus, the dynamically developing approaches to learning English based on the use of online technology and databases can also include the use of text corpora (Fauzan et al., 2022; McGrath et al., 2022; Nugraha et al., 2017).

The use of information technology in learning allows us to turn our focus toward the relevance of the individual student characteristics (Berge et al., 2019; Moote et al., 2020; Rajandran et al., 2015; Nja et al., 2019). It is emphasized that they facilitate the achievement of educational goals in groups of students who are distinguished both by sex and age, while within the framework of engineering education in Russia, this subject is still left largely unaddressed. At the same time, one of the distinctive features of students pursuing physics, mathematics and engineering educational programs in foreign countries is that most of them are male students (Wrigley-Asante et al., 2023). In Russia, the number of male students attending an engineering university is several times higher than the number of female students, as opposed to classical and humanities universities (Antoshchuk, 2021; Oblova et al., 2022; Zamiatnina, 2017). In this regard, a need arises to study and consider the influence of factors such as sex and age on students' academic performance. This paper provides for studying the influence of factors of sex, age and academic year on the efficiency of learning English for special purposes within the framework of the previously developed corpus-based approach model in mineral resource engineers teaching (Boyko et al., 2023).

2. Theoretical background

Foreign studies devoted to the analysis of sex and age characteristics in the learning process (Hirnstein et al., 2019; Hardebolle et al., 2022; Fényes, 2014; Abioye et al., 2019) specify that the existing differences between male and female students can manifest themselves at the cognitive, behavioral and physical levels. In particular, the process of learning English brings the properties of memory and cognitive activity of students to the forefront (Bećirović et al., 2021), which are inextricably linked with their age characteristics. Among the features that younger students have, we can mention increased endurance, resistance to psychological stress, flexibility in the process of learning new material and activation of short-term memory. Older students are noted for their concentration, a high scope of attention and long-term memory, as well as the ability to focus on educational material for a long time (Archer et al., 2018; Buranova, 2022). Thus, a number of studies (Tomakin, 2020; Kasimi et al., 2017) indicate that the strength of memorization and processing of educational materials, including those related to the vocabulary and grammar of the English language, by students of different sex and age groups is determined by the peculiarities of their left and right brain functioning. In the framework of research (Bao et al., 2022; Shalihin et al., 2021) on the connection between the brain and thinking mentions that students having a developed left brain rationally process educational material, and students having a developed right brain process educational material by intuitive learning.

According to a number of authors (Choi et al., 2020; Hirnstein et al., 2019; Liang et al., 2021; Xin et al., 2019), the majority of female students have the left brain more developed. In this regard, their way of thinking is more rational, which contributes to a better processing of subjects based on rational and logical ways of learning. It was also observed (Kljajevic, 2022) that the more developed left brain helps to process information by listening to it, which contributes to the storing of verbal information,

including the reproduction of sounds in a foreign language. According to this theory, female students with more pronounced short-term memory are more likely to show their analytical and communicative abilities (Loprinzi et al., 2018). Regarding male students, some authors (Choi et al., 2020; Hirnstein et al., 2019; Liang et al., 2021; Xin et al., 2019) believe that they have a more developed right brain, characterizing their thinking as abstract and creative. This ensures that it facilitates a better perception, visual analysis (Shaqiri et al., 2018) and deductive processing of the surrounding space, objects and their forms, including educational material. It was also noted that the memory of most male students could be characterized as long-term (Spets et al., 2019).

Since the above factors may influence the efficiency of the process of learning English for special purposes on the basis of previously developed corpus-based approach model in mineral resource engineers learning, this article was executed to identify the relationship between the academic performance of first-year and second-year mineral resource students and such factors as their sex, age and academic year.

In the present paper, we will test two research hypotheses:

1. The factors of sex, academic year and age did not significantly affect the data of introductory and final testing of bachelors who took training courses on the basis of the corpus-based approach model in mineral resource engineers learning, in terms of the terminological units grammatical environment features analysis.

2. The total amount of points obtained during the introductory testing of bachelors who took training courses on the basis of the corpus-based approach model in mineral resource engineers learning, in terms of the terminological units grammatical environment features analysis, does not differ much from the total points of the final testing.

This study involved the task to consider the influence of factors such as sex, age and academic year on the introductory and final testing results of bachelors of mineral resources, who took training courses on the basis of the corpus-based approach model in learning and its efficiency determination. The training was conducted on the basis of the terminological units grammatical environment features analysis developed and tested by us earlier, but with the involvement of a larger number of students.

3. Materials and methods

Experimental English language training for special purposes was conducted within the first-year and second-year curricula of undergraduate students of the Saint-Petersburg Mining University during the 2022–2023 academic year (two academic semesters). The unified introductory testing standard for the Saint-Petersburg Mining University was conducted among all first-year and second-year students at the beginning of the academic year to determine the level of foreign language proficiency. Since our research was focused on students with proven English proficiency of "upper – intermediate" (B2), the testing results allowed us to select 583 participants among all first-year and second-year students. According to the rule of random selection, 214 students were subsequently selected and took experimental training. Having studied the resulting random sample, we obtained the following data on the number of first-year and second-year students, their age and sex. General information about the participants is provided in Table 1.

Table 1. General information about the participants

Academic year	**Number**	**%**
1 year	119	55.61% (214)
2 year	95	44.39% (214)
Age group	**Number**	**%**
17 years	33	15.42% (214)
18 years	87	40.65% (214)
19 years	63	29.43% (214)
20 years	25	11.68% (214)
21 years	6	2.80% (214)
Sex	**Number**	**%**
Male	120	56.07% (214)
Female	94	43.92% (214)

Source: compiled by authors

Table 1 shows that out of 214 participants taking part in the experiment, 120 were male and 94 were female, 119 were first-year and 95 were second-year students. Age groups were represented by students aged 17 to 21. Specified information about the participants is presented in Table 2.

Table 2. Specified information about the participants

Academic year	N	%	Sex	N	%	%	Age				
							17	18	19	20	21
1	119	55.61 (214)	M	69	57.98 (119)	32.24 (214)	19	34	10	6	-
			F	50	42.02 (119)	23.36 (214)	14	27	9	-	-
2	95	44.39 (214)	M	51	53.68 (95)	23.83 (214)	-	10	25	12	4
			F	44	46.32 (95)	20.56 (214)	-	16	19	7	2

Source: compiled by authors

Based on the information presented in Table 2, 119 first-year students were from 4 age groups: 17-year-olds included 33 students of which 19 were male and 14 female, 18-year-olds included 61 students of whom 34 were male and 27 female, 19-year-olds included 19 students of whom 10 were male and 9 female, 20-year-olds included 6 male students. 95 second-year students were from 4 age groups: 18-year-olds included 26 students of whom 10 were male and 16 female, 19-year-olds included 44 students of which 25 were male and 19 female, 20-year-olds included 19 students of whom 12 were male and 7 female, 21-year-olds included 6 students of whom 4 were male and 2 female.

The educational materials used for the experimental training were prepared by applying several text corpora: Russian National Corpus and Hong Kong Engineering Corpus. The materials included the use by students of quantitative and qualitative methods of analysis presented in concordance lines of these corpora. In the course of experimental English language training for special purposes, first-year and second-year undergraduate students were trained to work with corpus data and analyze the grammatical environment of terminological units in addition to the standard educational materials provided for by the academic course working program. The process of experiential training was represented by three stages, introductory and final testing of students, followed by analysis of statistical data and their processing.

The experimental training included several stages: introductory, operational and final.

At the introductory stage, when determining the experimental training conditions, we used a corpus analysis model of the grammatical environment of terminological units as a guide, as well as criteria for evaluating tasks performed within the framework of introductory and final testing, developed and presented in our previous paper (Boyko et al., 2023).

The operational stage involved the conduct of introductory testing of participants, learning English for special purposes during the academic year, and final testing.

At the final stage, the introductory and final testing results were processed and statistically analyzed, as well as the results of experimental training.

The introductory and final testing results were analyzed using the IBM SPSS program (version 26). Initially, the average values of the introductory and final testing results were identified, as well as their standard deviation within the framework of descriptive statistical data analysis. Since our study involves data obtained before the experimental training and data obtained after it, we are dealing with dependent samples. In this regard, we used nonparametric techniques of mathematical statistics. As part of testing the first research hypothesis, the Mann-Whitney U tests were conducted to study the influence of independent variables of sex and academic year of students on the statistical significance of the differences between introductory and final testing, and the Kruskal-Wallis H test was used to determine the presence of statistical significance between the influence of students' age and introductory and final testing data. As part of testing the second research hypothesis, paired T-test was used to determine statistically significant differences between the introductory and final testing data, followed by the calculation of the effect size using Cohen's d.

4. Results

The Table 3 presents the introductory and final testing data. The average value of the introductory testing was 3.40, which is a satisfactory outcome relative to the 5-point assessment system in Russia, while the average value of the final testing was 4.46, which is the best outcome of the two presented. It is also worth mentioning that the final testing results were found to have a higher statistical variance relative to the introductory testing data, with data equal to 0.617 for the final testing and 0.553 for the introductory testing. An increase in the simple average values of the final testing by 1.06 relative to the introductory testing, as well as an increase in statistical variance indicates that after the experimental training, the students' performance became better than before the experimental training.

Table 3. Descriptive statistics of the introductory and final testing

Type of testing	Number	Sum of scores	Averages	Standard deviation	Variance	Points gain	Average arithmetic gain.
Introductory	214	727	3.40	0.553	0.30	228	1.06
Final		955	4.46	0.617	0.38		

Source: compiled by authors

The influence of sex on the introductory and final testing results presented in Table 4 was subsequently evaluated. Thus, female students obtained the higher point average according to the introductory testing data, which was 3.45 compared to the point obtained by male students being equal to 3.35. The difference in the point average is 0,10. This suggests that the difference in the points obtained by the male and female sexes in the introductory testing is not pronounced. It is worth noting that the point average was 4.57 (this is 1.12 more than the introductory test value) according to the data of the final testing of female students, which is also higher than the points obtained by male students being equal to 4.37 (this is 1.02 more than the introductory testing value). It is understood that the difference in the point average of male and female students is only 0.20. This suggests that the difference in the points obtained by the male and female sexes in the final testing is not great, but it is more pronounced relative to the introductory testing.

The Mann-Whitney U test of the introductory testing results showed that the standardized effect size is small (0.095). This indicates that the difference between the value of the introductory testing of male students and the value of the introductory testing of female students is small. It also pointed out that there is a difference in the values of the average rank of male and female students. So it is equal to 113.10 for female students, and equal to 103.11 for male students, which indicates that female students coped with the task better than male students in the framework of introductory testing. The Mann-Whitney U test of the final testing results showed that the standardized effect size is small (0.16). This indicates that the difference between the value of the final testing of male students and the value of the final testing of female students is small. It also pointed out that there is a difference in the values of the average rank of male and female students. So it is equal to 117.55 for female students, and equal to 99.63 for male students, which indicates that female students coped with the task better than male students in the framework of final testing.

The p-value equal to 0.164, (p(x Z) = 0.082) was obtained as part of the introductory testing. This means that the probability of the first-type error rejecting the correct null hypothesis "The difference between the random choice of the point of a male student and a female student in the introductory testing is not large enough to be statistically significant" is high (0.164), since the larger the value of p, the more it supports the null hypothesis. Consequently, the difference between the random choice of the point of a male student and a female student in the introductory testing is not large enough to be statistically significant. The p-value equal to 0.01775, (p(x Z) = 0.008875) was obtained as part of the final testing. This means that the probability of the first-type error rejecting the correct null hypothesis "The difference between the random choice of the point of a male student and a female student in the final testing is not large enough to be statistically significant" is small (0.017), since the smaller the value of p, the more it supports the first hypothesis. Consequently, the difference between the random choice of the point of a male student and a female student in the final testing is large enough to be statistically significant. This indicates that the degree of the influence of sex on academic performance is absent at the stage of

introductory testing preceding the beginning of experimental training, and can be noted at the stage of final testing, which was conducted after taking the experimental training.

Table 4. Sex impact on the results of the introductory and final testing

Type of testing	Sex	Sample size	Sample average	Sample std. dev.	Median	Mean rank	W Wilcoxon	U	P-value	Effect size
Introductory	M	120	3.35	0.528	3	103.11	12373.5	6166.5	0.164	small (0.095)
	F	94	3.45	0.580	3	113.10	10631.5	5113.5		
Final	M	120	4.37	0.635	4	99.63	11955	6585	0.017	small (0.16)
	F	94	4.57	0.577	5	117.55	11050	4695		

Source: compiled by authors

Further, the impact of the academic year on the introductory and final testing results was estimated, the results of which are presented in Table 5. According to the introductory testing data, the point average is higher for second-year students (3.58) than for first-year students (3.24). However, the difference in the point average is 0.24. This suggests that this difference is not pronounced. According to the final testing data, the point average is higher for second-year students (4.8) than for first-year students (4.18). At the same time, the difference in the point average of first-year and second-year students is 0.63, which means that this difference is of a pronounced nature.

The Mann-Whitney U test of the introductory testing results showed that the standardized effect size is small (0.3). This indicates that the difference between the value of the introductory testing of first-year students and the value of the introductory testing of second-year students is small. It also pointed out that there is a difference in the values of the average rank of first-year and second-year students. So it is equal to 124.76 for second-year students, and equal to 93.72 for first-year students, which indicates that second-year students coped with the task better than first-year students in the framework of introductory testing. The Mann-Whitney U test of the final testing results showed that the standardized effect size is large (0.51). This indicates that the difference between the value of the final testing of first-year students and the value of the introductory testing of second-year students is big. It also pointed out that there is a difference in the values of the average rank of first-year and second-year students. So it is equal to 139.05 for second-year students, and equal to 82.31 for first-year students, which indicates that second-year students coped with the task better than first-year students in the framework of final testing.

The p-value equal to 0.00001479, ($p(x \leq Z) = 0.000007394$) was obtained as part of the introductory testing. This means that the probability of the first-type error rejecting the correct null hypothesis "The difference between the random choice of the point of a first-year student and a second-year student in the introductory testing is not large enough to be statistically significant" is small (0.00001479), since the larger the p-value, the more it supports the null hypothesis. Consequently, the difference between the random choice of the point of a first-year student and a second-year student in the introductory testing is large enough to be statistically significant. The p-value equal to 5.729e-14, ($p(x \leq Z) = 02.864e-14$) was obtained as part of the final testing. This means that the probability of the first-type error rejecting the correct null hypothesis "The difference between the random choice of the point of a first-year student and a second-year student in the final testing is not large enough to be statistically significant" is small (5.729e-14), since the larger the p-value, the more it supports the null hypothesis. Consequently, the difference between the random choice of the point of a first-year student and a second-year student in the final testing is large enough to be statistically significant.

The data obtained allow us to mention that, both simple average and the Mann-Whitney U test involve pronounced differences between the introductory testing results of first-year and second-year students, emphasizing the degree of the influence of academic year on the experimental training outcome. However, they are less pronounced at the stage of introductory testing and more pronounced at the stage of final testing, after taking experimental training.

Table 5. Influence of the academic year on the results of introductory and final testing

Type of testing	Academic year	Sample size	Sample average	Sample std. dev.	Median	Mean rank	W Wilcoxon	U	P-value	Effect size
Introductory	1	119	3.24	0.431	3	93.72	11153	7292	0.000	small
	2	95	3.58	0.627	4	124.76	11852	4013	01479	(0.3)
Final	1	119	4.18	0.623	4	82.31	9795	8650	5.729e	large
	2	95	4.81	0.393	5	139.05	13210	2655	-14	(0.51)

Source: compiled by authors

The obtained data on the age influence on the introductory and final testing are presented in Table 6. Thus, in the framework of introductory testing among the five age groups, the highest simple average values are observed among students aged 21 (4.33), and the lowest among students aged 17 (3.15). The values of students aged 20, 19 and 18 were equal to 3.76, 3.52 and 3.24, respectively. Thus, in the framework of final testing among the five age groups, the highest simple average values are observed among students aged 21 (5), and the lowest among students aged 17 (4.21). The values of students aged 20, 19 and 18 were equal to 4.6, 4.69 and 4.31, respectively. As in the framework of introductory testing, this indicates a downward value in accordance with their age.

Table 6. Influence of age on the results of introductory and final testing

Type of testing	Age	Median	Average	Sample size	Rank sum	Mean Rank	P-value	Effect size
Introductory	17	3	3.15	33	2778	84.18	4.387e-8	large, 0.17
	18	3	3.24	87	8068.5	92.74		
	19	3	3.52	63	7563	120.04		
	20	4	3.76	25	3485.5	139.42		
	21	4	4.33	6	1110	185		
Final	17	4	4.21	33	2762.5	83.71	0.00003239	medium, 0.11
	18	4	4.31	87	8241	94.72		
	19	5	4.69	63	8054	127.84		
	20	5	4,6	25	2999.5	119.98		
	21	5	5	6	948	158		

Source: compiled by authors

The Kruskal-Wallis test showed that there is a significant difference in the dependent variable (the results of the introductory testing) and the age groups of students, $\chi 2(4) = 39.97$, $p < 0.001$, with an average of 84.18 for students of 17 years, 92.74 for students of 18 years, 120.05 for 19 years, 139.42 for 20 years and 185 for 21 years. The observed size of the effect η 2 is large, 0.17. This indicates that the difference between the averages is large. The p-value is 4.387e-8, (P(x 39.9719) = 1). This means that the probability of the first-type error rejecting the correct null hypothesis "The difference between the average ranks of some age groups during the introductory testing is not large enough to be statistically significant" is small (4.387e-8). The smaller the p-value, the more it supports the first hypothesis. Since the p-value is < α, the null hypothesis is rejected. That is to say that the difference between the average ranks of some groups is large enough to be statistically significant.

To check if there is a statistically significant difference in the average values of the points obtained by 214 students at the introductory and final stages of testing, a paired T-test was conducted. The data of such test are presented in Table 7 and reflected in Figure 1.

Also the Kruskal-Wallis test showed that there is a significant difference in the dependent variable (results of the final testing) and the age groups of students, $\chi 2(4) = 25.95$, $p < 0.001$, with an average rating of 83.71 for students of 17 years, 94.72 for students of 18 years, 127.84 for 19 years of age, 119.98 for 20 years of age and 158 for 21 years of age. The observed size of the effect η 2 is medium, 0.11. This indicates that the difference between the averages is average. The p-value

is 0.00003239, (P(x 25.95) = 1). This means that the probability of the first-type error rejecting the correct null hypothesis "The difference between the average ranks of some age groups during the final testing is not large enough to be statistically significant" is small (0.00003239). The smaller the p-value, the more it supports the first hypothesis. Since the p-value is < α, the null hypothesis is rejected. That is to say that the difference between the average ranks of some groups is large enough to be statistically significant. In accordance with the data obtained, it can be noted that there is the influence of age groups of students on the experimental training data. It is especially noticeable at the stage of introductory testing.

Table 7. Average values of introductory and final testing. Compiled by authors.

Type of testing	Sample size (n)	Averages	SDs	P-value	T-test	Average of differences ($\bar{x}_d$)	SD of differences (S_d)	Cohen's D
Introductory	214	3.397	0.553	1.5304E-63	24.3752	1.0654	0.6394	1.6663
Final	214	4.463	0.617					

Source: compiled by authors

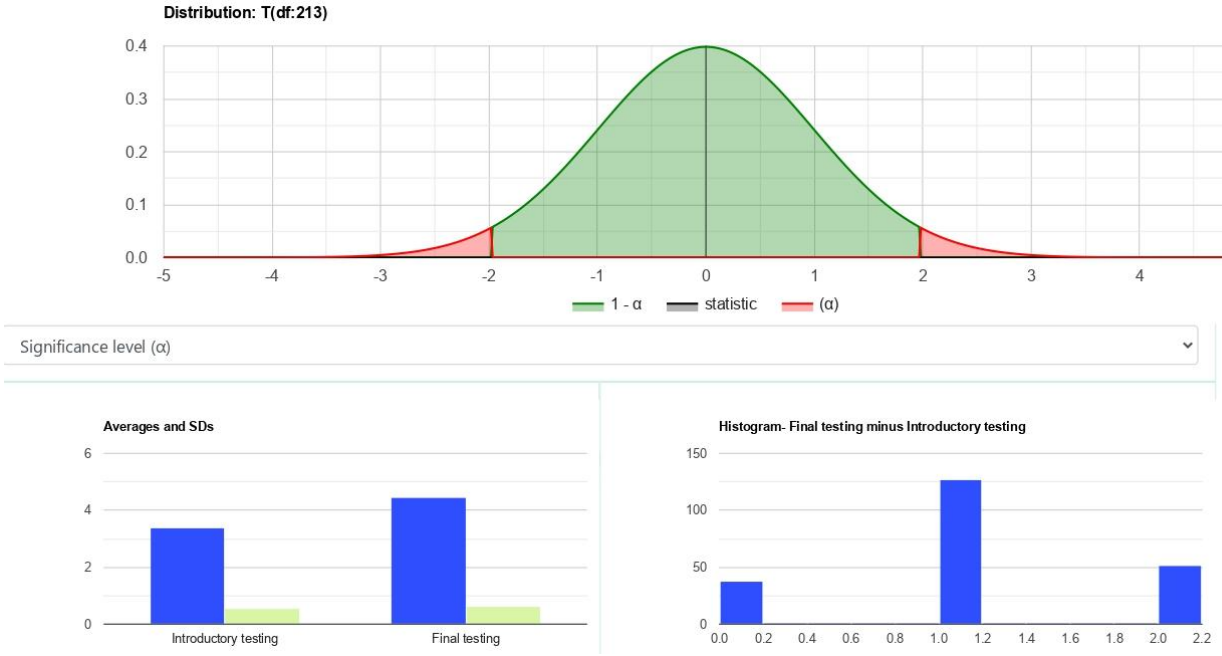

Fig. 1. Results of the paired T-test for the introductory and final testing
Source: compiled by authors

According to Table 7, there is a big difference between the introductory testing (mean = 3.397, standard deviation = 0.553) and the final testing (mean = 4.463, standard deviation = 0.617), so the criterion value t(213) = 24.3752 and p <0.001. Average values of the final testing results are unequal average values of the results of the introductory testing.

In other words, the average difference between the results of the final and the introductory testing is large enough to be statistically significant. The T-test value for paired samples is 24.3752, which is not included in the 95 % acceptance area [-1.9712, 1.9712]. 95 % confidence interval of final testing minus confidence interval of introductory testing is [0.9793, 1.1516]. The resulting value p is 1.5304E-63, (P(x 24.3752) = 1). This means that the probability of the first-type error rejecting the validity of the null hypothesis "The difference between the average values of the results of the final and the introductory testing is not large enough to be statistically significant", is small (equal to 0). This is important because the smaller the value p, the more it supports the first hypothesis. In this regard, we can say that based on the received data p-value < α, therefore,

the null hypothesis is rejected. In addition, the effect size of Cohen's d was calculated, which showed the effect size to be 1.6663, indicating the magnitude of the difference between the mean values of the differences between the results of the introductory and final testing and the expected average of the differences between the results of the introductory and final testing is high.

This also confirms the correctness of the previously obtained outcome and testifies to the efficiency mineral resource engineers learning who took training on the basis of the corpus-based approach model, in terms of the terminological units grammatical environment features analysis.

5. Discussion

According to the obtained data of the average value, male and female students had minimal differences in the introductory testing, but the average value of the final testing results indicates that the difference between the outcome of the male and female sexes was more pronounced. At the same time, it is worth noting that the outcome of female students was higher than the same of male students at both stages of testing. The Mann-Whitney U test showed a small standardized effect size of male and female students, both at the introductory and final stages of testing. However, it is worth mentioning that the p-value in the introductory testing indicated a high probability of the first-type error, in contrast to the p-value in the final testing. This suggests that if the difference between the random choice of the points of male and female students was not pronounced at the introductory stage of testing, it became pronounced at the final testing. The data obtained are consistent with the previously published data of foreign authors (Nja et al., 2019; Wrigley-Asante et al., 2023; Rajandran et al., 2015; O'Dea et al., 2018) who noted the influence of sex on student academic performance.

With due account for the data of the average value of second-year students, it can be noted that they coped with the introductory testing slightly better than first-year students. However, with the Mann-Whitney U test results in mind, the standardized effect size for introductory testing of first-year and second-year students was small, therefore, the advantage of second-year students over first-year students is not significant. Considering the final testing data, it can be noted that second-year students managed to cope with the test better than first-year students within the average value and the standardized effect size for the final testing was large in accordance with the Mann-Whitney U test results. The data obtained allow us to note that, as in the framework of the arithmetic mean, and in the framework of the Mann-Whitney test, there are pronounced differences between the results of introductory testing of first-year and second-year students, emphasizing the influence of the academic year on the results of experiential learning. Therefore, we can agree with a number of authors (Long et al., 2008; Koyuncuoğlu, 2021) that the academic year can influence academic performance.

The Kruskal-Wallis H test presented in the paper on the points received by students of the age groups from 17-21 years as part of the introductory stage of testing demonstrated that students of the age group of 21 years had the highest average rank 185 (in the final testing they had 158), and the lowest average rank 84.18 was among students of the age group of 17 years (in the final testing they had 83.71). This is also confirmed by the difference in the simple average value of the age group data both within the introductory and final testing. It is worth mentioning that the revealed influence of age groups of students on the experimental training outcome was more pronounced at the introductory testing stage than at the final testing stage. Some authors (O'Dea et al., 2018; Nja et al., 2019) also noted the possibility of the impact of the age of students on academic performance, which is reflected in this experimental training.

The T-test data obtained allow us to note that the difference in the average values of the final and introductory testing results turned out to be sufficiently large to be statistically significant. This points the effectiveness of the experimental training of mineral resource engineers. Given that the experimental training was conducted on the basis of the corpus-based approach model, we can confirm the results obtained (McGrath et al., 2022; Fauzan et al., 2022) as they relate to the effectiveness of using the corpus of texts in learning English.

There were a number of limitations in the presented study. One of them was the level of foreign language proficiency (B2), confirmed by the annual unified introductory testing for Saint-Petersburg Mining University. Another limitation was the use of dependent samples in order to compare the data of dependent variables obtained before and after exposure to an experimental factor, rather than independent samples, which could affect the reliability of the results obtained. The third limitation is to conduct experimental training in only one engineering university, while

conducting it in a larger number of universities would contribute to greater validity of the results. Subsequent studies must consider a greater number of levels of foreign language proficiency, as well as be conducted in a larger number of engineering universities.

6. Conclusion

Within the framework of this experimental English language training for special purposes, we used the previously developed corpus-based approach model in mineral resource engineers learning. The training was conducted at Saint-Petersburg Mining University during the 2022–2023 academic year with first-year and second-year bachelors in order to identify the relationship between the academic performance of mineral resource students studying in the first and second years and factors such as their sex, age and academic year.

Having regard to the training goal, research hypotheses were created, suggesting that the factors of sex, academic year and age do not greatly affect the introductory and final testing results of bachelors who took training on the basis of the corpus-based approach model in mineral resource engineers learning, in terms of the terminological units grammatical environment features analysis, and the total score of introductory testing is not much different from the final testing scores.

Accordingly, the task was to consider the influence of factors such as sex, age and academic year on the introductory and final testing results of bachelors who took training on the basis of the corpus-based approach model in mineral resource engineers learning and its efficiency determination, in terms of the terminological units grammatical environment features analysis.

The obtained data demonstrated that the degree of the influence of sex on academic performance was absent at the introductory stage of testing, and was found at the final stage of testing, which was conducted after taking the experimental training. And also that female students coped with the above better than male students, according to the data of both stages of testing. The influence of the students' academic year on the experimental training outcome was also noted at both stages of testing. However it was less pronounced at the stage of introductory testing and more pronounced at the stage of final testing. The influence of age groups of students on the experimental training outcome was also noted at the introductory and final testing. It was especially pronounced in the simple average values of the age groups of 17 and 21, indicating a downward value in accordance with the age of students. The obtained T-test data for paired samples indicates that the difference in the average values of the final and introductory testing results was large enough to be statistically significant. Consequently, the bachelors who took training on the basis of the corpus-based approach model in mineral resource engineers learning, in terms of the terminological units grammatical environment features analysis, significantly improved their academic performance as a result of experimental training.

This outcome can be applied in the development of new curricula and “English for special purposes” academic course working programs for the purpose of learning of bachelors of mineral resources.

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