TECHNOLOGIZATION OF THE TRANSLATION PROCESS UPON USING INDIVIDUAL TRAINING AIDS

Zhanara S. SARMANOVA[1], Almas A. KURMANGALIYEV[1], Gulnara I. KULDEYEVA[1], Laura K. KARABAYEVA[2], Ainagul M. MUKHTARKHANOVA[1], Gulden K. TUSSUPOVA[1]
[1]Department of Theory and Practice of Translation, L.N. Gumilyov Eurasian National University, Nur-Sultan, Republic of Kazakhstan
[2]Department of Languages, International Humanitarian and Technical University, Shymkent, Republic of Kazakhstan

Abstract: *The translation process is closely linked with two performance indicators of a professional translator. In particular, the process employs the translation tools, which relate to technical means, and the understanding of the text by the translator. In this regard, the relevance of the study is determined by the fact that a significant part of the technical means for the translator is used either only in the process of automatic preparation of the text for perception, or as dictionary tools to speed up the work of the translator. The necessity to consider the issue of application of automatic contextual translation programs and building of dictionary entries form the relevance of the study. The novelty of the study is determined by the fact that the translator mainly uses contextual translation tools and individual dictionary entries. In the article, the authors suggest using automatic translation systems based on online tools, particularly for the purpose of constructing the primary translation of the text. In this regard, the authors show that the use of such technology is possible not only within the framework of the private practice of a translator, but also for the training of specialists who form their translation qualifications. Practical application of the research findings is possible upon considering further informatization of text translation processes when employing tools such as machine learning and neural networks in a translator's practical toolkit.*

Keywords: information system, text translation, translator qualification, help system, text formalization.

Today, a characteristic feature of higher education is the increased attention of scientists from various industries to the issue of professional training of translators. Since it is still underdeveloped in pedagogical science, the formation of the professional competence of a translator, namely, providing future translators with the necessary knowledge, developing their translation skills and abilities, are some of the important and difficult challenges faced by the university teachers[1].

It is extremely relevant to determine the goal of training future translators to perform translation using a support system for lexical correction of text, its place in the overall content of professional training for future

[1] Y. Song, C. Yang, Z. Lin, X. Liu, Q. Huang, H. Li, C.-C.J. Kuo, "*Contextual-based image in painting: Infer, match, and translate*", in: V. Ferrari, M. Hebert, C. Sminchisescu, Y. Weiss (Eds.), *Computer Vision – ECCV 2018*, Springer International Publishing, Cham, 2018, p. 3-18.

translators, and a list of disciplines that influence the effectiveness of professional training for future translators[2].

We shall begin with consideration of such components of the pedagogical system of professional training in translation as the purpose and content of training[3]. The objective of professional training of future translators is to develop their translation skills using the support system for lexical correction of text[4]. When defining the goals of forming the professional competence of future translators, we proceed from an understanding of a specific result of educational activities[5]. In other words, during professional training, the purpose of developing translation experience using the support system for lexical correction of text is to master the knowledge, skills needed to perform translation activities and to educate, form and develop the personality of future translators in this process[6].

The modern theory and methodology of professional training substantiates the four main purposes of the professional training of future translators: practical, educational, pedagogic and developing. In our opinion, within the framework of professional competence, it is necessary to add professional, emotional and cognitive purposes to them[7]. A professional purpose was added since it is the matter of preparing future translators for professional activities[8]. The cognitive purpose of the professional training of future translators is closely connected with the formation of strategic supercompetence, and the emotional – with extra-linguistic subcompetence.

---

[2] N. Habash, J. Olive, C. Christianson, J. McCary, "*Machine translation from text*", in: J. Olive, C. Christianson, J. McCary (Eds.), *Handbook of Natural Language Processing and Machine Translation: DARPA Global Autonomous Language Exploitation*, Springer New York, New York, 2011, p. 133-397.

[3] E.T.K. Sang, "*Improving part-of-speech tagging of historical text by first translating to modern text*", in: B. Bozic, G. Mendel-Gleason, C. Debruyne, D. O'Sullivan (Eds.), *Computational History and Data-Driven Humanities*, Springer International Publishing, Cham, 2016, p. 54-64.

[4] X. Wang, C. Chen, Z. Xing, "Domain-specific machine translation with recurrent neural network for software localization", in *Empirical Software Engineering*, 2019, no. 24, p. 3514-3545.

[5] D. Alamargot, L. Chanquoy, "*Translating process*", in: *Through the Models of Writing*, Springer Netherlands, Dordrecht, 2001, p. 65-96.

[6] S. Gaur, N.H. Vo, K. Kashihara, C. Baral, "*Translating simple legal text to formal representations*", in: T. Murata, K. Mineshima, D. Bekki (Eds.), *New Frontiers in Artificial Intelligence*, Springer Berlin Heidelberg, Berlin, Heidelberg, 2015, p. 259-273.

[7] J. Wilhelm, R. Wilhelm, M. Cole, "*How can teachers locate and translate research specific to instructional practice?*", in: *Creating Project-Based STEM Environments: The REAL Way*, Springer International Publishing, Cham, 2019, p. 35-41.

[8] S. Nisioi, "*Unsupervised classification of translated texts*", in: C. Biemann, S. Handschuh, A. Freitas, F. Meziane, E. Métais (Eds.), *Natural Language Processing and Information Systems*, Springer International Publishing, Cham, 2015, p. 323-334.

Literature review

The purposes of professional training are closely connected to the content of building the professional competence of a translator[9]. The content of professional training of future translators with the skill of translation using the support system for lexical correction of text as a process and result should ensure the achievement of the main goal, which is to create favourable pedagogical conditions for the formation of professional competence in them[10]. Given the historiography of the development of translation practice and the different categories that are used by scientists during the classification of translation, we believe that the basis for the classification of types of translation plays an important role in identifying the main approaches to the professional training of future translators[11]. The training approaches for future translators can be divided into general and special[12]. General approaches can be used to prepare for the implementation of various types of translation, while the use of special approaches ensures the effectiveness of preparing a separate type of translation[13].

Professional training of future translators for performance of translation using the support system for lexical correction of text is not limited to fluency in English[14]. It (professional training) is designed to facilitate a high culture, wide encyclopaedic erudition in the scientific and technical field, sociability, tact, ability to learn throughout life, a variety of interests, etc.[15] Therefore, the modernization of the professional training of future translators to translate using the support system for lexical correction of text should be performed on the basis of carefully developed and purposeful intersubject communications

---

[9] Y. Wu, X. Zhuang, Q. Pan, "*A study on the influence of the computer-aided translation (CAT) technology on the quality of the translated text*", in: T. Zhang (Ed.), *Mechanical Engineering and Technology*, Springer Berlin Heidelberg, Berlin, Heidelberg, 2012, p. 15-20.

[10] S. Cao, "*The variation theory in cross-language context*", in: *The Variation Theory of Comparative Literature*, Springer Berlin Heidelberg, Berlin, Heidelberg, 2013, p. 101-158.

[11] *Ibidem.*

[12] J. Piqué-Angordans, S. Posteguillo, L. Melcion, "*The development of a computer science dictionary, or how to help translate the untranslatable*", in: E.A. Macià, A.S. Cervera, C.R. Ramos (Eds.), *Information Technology in Languages for Specific Purposes: Issues and Prospects*, Springer US, Boston, MA, 2006, p. 213-229.

[13]K. Hu, "*Corpus-based study of features of translation*", in: *Introducing Corpus-based Translation Studies*, Springer Berlin Heidelberg, Berlin, Heidelberg, 2016, p. 85-121.

[14] D. Carter, D. Inkpen, "*Searching for poor quality machine translated text: Learning the difference between human writing and machine translations*", in: L. Kosseim, D. Inkpen (Eds.), *Advances in Artificial Intelligence*, Springer Berlin Heidelberg, Berlin, Heidelberg, 2012, p. 49-60.

[15] X. Zhang, "Keeping the meanings of the source text: An introduction to yes translate", in: M. Sun, X. Huang, H. Lin, Z. Liu, Y. Liu (Eds.), *Chinese Computational Linguistics and Natural Language Processing Based on Naturally Annotated Big Data*, Springer International Publishing, Cham, 2016, p. 64-75.

of the theory and practice of translation and other academic disciplines[16]. All of the above requires the use of modern approaches to the training of future translators for performance of translation using the support system for lexical correction of text[17].

Supporting the view that ensuring the unity of structural elements and the development of new forms and technologies for the professional training of translator from various aspects requires improving the entire professional training system for future translators. We suggest to employ the competence-based, linguistic-communicative, cognitive-active, transdisciplinary and information and communicative approaches to ensure effective training of future translators performance of translation using the support system for lexical correction of text[18].

Materials and methods

To verify the correspondence of professional competence of future translators with the criteria of readiness to use information systems in the translation process, they were given the task of sight translation in the form of parts of a scientific article or scientific and technical development in the field of nanotechnology and computer technology[19]. The students' objective was to translate using the support system for lexical correction of text of one of the provided texts without preliminary preparation. Student responses were recorded on a voice recorder and later analysed by the researcher[20].

Having analysed the methodological literature, we came to the conclusion that to determine the quality criterion regarding the maturity of professional competence of future translators, it is necessary to apply formulas for calculating the "proficiency coefficient" (1):

$$K = \frac{Q}{N} \tag{1}$$

---

[16] M. Maskrey, K. Topley, D. Mark, F. Olsson, J. Lamarche, "*Translating apps using localization*", in: *Beginning iPhone Development with Swift 3: Exploring the iOS SDK*, Apress, Berkeley, CA, 2016, p. 677-701.

[17] C. Baral, "*Lessons from efforts to automatically translate English to knowledge representation languages*", in: J.P. Delgrande, W. Faber (Eds.), *Logic Programming and Nonmonotonic Reasoning*, Springer Berlin Heidelberg, Berlin, Heidelberg, 2011, p. 12.

[18] P.J. Chamizo-Domínguez, "*Pragmatic strategies when reading (problematic) translated texts*", in: K. Allan, A. Capone, I. Kecskes (Eds.), *Pragmemes and Theories of Language Use*, Springer International Publishing, Cham, 2016, p. 455-476.

[19] A. Wallwork, "*Using Google Translate and analysing student- and GT-generated mistakes*", in: *English for Academic Research*: *A Guide for Teachers*, Springer International Publishing, Cham, 2016, p. 55-68.

[20] A. Jensson, K. Iwano, S. Furui, "*Language model adaptation using machine-translated text for resource-deficient languages*", in *EURASIP Journal on Audio, Speech, and Music Processing*, 2009, no. 1, Article number: 573832.

where K – proficiency coefficient, Q – total number of points scored by a student according to all criteria of competencies, N – the maximum number of points for all criteria of competencies, which in our case is 100 points. To simplify the calculation, we introduce the 0.25 coefficient, therefore 100 points x 0.25 = 25 points, the maximum number of points for all criteria of competencies is 25 points, and for each of the competencies – 5 (25 points x 0.2 = 5) points respectively.

As is known, the level of task completion is considered sufficient, where the proficiency coefficient is greater than or equals 0.7 ($K \geq 0.7$). The objective of the pre-experimental section was to identify the initial level of professional competence among future translators using the support system for lexical correction of text. The results obtained after the pre-experimental section indicate that the level of maturity of professional competence among future translators upon performing translation using the support system for lexical correction of text prior to the experiment is unsatisfactory[21]. Although the level of training of future translators in control groups (CG) is slightly higher than that of students of experimental groups (EG). The results of the experiment stage, during which the language difficulties were established, coincide with the results of the pre-experimental section in terms of the list of difficulties that students encounter upon translation using the support system for lexical correction of text:

1) lack of translation process planning skills;
2) lack of deverbalization and syntagmatic reading skills and abilities;
3) insufficient level of development of skills and abilities in application of translational transformations;
4) lack of skills for forecasting and synchronizing operations (reading and speaking);
5) lack of translation assessment skills;
6) insufficient level of subject knowledge and terminology (the field of computer technology and nanotechnology);
7) insufficient knowledge of translation ethical standards.

Analysing the recorded answers, regarding the "absence of unmotivated pauses" criterion, it was found that sight translations of both the CG and the EG students are characterized by a large number of unmotivated pauses, 15 on average, which indicates a low level (or absence) of skills and abilities for deverbalization and synchronization of operations.

Indicators according to the "correct language" criterion also turned out to be insufficiently high in all groups, as evidenced by a large number of literalisms, a lot of parasitic words, repetitions, self-corrections, as well as jargonisms. However, it should be noted that according to the

[21] S.Y. Hashimi, S. Komatineni, D. MacLean, "*Exploring text to speech and translate APIs*", in: *Pro Android 2*, Apress, Berkeley, 2010, p. 563-589.

abovementioned criterion, CG students in their majority had difficulties of lexical rather than grammatical nature, while the EG students had difficulties both of lexical and grammatical nature.

According to the criteria of "clarity of pronunciation" and "fluidity and flexibility of speech", future translators in all groups also displayed unsatisfactory results. The level of these indicators particularly decreased when students were confident in the answer or when they provided their own comment "I don't know". Therefore, in our opinion, a high level of mastery in forecasting, semantic analysis, and synchronization is closely related to increases in the abovementioned criteria.

Low indicators for all preliminary criteria inevitably led to low indicators according to the "degree of preservation of the main content of the text in the translation" criterion. Significant language errors lead to loss or distortion of essential information and a change in content, unmotivated pauses and unclear pronunciation lead not only to suspension of discussion of issues during the translation, but sometimes to loss of information as well.

Although a small number of students (10% in the EG and 15% in the CG), upon performing the translation using the support system for lexical correction of text, maintained confidence and completed the task at a satisfactory level, for example, with only three unmotivated pauses and several type II errors, the rest (90% in the EG and 85% in the CG) felt insecure, with some students refusing to finish the translation, motivating the answer with the phrase "I don't know," some students asking if they would have 5-10 minutes to prepare, which is not only evidence on the low level of development of translation (skills and abilities of forecasting, use of translation transformations), but also extralinguistic (low level of subject knowledge and terminology) and personal subcompetence (psychological unpreparedness for translation in front of an audience).

Next, we compared the initial level of maturity of professional competence upon performance of translation using the support system for lexical correction of text in students of four experimental and control groups of the third year (CG-1 – CG-2, EG-3 – EG-4) and four experimental and control groups of the fourth year (EG-5 – EG-6, CG-7 CG-8), which facilitated, in fact, the determination of the possibility of checking the effectiveness of the pedagogical system. We support the opinion of methodologists that groups of students are ready to conduct an experiment if they have approximately the same level of professional competence upon performing translation using the support system for lexical correction of text. To verify the reliability of the results of the pre-experimental section, we used the non-parametric Shapiro-Wilcoxon criterion (to verify the normality of the samples), and then the parametric criterion for matching the Pearson χ^2 distribution. The results of testing the hypothesis according to the Shapiro-Wilcoxon criterion regarding the normality of the distribution of samples

(Table 1) allows us to accept the null hypothesis for all 6 samples, since the values of Intervals 1, 2, 3 for the third year and Intervals 1, 2, 3 for the fourth year do not exceed 1.

Table 1: Hypothesis test results according to Shapiro-Wilcoxon criterion

Categories – intervals	Test indicators
Third year	
Interval 1	0, 28
Interval 2	0, 16
Interval 3	0, 16
Fourth year	
Interval 1	0, 24
Interval 2	0, 08
Interval 3	0,12

The matching criteria are intended to verify the conformity of the hypotheses of empirical distribution according to the theoretical law. Simple and complex hypotheses testing is distinguished. Pearson's matching criterion is the most common criterion for testing hypotheses. It is used to test simple hypotheses. In parallel with the use of the asymptotically optimal grouping, the matching criterion for the distribution of χ^2 has advantages in power compared with nonparametric matching criteria.

The initial data for applying the criterion are given in Table 1, which contains the results of a pre-experimental section of four experimental groups and four control groups, sorted by the proficiency coefficient of future translators. We consider the proficiency coefficients of EG-1 students as sample 1, then the proficiency coefficients of CG-8 students are sample 8, the proficiency coefficients of EG and CG-2, 3, 4, 5, 6, 7 students are samples 2, 3, 4, 5, 6 and 7. To perform calculations of the results of the pre-experimental section, statistical hypotheses were formulated, which provide for two zero (H_0) and two alternative (H_1) hypotheses, since students of different years took part in the experiment.

So, for students in the EG and CG of the third year according to H_0(III): the empirical distribution of sample 1 does not differ from the empirical distribution of sample 2, from the empirical distribution of sample 3 and from the empirical distribution of sample 4; and H_1(III) is that the empirical distribution of sample 1 differs from the empirical distribution of sample 2, from the empirical distribution of sample 3 and from the empirical distribution of sample 4.

For students in the EG and CG of the fourth year, according to H_0(IV): the empirical distribution of sample 5 does not differ from the empirical distribution of sample 6, from the empirical distribution of sample and from the empirical distribution of sample 8, whereas under conditions of H_1(IV) the

empirical distribution of sample 5 differs from the empirical the distribution of the sample 6, from the empirical distribution of the sample 7 and from the empirical distribution of the sample 8.

The null hypothesis is a hypothesis that indicates the absence of disagreement, separately, in the EG and CG by distribution of signs of the level of professional competence upon performing translation using the support system for lexical correction of text, and evidence of an alternative hypothesis serve as the confirmation of the differences in the groups by the distribution of signs of the level of professional competence upon performing translation using the support system for lexical correction of text.

To test the hypotheses formulated above, it is necessary to determine the number of encounters of different attribute values in four samples. Considering the fact that some values of the attribute are found in only one sample (the value 0.88 occurs only in the sample in the third year or the value 0.84 occurs only once in the sample 6 in the fourth year), or are found in four or three samples, but the number of their occurrence is much smaller (a value of 0.76 occurs 3 times in the third year or a value of 0.4 occurs 2 times in the fourth year) than other values (a value of 0.6 occurs 6 times, and 0.56 occurs 7 times in the third year, a value of 0.76 occurs 12 times, while a value of 0.68 occurs 8 times in the fourth year), we came to the conclusion that it is impossible to use each individual sample value as a category for analysing the frequency of their appearance. Therefore, in order to continue further calculations, we will move from analysing the frequency of occurrence of each sample value to analysing the frequency of sample values falling into intervals that are equal in size and cover all the values that are found in the samples.

Interval 1 = [0,28; 056)

Interval 2 = [0,56; 072)

Interval 3 = [0,72; 0,88)

And also three equal in length intervals for the fourth year:

Interval 1 = [0,4; 064)

Interval 2 = [0,64; 072)

Interval 3 = [0,72; 0,84)

As is evident, the range: interval 1 interval 2 interval 3 includes all the different values that are found in four samples of the EG and in four samples of the CG.

Next, we calculate the number of different values of the attribute that fall into each of the proposed intervals for the experimental and control groups of the third and fourth years. The calculation results for both years are presented in Table 2 in the column of empirical frequencies. It is characteristic that in four columns (for four EG and four CG of the third and fourth years) the sum of the frequency values for the group from CG-1 to CG-8 and EG-3 EG-6 is 13 (the number of students in each group) – the number of items in the

samples. This is a necessary verification of the correct determination of the frequencies of sample values falling into the intervals.

To determine the theoretical frequencies, we were guided by the following rule: for instance, we need to find the theoretical frequency of the interval i for the group j, then the value of the theoretical frequency that interests us will be found using the formula (2):

$$P_{ij}^{theor} = \frac{S_1 S_2}{S_3} \quad (2)$$

then S_1 – the sum of the empirical frequencies of the four groups for the interval i; S_2 – the sum of the empirical frequencies of all intervals for the EG group – j; S_3 – total number of elements in two samples.

Table 2: Calculation of the frequencies of the χ^2 Pearson criterion

Categories-intervals	Empirical frequencies				Sum of empirical frequencies at intervals	Theoretical frequencies			
	CG-1	CG-2	EG-3	EG-4		CG-1	CG-2	EG-3	EG-4
Third year									
Interval 1	5	6	4	5	20	5	5	5	5
Interval 2	5	4	4	3	16	4	4	4	4
Interval 3	3	3	5	5	16	4	4	4	4
Sum of empirical frequencies for the group	13	13	13	13	52				
Fourth year									
	EG-5	EG-6	CG-7	CG-8		EG-5	EG-6	CG-7	CG-8
Interval 1	4	3	6	6	19	4.75	4.75	4.75	4.75
Interval 2	4	4	4	4	16	4	4	4	4
Interval 3	5	6	3	3	17	4.25	4.25	4.25	4.25
Sum of empirical frequencies for the group	13	13	13	13	52				

The coincidence of the theoretical frequencies for all intervals in four groups of the third year and four groups of the fourth year was obtained due to the same number of students in the groups and, as a result, the same number of elements in the three studied samples.

Using the calculations, we shall find the number χ^2_{emp} using the formula (3):

$$\chi^2_{emp} = \sum_{i=1}^{3} = \frac{(p_l^{emp} - p_l^{theor})^2}{p_l^{theor}} \quad (3)$$

In our case, for experimental groups and control groups of the third year, this is:

$$\chi^2_{emp} = 0+0.25+0.25+0.2+0+0.25+0.2+0+0.25+0+0.25+0.25=1.9$$

And for experimental groups and control groups of the fourth year, respectively:

$$\chi^2_{emp} = 0.11+0+0.13+0.64+0+0.72+0.64+0+0.72+0.4+0+.072=4.08$$

In order to determine the critical values of the criterion, we shall find the number of degrees of freedom v using the formula (4):

$$v = (k-1)(p-1) \quad (4)$$

where k – the number of categories by which the frequency response was found, and p is the number of samples compared.

In our case:

v = (4–1)(4–1).

According to the tables for the critical values of the χ^2 criterion, we have:

$$\chi^2_{cr} = \begin{cases} 5,991(p \le 0,05) \\ 9,210(p \le 0,01) \end{cases}$$

Let us compare the values χ^2_{emp} and χ^2_{cr}

$$\chi^2_{emp} < \chi^2_{cr}(0,05)$$

$$1,9 < 5,991(III)$$

$$4,08 < 5,991(IV)$$

The empirical values that we obtained for the experimental and control groups of both the thirds and fourth years are in the zone of insignificance. This means that we can accept the H_0(III) hypothesis (the empirical distribution of sample 1 does not differ from the empirical distribution of sample 2, the empirical distribution of sample 3 and the empirical distribution of sample 4) and H_0(IV) hypothesis, where the empirical distribution of sample 5 does not differ from the empirical distribution of the sample is 6, from the empirical distribution of the sample and from the empirical distribution of the sample 8. Thus, there are no disagreements in CG-1, CG-2, EG-3 and EG-4 in the third year and no disagreements in EG-5, EG- 6, CG-7 CG-8 in the fourth year by the distribution of the signs of formation of professional competence, which indicates the readiness of groups for experimental testing of pedagogical system.

Having analysed the results of the pre-experimental section in the experimental groups, we can state that the students of the selected groups do not have enough professional competence to perform translation using the

support system for lexical correction of text. This is preceded by several reasons, firstly, the lack of the abovementioned pedagogical conditions for the professional training of future translators to perform translation using the support system for lexical correction of text; secondly, insufficient attention paid to the formation of professional competence of future translators upon performing translation using the support system for lexical correction of text for text translation in the translation practice classes, in the interpretation classes, translation of scientific and technical literature, etc.; thirdly, the absence of the disciplines of educational material from the field of nanotechnology and computer technology in the working curricula, tasks with a time limit, etc.

Having researched the maturity of professional competence upon performing translation using the support system for lexical correction of text for third-year students, we found that it is approximately the same. Although in the CG-1 group the indicators were slightly lower than in the EG-4, and in the CG-2 and EG-3 groups the proficiency level was the same (0.59). Students of the fourth year had the highest indicator in the EG-6 group, and the lowest – in the CG-7 group, with that, the indicators of the EG-5 and EG-6 groups differed by 0.01, and the difference in the proficiency level in the groups CG-7 CG-8 was the same.

The material selected for the formation of professional competence of future translators upon performing translation using the vocabulary correcting system allowed to determine the pedagogical conditions, a model of the pedagogical system of professional training of future translators was designed, a special course for the formation of professional competence was developed, trainings were conducted, criteria for the level of translation competence assessment upon performing translation using the support system for lexical correction of text, as well as the absence of significant differences in the distribution of learnability attributes between CG-1, CG-2, EG-3 and EG-4 in the third year and between EG-5, EG-6, CG-7 CG-8 in the fourth year allowed us to proceed to the experimental testing of the pedagogical system.

Experimental testing of the pedagogical system of professional training upon performing translation using the support system for lexical correction of text was carried out according to the schedule, in the practice of translation classes, with regard to information resources in translation, translation of scientific and technical literature, from oral two-way translation, according to the program of a special course. The experimental testing was performed in appropriate pedagogical conditions and in parallel with professional training for other types of translation in accordance with the work program of each year of study, which indicates the natural conditions of the experiment.

We shall consider the content of the experimental testing of the pedagogical system. As previously noted, the experiment was vertically horizontal, which allowed to draw a conclusion on the overall effectiveness of

the developed pedagogical system of training future translators for performing professional activities.

The application of the selected pedagogical conditions for the professional training of future translators to perform translation using the vocabulary correcting system allowed us to create a high level of professional competence for future translators in oral two-way scientific and technical translation, due to the formation of each of the subcompetences and strategic supercompetences. For example, to develop and improve such skills and abilities of such translational subcompetence as deverbalization, syntagmatic reading, forecasting, to ensure that future translators are aware of such type of translation as the one using the support system for lexical correction of text; such skills and abilities of bilingual subcompetence as synchronization of operations (reading and speaking); psychological readiness to complete the abovementioned type of translation in front of an audience (personal competence), skills and abilities of semantic analysis as components of personal competence; to develop and improve such skills and abilities of implementing translation strategies as a component of strategic competence. Experimental testing of the pedagogical system of professional training of future translators under the suggested conditions will ensure the proper level of formation of extra-linguistic competence, namely subject knowledge and knowledge of the terminology of computer technology and nanotechnology.

The following was attributed to the pedagogical conditions influencing the effectiveness of the professional training of future translators for performing translation using the support system for lexical correction of text:

1) integrated application of strategies in the training process;

2) priority of communicative tasks with a time limit in the preparation of the translator;

3) transdisciplinary nature of the formation of professional competence of future translators;

4) use of authentic educational and informational resources and focusing on leading world standards;

5) commitment of the professional training process to the future translators' recognition of the prospects of professional activity.

After completing the experimental testing of the pedagogical system of professional training upon performing translation using the support system for lexical correction of text for future translators of the third year (CG-1, CG-2, EG-3 and EG-4) and fourth year (EG-5, EG- 6, CG-7 and CG-8) we performed a post-experimental section to determine the level of professional competence.

Results and discussion

The ascertaining stage of the experimental testing of the pedagogical system of professional training of future translators upon performing translation using the support system for lexical correction of text, which was carried out from September 2018 to May 2019, was one-part, carried out in eight groups and ended with a post-experimental section. According to the procedure, the conduct and the nature of the tasks that were performed by future translators of the experimental and control groups, this section was similar to the pre-experimental section. Sight translations of future translators were recorded using a voice recorder and later analysed by the researcher.

Future translators received an assignment for sight translation in the form of parts of a scientific article or scientific and technical design in the field of nanotechnology and computer technology. The task of the translators was to perform sight translation of one of the given texts without preliminary preparation. The only difference was the direction of translation. According to the topic of our study, we were testing the training for translation using the support system for lexical correction of text, therefore, during the post-experimental section, future translators received an assignment for translation from Russian into English, while during the pre-experimental section, the translation was performed from English into Russian.

To verify the reliability of the experimental study data, we used methods for studying quantitative characteristics, namely, the Fisher's angular transformation criterion. The Fisher's angular transformation criterion is used to verify the equality of variances of two samples. It belongs to the dispersion criteria. During the regression analysis, the Fisher criterion allows to evaluate the significance of linear regression models. In particular, it is used for stepwise regression in order to verify the feasibility of including or excluding independent variables (features) in the regression model. In the analysis of variance, the Fisher's test allows you to evaluate the significance of factors and their interaction.

The choice of the abovementioned criterion allowed to compare two samples according to the frequency of the presence of the effect that is of interest to us. This criterion allows us to assess the significance of differences between the percentages of two samples in which the effect, which is of interest to the researcher, is recorded. The term "effect" usually implies the level of learnability defined for each student - its coefficient should be at least 0.7. Using the Fisher's angular transformation criterion, it was established that changes in percentage values are significant from the viewpoint of statistic patterns.

For this, we compared the percentages of future translators in each group who reached a sufficient level of professional competence before the experimental testing of the pedagogical system, and the percentages of students

in each group who reached a sufficient level of development of professional competence after the experimental testing of the pedagogical system.

In accordance with the objectives of the experimental verification of the pedagogical system, we had to prove the effectiveness of certain pedagogical conditions for the formation of professional competence in future translators upon performing translation using the support system for lexical correction of text in the third and fourth year of study. For this, the Fisher angular transformation criterion was applied to each of the eight groups.

We shall start by checking the effectiveness of the pedagogical system of professional training upon performing translation using the support system for lexical correction of text on future translators in the third year of study. The results of the pre- and post-experimental sections for the CG-1, CG-2, EG-3, and EG-4 groups are presented in Table 3. The learnability coefficients of future translators of the CG-1, CG-2, EG-3, and EG-4 groups are calculated in pre-experimental section according to sample 1 data.

As is evident, the calculated coefficient of students in each group, according to the results of the post-experimental section, exceeds the average indicator according to the results of the pre-experimental section. However, we have to verify whether the observed differences are really significant in average indicators. We shall formulate statistical hypotheses to conduct research using the Fisher's angular transformation criterion.

1. Null hypothesis (H_0)III: the proportion of students who reached a sufficient coefficient of maturity of professional competence based on the results of the post-experimental section is not larger than the percentage of students who reached a sufficient coefficient of maturity of professional competence based on the results of a pre-experimental section.

2. Alternative hypothesis (H_1)III: the proportion of students who reached a sufficient coefficient of maturity of professional competence based on the results of a post-experimental section, is larger than that of the students who reached a sufficient coefficient of maturity of professional competence according to the results of a pre-experimental section.

We shall construct a table of empirical frequencies for two experimental and two control groups according to two values of the attribute: “there is an effect” “there is no effect” (Table 3). According to the results of the pre-experimental section, in the CG-1 and CG-2 groups, 3 students received a sufficient coefficient of maturity of professional competence. And in the EG-3 and EG-4 groups, 5 students received a sufficient coefficient of maturity of professional competence.

Table 3: Table of sections of empirical frequencies for students of CG-1, CG-2, EG-3 and EG-4

Sections	«There is an effect»			«There is no effect»	Total number of students
	Number of students	Percentage frequency	φ	Number of students	
CG-1					
Pre-experimental section	3	15%	1.001	10	13
Post-experimental section	12	92 %	2.57	1	13
CG-2					
Pre-experimental section	3	20%	1.001	10	13
Post-experimental section	12	95%	2.57	1	13
EG-3					
Pre-experimental section	5	40%	1.33	8	13
Post-experimental section	13	100 %	3.14	0	13
EG-4					
Pre-experimental section	5	40%	1.33	8	13
Post-experimental section	13	100 %	3,14	0	13

Thus, we take the numbers 3 and 5 to the upper left corner. According to the results of the post-experimental section, 12 students in the CG-1 and CG-2 groups surpassed the threshold with a learnability coefficient of 0.7. In the EG-3 and EG-4 groups, all students surpassed the aforementioned threshold. We shall determine the corresponding angular values of percentages in groups using the formula (5).

$$\varphi = 2\arcsin\sqrt{p} \tag{5}$$

where φ – central angle value, and p – percentage value.

Thus, for groups CG-1 and CG-2:

$$\varphi_{*1} = 2\arcsin\sqrt{\frac{3}{13}} = 1{,}00$$

And for groups EG-3 and EG-4:

$$\varphi_{*1} = 2\arcsin\sqrt{\frac{5}{13}} = 1{,}33$$

Whereas the value of the second sample for groups CG-1, EG-3, and EG-4 is:

$$\varphi_{*2} = 2\arcsin\sqrt{\frac{11}{13}} = 2{,}34$$

For the CG-2 group, accordingly:

$$\varphi_{*2} = 2\arcsin\sqrt{\frac{12}{13}} = 2{,}57$$

We shall find the empirical value of the φ^*_{emp} criterion using the formula (6):

$$\varphi^*_{emp} = (\varphi^*_{\max} - \varphi^*_{\min})\sqrt{\frac{n_1 n_2}{n_1 + n_2}} \quad (6)$$

where φ_{max} – angle that corresponds to a larger percentage; φ_{min} – angle that corresponds to a smaller percentage; n_1 – the number of elements in the sample 1; n_2 – the number of elements in the sample 2.

In our case, for CG-2 and CG-2 groups:

$$\varphi^*_{emp} = (2,57 - 1,001)\sqrt{\frac{13*13}{13+13}} = 4$$

For EG-3 and EG-4 groups:

$$\varphi^*_{emp} = (3,14 - 1,33)\sqrt{\frac{13*13}{13+13}} = 4,66$$

The critical values of the criterion are determined according to the table of significance of different values of the Fisher criterion:

$$\varphi^*_{cr} = \begin{cases} 1,64(p \le 0,05) \\ 2,31(p \le 0,01) \end{cases}$$

As is evident, the empirical values in all four groups exceed the critical values of the criterion:

$$\varphi^*_{cr}(0,01) < \varphi^*_{emp}$$
$$2,31 < 4(ЭГ - 1 / ЭГ - 2)$$
$$4,66(ЭГ - 3 / ЭГ - 4)$$

As we can see, the obtained empirical values of the criterion are in the zone of significance. Consequently, the presence of differences in the percentage of samples from the results of pre- and post-experimental sections in the CG-1, CG-2, EG-3, and EG-4 groups indicates that we shall accept the alternative hypothesis. And this means that certain pedagogical conditions for the training of future translators in the third year are effective. Let us proceed to checking the effectiveness of the pedagogical system of professional training of future translators in the fourth year of study.

Following the sequence of calculations described above using the calculation of the Fisher criterion, we shall verify the reliability of the results of an experimental testing of the pedagogical system of professional training of future translators. The initial samples for analysis are the coefficients of the level of formation of professional competence of fourth-year students of EG-5, EG-6, CG-7 and CG-8 groups in the pre- and post-experimental sections. The statistical hypotheses that we formulated for the assessment using the Fisher's criterion are completely identical to the previously formulated hypotheses.

1. Null hypothesis (H_0)IV: the proportion of students who reached a sufficient coefficient of maturity of professional competence based on the results of the post-experimental section is not larger than the percentage of students who reached a sufficient coefficient of maturity of professional competence based on the results of a pre-experimental section.

2. Alternative hypothesis (H_1)IV: the proportion of students who reached a sufficient coefficient of maturity of professional competence based on the results of a post-experimental section, is larger than that of the students who reached a sufficient coefficient of maturity of professional competence according to the results of a pre-experimental section.

Next, we shall construct a table of empirical frequencies according to two values of the attribute: "there is an effect" "there is no effect" (Table 4).

Table 4: Table of sections of empirical frequencies for EG-5, EG-6, CG-7, and CG-8 student groups

Sections	"There is an effect"			"There is no effect"	Total number of students
	Number of students	Percentage frequency	φ	Number of students	
EG-5					
Pre-experimental section	6	49%	1.49	7	13
Post-experimental section	13	100 %	3.14	0	13
EG-6					
Pre-experimental section	6	49%	1.49	7	13
Post-experimental section	13	100%	3.14	0	13
EG-7					
Pre-experimental section	3	15%	1.001	10	13
Post-experimental section	11	90%	2.34	2	13
EG-8					
Pre-experimental section	3	15%	1.001	10	13
Post-experimental section	11	90%	2.34	2	13

The results of the pre-experimental section displayed that in the EG-5 and EG-6 groups, 6 students obtained a sufficient coefficient of maturity of professional competence. In CG-7 CG-8 groups, 3 students obtained a sufficient coefficient of maturity of professional competence. Thus, we take the numbers 6 and 3 to the upper left corner. According to the results of the

post-experimental section, all students (13 people) in the EG-5 and EG-6 groups surpassed the threshold with a learnability coefficient of 0.7. In the CG-7 and CG-8 groups, the number of students who surpassed the aforementioned threshold is 11 people. Using the results of pre- and post-experimental sections, we shall determine the corresponding angular values of percentages in groups using the formula.

Thus, in CG-7 CG-8 groups the percentage is:

$$\varphi_{*1} = 2\arcsin\sqrt{\frac{3}{13}} = 1,00$$

In EG-5 and EG-6 the percentage is

$$\varphi_{*1} = 2\arcsin\sqrt{\frac{6}{13}} = 1,49$$

The value of the second sample for CG-7 CG-8 groups is:

$$\varphi_{*2} = 2\arcsin\sqrt{\frac{11}{13}} = 2,34$$

And for EG-5 and EG-6 groups, accordingly

$$\varphi_{*2} = 2\arcsin\sqrt{\frac{13}{13}} = 3,14$$

Using the Fisher's angular transformation formula, we shall determine the empirical value of the criterion. In the EG-5 and EG-6 groups it will be 4.2.

$$\varphi^*_{emp} = (3,14 - 1,49)\sqrt{\frac{13*13}{13+13}} = 4,2$$

For CG-7 and CG-8 groups:

$$\varphi^*_{emp} = (2,34 - 1,001)\sqrt{\frac{13*13}{13+13}} = 3,4$$

We shall compare the empirical values with the critical value of the criterion:

$$\varphi^*_{cr}(0,01) < \varphi^*_{emp}$$

$$2,31 < 4(ЭГ - 5 / ЭГ - 6)$$

$$3,4(ЭГ - 7 / ЭГ - 8)$$

As in previous cases, the obtained empirical values of the Fisher criterion are in the zone of significance. So, we repeatedly accept the alternative hypothesis, which indicates the presence of differences in the percentages of the two samples according to the results of pre- and post-experimental sections in EG-5, EG-6, CG-7 CG-8 groups and proves the effectiveness of certain pedagogical conditions for the professional training of future translators in experimental groups (EG-5 and EG-6) in the fourth year of study.

Having analysed the results of statistical research of the coefficients of maturity of professional competence among future translators in the experimental and control groups, we found that the highest level of maturity of professional competence is observed in two groups (EG-3 and EG-4) of future translators on the third year and (EG-5 and EG-6) on the fourth year of study, where the pedagogical conditions selected by us were applied in the maturation of professional competence. The average coefficient of maturity of professional competence in four experimental groups is 0.84. This fact proves that the developed pedagogical system is effective for the successful maturation of professional competence upon performing translation using the support system for lexical correction of text. The control groups, the maturation of professional competence of which took place under normal conditions on the third year in CG-1 and CG-2 groups and in CG-7 CG-8 groups on the fourth year had a lower indicator (0.79).

Next, we shall analyze the results of this slice according to the criteria for assessing the level of maturity of professional competence among future translators upon performing translation using the support system for lexical correction of text. An analysis of the given data displays that in all experimental groups the indicators of the criteria for the level of maturity of professional competence in future translators increased, and corresponds to a "satisfactory level".

Quantitative indicators in the experimental groups of the third year (EG-3 - EG-4) increased in comparison with the pre-experimental section. The total increase in all groups is 35%, in the third year the largest growth is according to the "no unmotivated pauses" criterion – 41%, the lowest is according to the "clarity of pronunciation" criterion. In the experimental groups of the fourth year (EG-5 - EG-6), the total increase in all groups is 23%.

Analysis of qualitative indicators of the level of maturity of professional competence among future translators upon performing translation using the support system for lexical correction of text according to the results of the post-experimental slice given in Table 5, displayed that the indicators improved in all groups that took part in the experimental testing of the effectiveness of pedagogical conditions in the third year of study.

Table 5: Results of pre- and post-experimental sections according to the criteria for assessing the level of maturity on the third year of study

	Indicators											
Groups	Bilingual competence		Translational subcompetence		Extralinguistic subcompetence		Personal subcompetence		Strategic supercompetence		Total points per student group	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After

CG-1	29	45	40	56	35	52	40	55	42	57	186	265
CG-2	35	47	39	53	33	49	41	52	43	57	191	258
EG-3	37	49	40	53	38	53	44	60	44	58	203	273
EG-4	39	48	42	56	40	54	43	54	43	56	207	268
Growth in all groups in %		35 %		35 %		41 %		31 %		34 %		35 %

Having examined some criteria of translational and bilingual subcompetence, we can see that the indicators according to the "degree of preservation of the main content" criterion, which is one of the leading criteria in determining the level of maturity of translational subcompetence, have improved. During the post-experimental section, the adequacy of the technical translation increased in most students, the change in the content of the text, if any, was insignificant, the type 1 errors were absent, while during the pre-experimental section, only a small number of students managed to avoid this type of error, leading to loss of content or misrepresentation of material information. It should also be noted that the tasks of the pre- and post-experimental slices differed in the direction of translation.

During the pre-experimental section, future translators performed the translation from English, while during the post-experimental section, the translation was performed from Russian. Some scientists find the second direction (from Russian to English) more difficult than the first one (from English to Russian). In our opinion, if future translators have a sufficient level of professional competence, then the direction of translation does not present significant difficulties.

Indicators according to the "correct language" and "fluidity and flexibility of speech" criteria are almost the same, 35% and 34% respectively. Increase in the fluidity indicates the level of maturity of deverbalization skills and abilities, since during the translation, upon pronouncing the first phrase of the text aloud, the translator is already perceiving the second, etc. And an increase in flexibility indicates the development of the translator's abilities to adjust the speed/pace of speech depending on the speed of perception of the text.

The indicators according to such a criterion as "absence of unmotivated pauses" are the highest in the experimental groups (EG-3 - EG-4), compared to other indicators, which most likely is due to the effectiveness of using such pedagogical conditions as the integrated use of communicative, cognitive and metacognitive strategies and the use of authentic information resources in the training process. Future translators made significantly fewer pauses upon performing translation during the post-experimental section, which indicates

an increase in the level of maturity of abilities and the development of segmentation skills due to the priority of communication tasks with a time limit in the translator preparation process.

Indicators by the "clarity of pronunciation" criterion are the lowest in comparison with other indicators. Students did not always clearly, accurately and expressively pronounce words and phrases, which affects the intelligibility of the speech and its comprehension by the recipient. Let us analyse some of the qualitative indicators of the level of maturity of professional competence of future translators upon performing translation using the support system for lexical correction of text in the fourth year of study. Concerning the translational and bilingual sub competences, the highest growth according to the "degree of preservation of the main content" criterion is 28%, this fact indicates that most fourth-year students were able to convey the meaning of the text to the fullest extent during the post-experimental section (Table 6).

Table 6: Results of pre- and post-experimental sections according to the criteria for assessing the level of maturity of translational competence on the fourth year of study

Criteria	Indicators											
	Bilingual competence		Translational subcompetence		Extralinguistic subcompetence		Personal subcompetence		Strategic supercompetence		Total points per student group	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
EG-5	38	52	46	53	44	58	46	56	47	59	221	278
EG-6	39	50	44	54	47	57	46	55	50	57	226	273
CG-7	39	47	41	50	41	51	42	53	43	54	206	255
CG-8	37	46	39	51	39	50	45	55	47	55	207	257
Growth in all groups in %		28 %		22 %		23 %		22 %		21 %		23 %

The indicators are the same according to the criteria of "correct language" and "clarity of pronunciation" – 22%, which is an important criterion for assessing the level of proficiency in bilingual competence upon performing translation using a support system for lexical correction of text. So, during the post-experimental section, it is observed that the speech of future translators became more intelligible, students were choosing adequate lexical units and constructed sentences correctly from the grammatical point of view.

In comparison with others, the lowest is the growth according to the "fluidity and flexibility of speech" criterion – 21%. Unfortunately, not all students in the experimental groups of the fourth year had high indicators, the speech pace of most students cannot be considered moderate, but a general analysis of the indicators by the mentioned criterion indicates that future translators are already trying to adjust the speed and pace of speech depending on the text perception speed. The introduction of a pedagogical system for the maturation of professional competence among future translators contributed to the dynamic changes in each of the criteria for assessing the mastery level of professional competence upon performing translation using the support system for lexical correction of text (Figure 1).

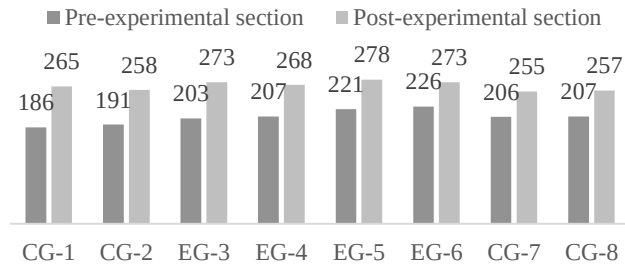

Figure 1: Dynamics of changes in the level of maturity of professional competence among future translators

The selection of precisely such pedagogical conditions, that constitute one of the basic components of the pedagogical system, was conditioned by the results of monitoring the process of professional training of future translators.

Conclusions

A quantitative and qualitative analysis of the results of an experimental testing of the pedagogical system of professional training of future translators upon performing translation using the support system for lexical correction of text proves the expediency of using the pedagogical system that we suggested, since the results of the post-experimental section of EG-3 and EG-4 student groups of the third year and EG-5 and EG-6 student groups of the fourth year are higher according to all criteria for assessing the mastery level of professional competence in two-way translation – this confirms our hypothesis on the effectiveness of not only the selected pedagogical conditions for the professional training of future translators for performance of translation using the support system for lexical correction of text, but also the effectiveness of the application of competence-based, transdisciplinary, linguistic-

communicative, cognitive-activity and information-communicative approaches in the process of professional training of future translators.

As a result of application of the developed pedagogical system, future translators have an increased sense of confidence in their own competence upon performing translation using the support system for lexical correction of the text. The degree of preservation of the main content of the text during the translation process increased, future translators were less nervous, and therefore made fewer unmotivated pauses, speech became clearer, and the resulting text became more fluid and flexible.