The paper highlights, analyses and interprets the results of the pedagogical experiment on applying the authors’ teaching methodology to form students’ terminological competence in bilateral interpreting in the Moodle-based e-learning course. It is stated that online instruction as a competitive option to regular forms of classroom learning is establishing an apparent connection between students’ outcomes of learning and the modern world at large enhancing their responsibility in acquiring and exploiting knowledge in practice. The authors argue that future translators and interpreters are more stimulated to learn technical terminology in the digital environment through subject-oriented terminology courses on the basis of e-technologies. In this study, the mixed research design was based on quantitative (experiment, measuring variables, finding frequencies, hypothesis testing) and qualitative methods (analysis of the data collected, monographic method – to interpret the results obtained in a coherent logical perspective). The experiment, conducted by the authors, engaged the fourth-year students of the National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute” (after this, officially abbreviated name – Igor Sikorsky KPI), majoring in translating and interpreting. To carry out the pedagogical experiment, the subsystem of exercises for forming terminological competence in bilateral interpreting in Moodle-based e-learning course was developed in collaboration between the educators from Kütahya Dumlupinar University (School of Foreign Languages) and Igor Sikorsky KPI (Department of Theory, Practice and Translation of the English Language). The proposed subsystem of exercises was supposed to: meet the ultimate goals of forming terminological competence; gradually contribute to acquiring knowledge and skills, which determined the three-stage training process; have a unified structure; have a built-in assessment system; provide students with self-test capability when performing the exercises. It is noted that the opportunity to do the designed course from any convenient device (smartphone, tablet, laptop, PC) makes it easily approachable, and helps students improve the skills of autonomous learning and self-monitoring.

**Keywords**: bilateral interpreting; mediation; e-learning; Moodle-based course; students majoring in translating and interpreting; terminological competence.

**Introduction**

The integration of the Ukrainian market economy with the markets of different countries in the world, on the one hand, and the merging of technologies and the blurring of boundaries between different areas of knowledge, on the other hand, contribute to the growing demand for professional translation and interpreting as a means of cross-cultural mediation. Therefore, specialists with specialised expertise in foreign languages and the ability to successfully communicate with specialists from other cultures are needed nowadays more than ever. And an interpreter is considered a front-line player in the context of the rapidly developing modern technologies, and such dynamics is providing the necessity of forming future interpreters’ terminological competence on the basis of mediation. As an educational activity, mediation is characterised by practical orientation, and allows naturally combining translation and linguistic aspects in foreign language learning in accordance with the methodological principle of the dialogue of cultures.

In addition, the paradigm of modern education is transforming in the wake of the new challenges of society. A sudden outbreak of Covid-19 has destabilised the entire educational system worldwide, forcing the educators to shift from the classroom to online mode during the pandemic period, which requires a symbiosis of e-technologies and distance learning in the educational process. Meanwhile, such a situation has provided students with more autonomy in the whole process of learning and monitoring their progress as well (Saienko & Chugai, 2020, p. 155). In view of this, teachers have had to develop and apply different self- and peer-assessment procedures involving various information technologies (e.g. open-source distance learning platform Moodle, Google Docs apps, etc.) (Korol, 2020). Today, numerous higher education institutions have had to adjust their traditional educational process to online mode. And training of future interpreters is no exception. The educators in Kütahya Dumlupinar University (Turkey) and Igor...
Sikorsky KPI have smoothly switched to the e-learning model of instructing will-be translators and interpreters.

Thus, quite recently, online education as a competitive option to regular forms of classroom learning has been brought into greater focus. The online mode of learning is establishing an apparent connection between students’ outcomes of learning and “the modern world of multimodal information” enhancing their responsibility in acquiring and exploiting knowledge in practice (Fedorenko, 2019, p. 14). It also makes students aware how the knowledge and skills acquired with the help of e-learning technologies influence their personality development as well as their career perspective in interpreting (Adams Becker et al., 2017; Gile, 1995).

In the revised Common European Framework of Reference for Languages (CEFR), developed by the Council of Europe, it is noted that the replacement of the concept “four skills” with four activities (reception, interaction, production, mediation) allows considering interpreting as a cross-linguistic facet of mediation (Council of Europe, 2018; North & Piccardo, 2016; Stathopoulou, 2015). The CEFR clarifies the notions of multilingualism and plurilingualism in the aspect of mediation. The former is the coexistence of different languages at the social or individual level, and the latter is defined as a student’s dynamic, continuously evolving language idiolect, which, in practice, is combined with general competencies to perform tasks (North & Piccardo, 2016; Stathopoulou, 2015). The researchers (North & Piccardo, 2016; Stathopoulou, 2015) have arrived at the conclusion that mediation definitely provides the formation of students’ polylingual competence, which presupposes the ability to switch from one language to another, to speak one language and understand a person who speaks another language, and to recognise common international words in a new context.

Thus, in the mediation process, an important place is occupied by the constant expansion of the polylingual repertoire of the future interpreters, which, in its turn, requires the development of their terminological competence as the ability to manage and operate specialised languages, their terminology databases, and terminology tools as well.

Given the fact that terminology plays an important part in the mediation between experts from various spheres all over the world, and recognising the essential role of learning different aspects of specialised languages in educating future translators and interpreters, Kütahya Dumlupınar University (Turkey) and Igor Sikorsky KPI (Ukraine) have added terminology related contents to their classes with the aim of developing students’ terminological competence. Meanwhile, a sense of terminological consciousness and proper terminology management accord with the process of forming students’ terminological competence through training in simultaneous interpreting (Antón, 2016; Bowker & Pearson, 2002; Cabrera, 2017; Costa et al., 2014a; 2014b; Xu, 2015). Furthermore, it is worth mentioning glossary building as a crucial method of forming students’ terminological competence, and promoting their interaction and teamwork: students are assigned to create short encyclopedic resources regarding interesting facts about breakthroughs in different spheres of science (e. g. robots evolution, etc.) (Lukianenko & Vadaska, 2020, p. 66).

Spanish scholars Montero Martínez and Faber (2009) state that the level of translators’ expertise is normally not the same as one of the original text creators and recipients, stressing on the importance of terminological competence development within the context of translation and interpreting studies. Nevertheless, as reported by these educationalists, terminology courses for undergraduate students majoring in translation and / or interpreting have received insufficient focus (Kurz, 2001; Montero Martínez & Faber, 2009). Recent studies (Alcina, 2011; Antón, 2016; Cabrera, 2017; Costa et al., 2017; Guryeyeva, 2017; Costa et al., 2014a; Costa et al. 2014b; Kolomeets & Guryeyeva, 2018; Sikora, 2014) in teaching different aspects of terminology have indicated that students are more stimulated to learn technical terminology in the digital environment. Sikora (2014) has also found that subject-oriented terminology courses on the basis of e-technologies can substantially improve the quality and efficiency of future translators’ / interpreters’ performance.

However, despite the apparent importance of turning to specialised languages in the process of teaching bilateral interpreting, this aspect of educating future translators and interpreters has not become the subject of special research yet. As well as the problem of developing students’ terminological competence in bilateral interpreting within an interdisciplinary context has not been a subject of particular scrutiny yet, which determines the relevance of our study.

The paper aims to highlight, analyse and interpret the results of the pedagogical experiment on applying the authors’ teaching methodology to form students’ terminological competence in bilateral interpreting in the Moodle-based e-learning course.
Methods

Research Design

In this study, the mixed research design was based on quantitative (experiment, measuring variables, finding frequencies, hypothesis testing) and qualitative methods (analysis of the data collected in a statistically valid manner, monographic method – to interpret the results obtained in a coherent logical perspective). The results of the experiment were calculated and processed using the methods of mathematical statistics and probability theory including normal distribution hypothesis verification applying Pearson’s chi-squared test.

To conduct the pedagogical experiment, the subsystem of exercises for forming terminological competence in bilateral interpreting in Moodle-based e-learning course was developed in the collaboration between the educators from Kütahya Dumlupinar University (School of Foreign Languages) and Igor Sikorsky KPI (Department of Theory, Practice and Translation of the English Language).

Participants

The experimental study covered 68 fourth-year undergraduate students (speciality “035 Philology”), doing the course “Bilateral Interpreting” (developed on the Moodle Platform at the Department of Theory, Practice and Translation of the English Language in Igor Sikorsky KPI). The students were placed into two experimental groups (EG), correspondingly: EG-1 – 34 students, EG-2 – 34 students. The students in EG-1 studied according to methodology A with a strictly allocated time in performing tasks, while the students in EG-2 – methodology B without inflexible time management. The participants gave their voluntary informed consent for their participation in the study.

Instruments and Procedure

Developing the subsystem of exercises for forming students’ terminological competence, we turned to the terminological field of power engineering, which consists of ecology, physics, chemistry, and electronics terms. Criteria for selecting interdisciplinary and industry-specific terms were as follows: a subject area, students’ familiarity with vocabulary items, frequency of lexical units’ usage, semantic values of terms, standardisation, and the ability of lexical units to collocate with other words. One thousand interdisciplinary terms and five hundred industry-specific ones were selected.

The subsystem of exercises in question covered three stages: 1) preparatory stage (setting psychophysiological mechanisms of memory, attention, as well as mechanisms of auditing); 2) training stage (practising in interpreting skills); 3) mastering stage (enhancing interpreting skills).

Consequently, the first stage included non-contextual preparatory exercises to develop the speed of reaction, listening skills, increased attention span, improved memory, and knowledge of interdisciplinary terms and industry-specific lexical units. The exercises at this stage (type 1 preparatory non-contextual exercises) presented a simulator for activating students’ psychophysiological mechanisms (memory, attention, and reaction) and developing listening skills. Students were limited in time while doing the exercises allowing stimulation of stressful situations, which are an integral part of interpreter’s professional activities. Before working with the simulator and after the end of type 1 exercises session, the students filled out the Test Anxiety Inventory for assessing their state anxiety (a person’s ability to withstand external conditions) and trait anxiety (a person’s inner perception of psychological situations). This allowed predicting students’ reaction to stressful situations and increase stress resistance.

Type 1 exercises included four subgroups of exercises on developing the speed of response, listening skills, short-term memory, and attention span. The reaction span measurement allowed studying speech behaviour in real-time, which was important because an interpreter must quickly respond and instantly analyse information. Therefore, there is a need for systematic exercises aimed at improving the speed of reaction. Another important aspect was the development of long-term and working memory, as systematic exercises aimed at developing short-term memory play an equally important role in all speech activity types. Exercise time is significantly limited, which imitates a stressful situation, improving general psychophysiological skills and future interpreters’ stress-adaptive system. All exercises were performed in a strict control mode and provided an opportunity to track students’ performance, developing self-learning, and critical analytical skills. The result of the tasks was estimated in percentage points. Unsuccessful attempts lead to a lower score. The Moodle platform functionality helped turn this group of exercises into a psychophysiological simulator. It allowed students to improve their performance through an unlimited number of attempts working at their own pace.

The second stage contained micro-context training exercises (type 2 exercises at a word and a phrase-level) to form a thesaurus of terminology functioning within a particular field of science, and develop code-
switching skills in interpreter-mediated interaction. The main aim was to automate the code-switching skills within a selected semantic system. The exercises involved triggering the psychophysiological mechanisms mentioned above (memory, attention, reaction) and developing listening skills. The tasks were aimed at developing the skills of code-switching within the interdisciplinary and industry-specific terms. Type 2 exercises contribute to forming lexical and grammatical skills of bilateral interpreting and code-switching skills as well. The exercises performed at the training stage helped prepare students for the interpreting exercises at a text level. The aim was to automatically make the students use lexical and grammatical structures, analyse vocabulary and identify professional terminology. The group of exercises for the formation of code-switching skills included two subgroups of exercises for the development of code-switching skills from Ukrainian to English and from English to Ukrainian within the selected semantic system. At this stage, the level of control was moderate; the students had the opportunity to track their results, and assessments made by the teacher.

The final mastering stage (skills automation) covered macro-context (text-level) interpreting exercises, and exercises to develop terminological competence in bilateral interpreting within the context of interdisciplinary and industry-specific terms. This stage included the exercises on interpreting by students an authentic audio recording of mini-dialogues between two technical specialists followed by recording their interpreting. In such a way, the students had to interpret the recorded conversation in real-time, which completely simulated a bilateral interpreting process. The authenticity of the material and the conditions of performing the exercises brought students as close as possible to the real situation of bilateral interpreting. The linguistic context played the role of the natural support in attributing the terminological polysemantic term to a particular field of science; it encompassed micro-context at the level of words and phrases, and macro-context – at the level of text.

Assessment as a continuous process of observation was a crucial tool for managing students’ cognitive activity. Since the Moodle Platform became a basis for the developed subsystem of exercises, it allowed the teacher to keep track of a student’s time spent on performing the task, the number of student’s attempts to choose correct options, and various options for solving the task as well.

The primary purpose of experimental training was to test the effectiveness of the developed methodology of forming students’ terminological competence in bilateral interpreting through online learning, and to determine the most effective alternative (A or B). This required the formulation of a hypothesis, according to which the increased efficiency of forming students’ terminological competence is possible under the following conditions:

1) online learning;
2) keeping consistency in the formation of elements of terminological competence, taking into account the peculiarities of teaching interlingual mediation;
3) performing the subsystem of exercises using an A alternative, which implies a strict time limit simulating a real-life interpreting situation.

Two experimental groups (EG-1 and EG-2) were formed for the empirical study. They studied correspondingly two alternatives (A and B) of the suggested methodology based on the developed subsystem of exercises for forming terminological competence in bilateral interpreting. The number and types of exercises performed by EG-1 and EG-2 students were the same. Still, the students of EG-1 were strictly limited in time, which allowed simulation of the psychological situation typical of the bilateral interpreting process.

Results

In the first stage, the optimal number of students $n$ participating in the experiment was calculated, provided that the maximum permissible error $\varepsilon$ does not exceed 3% (Nuzzo, 2014). To determine the optimal number of students, we conducted a preliminary training in a small group of students on the basis of the developed methodology. The achievement coefficient $k$ was calculated exploiting the formula of Bespalko (1968):

$$k = \frac{A}{n},$$

where $A$ was the number of points for one correctly completed task, $n$ was the maximum possible number of points for a given task.

To determine the achievement coefficient for all tasks $K$, a similar formula was applied:

$$K = \frac{Q}{N},$$

where $Q$ was the total number of points for all tasks, $N$ – the maximum number of points for all tasks.
Therefore, the optimal number of students was equal to
\[ n = \frac{t_{p}^{2} \sigma^{2}}{\varepsilon^{2}} = 68, \]
where \( t_{p} = 2.262 \) was Student’s coefficient value for this group with confidence level \( p = 0.95, \sigma = 0.164 \) was the standard deviation of the obtained results, and \( \varepsilon \) was an error. The experimental study covered 68 fourth-year students placed into two experimental groups (EG-1 and EG-20) with equal numbers of students in each group.

Before the start of the experimental training, a pre-test was conducted. As Monteiro (2014) mentioned, online testing research presented a great challenge and could contribute significantly to the educational context. The EG-1 group pre-test results showed that the average achievement coefficient was 0.52, and the EG-2 group pre-test average achievement coefficient – 0.51. The results suggested that the level of terminological competence in bilateral interpreting in both groups was approximately the same. It conditioned a natural experiment.

After completing the experimental study, a post-test was performed. The average achievement coefficient in EG-1 was 0.80, and for EG-2 – 0.72. EG-1 reached a higher achievement quotient by all the criteria. For the EG-1 group, the average increase was 0.27, and for the EG-2 group – 0.21. The statistical data provided above allow revealing positive dynamics in both groups.

The efficiency of the proposed methodology in the experimental groups EG-1 and EG-2 was tested using mathematical methods of data processing. Within the framework of this study, the hypothesis of a normal distribution was tested in the first stage. In the second stage, we tested the hypothesis about training effectiveness in a strict time constraint (Öz & Özturan, 2018). A number of students \( n > 30 \); therefore, the Pearson’s Chi-Squared Test was applied. The calculated criterion value \( X^2 = 5.7 \), critical point \( X^2(a, k) \) for a set significance point \( \alpha \) and degrees of freedom \( k \), \( X^2_p(0.05; 4) = 9.5 \).

Given that \( X^2 = 5.7 < X^2_p = 9.5 \), then the empirical and theoretical frequencies differed insignificantly.

We concluded that the empirical data were consistent with the general normal distribution hypothesis.

Testing the hypothesis about the normal distribution of the experiment results allowed us to correctly select criteria to test the effectiveness of the proposed methodology and avoid type I and type II errors. Preliminary calculations showed that the achievement level for EG-1 was more significant than for EG-2. Still, the difference significance were determined by comparing the universe means \( a_{1a} \) and \( a_{2a} \), the statistical estimates of which were the sample means of the achievement level – \( a_{1EG} \) and \( a_{2EG} \).

As a null hypothesis, it was assumed that the average value of the achievement coefficient in the group EG-1 was equal to the average value of the achievement coefficient in the group EG-2 with the competing hypothesis, that the average value of the achievement coefficient in the group EG-1 was significantly higher than in the group EG-2. At the second stage, we tested the null hypothesis \( H_0 : a_1 = a_2 \) and the competing hypothesis \( H_1 : a_1 > a_2 \). We considered the learning outcomes of students in each group as two independent samples (volumes \( n_1 = 34 \) and \( n_2 = 34 \) respectively) from the normally distributed general totality of EG-1 and EG-2.

Therefore, at the second stage, the null hypothesis was tested under the competing hypothesis. The calculated criterion value \( Z_{c} = 3.38 \), critical value for significance level \( \alpha = 0.05 \) is \( Z_{cp} = 1.65 \). Consequently, we rejected the null hypothesis. Since the null hypothesis had been rejected, the difference in learning outcomes was significant and could not be explained by random reasons.

As described above, two experimental groups took part in the experiment practising bilateral interpreting using interdisciplinary terminology. Both groups had similar tasks. However, following the developed alternatives (A and B), the first group had limited time to perform the tasks that allowed imitating stressful conditions of the real bilateral interpreting process. In contrast, the second group of students had more time to complete the test, creating a more favourable psychological situation.

The results of the experiment suggested that both groups increased their performance. The average level of achievement in the experimental group EG-1 was 0.80, and in the second group – 0.72, which reflected the improved performance of both groups. The results of the pre-test and post-test are summarised in Table 1.
Table 1. Pre-test and post-test results

<table>
<thead>
<tr>
<th></th>
<th>EG-1</th>
<th>EG-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mastering of learning techniques</td>
<td>0.51</td>
<td>0.51</td>
</tr>
<tr>
<td>acquisition of skills</td>
<td>0.46</td>
<td>0.49</td>
</tr>
<tr>
<td>automation of skills</td>
<td>0.61</td>
<td>0.52</td>
</tr>
<tr>
<td>average</td>
<td>0.52</td>
<td>0.51</td>
</tr>
<tr>
<td>Post-test results</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mastering of learning techniques</td>
<td>0.79</td>
<td>0.70</td>
</tr>
<tr>
<td>acquisition of skills</td>
<td>0.77</td>
<td>0.71</td>
</tr>
<tr>
<td>automation of skills</td>
<td>0.83</td>
<td>0.72</td>
</tr>
<tr>
<td>average</td>
<td>0.80</td>
<td>0.72</td>
</tr>
</tbody>
</table>

The obtained results are consistent with the hypothesis of the general normal distribution. Therefore, the proposed methodology can be effectively applied to larger groups of students.

Thus, the comparison of pre- and post-test results allowed concluding that the proposed methodology of forming terminological competence in bilateral interpreting was significant, and we could recommend it for students majoring in interpreting during online learning. Moreover, the implementation of the developed methodology in the educational process of the university under research confirmed its effectiveness in teaching undergraduates majoring in translating and interpreting.

Discussion

This study is a modest contribution to the ongoing discussions about the efficiency of different aspects of e-learning mode of instructing future translators and interpreters, especially in forming their terminological competence in bilateral interpreting, during the pandemic process. Our results are in good agreement with other studies (Adams Becker et al., 2017; Alcina, 2011; Antón, 2016; Lukianenko & Vadaska, 2020; Saienko & Chugai, 2020; Sikora, 2014) which have shown that terminology-content assignments on the basis of through computer-mediated instruction can substantially improve the quality and efficiency of the educational process.

The questions concerning successful triggering students’ psychophysiological mechanisms, and the requirements of the exercises on effective forming students’ terminological competence arose in this study. The mechanisms of memory and attention operation, and the speed of reaction, which are crucial for future interpreters, are not stable and needed to be developed. Mastering these mechanisms is quite a challenge that students cannot always overcome independently. This problem can be solved only through the system of particular exercises aimed at developing and enhancing the mentioned mechanisms.

Moreover, it should be stressed the important role of the developed subsystem of exercises in enhancing students’ proper terminology management as one of the key elements of terminological competence in the course of bilateral interpreting. The proposed subsystem of exercises was supposed to: meet the ultimate goals of forming terminological competence in bilateral interpreting; gradually contribute to acquiring knowledge and skills, which determined the three-stage training process; have a unified structure; have a built-in assessment system, since the objects under control were particular lexical material and relevant knowledge and skills, and the assessment stages had to coincide with certain phases of mastering the necessary material and stages of acquiring specific skills; provide students with self-testing capability when performing the exercises.

We consider it essential to outline the benefits of teaching with Moodle. The main advantage is that students autonomously, at their own pace, taking into account their psychological characteristics, can do all exercises, which allows achieving maximum flexibility in the course of study. Thus, students’ role in the educational process is increasing as they get autonomy and can control their progress. The functions of the simulator help reduce the difficulties in the learning process. The acquired skills are tested during the class by discussing the answers / options. It should also be noted that the opportunity to do the designed course from any convenient device (smartphone, tablet, laptop, PC) makes it easily approachable, and helps students improve the skills of autonomous learning and self-monitoring. But at the same time, it can exert pressure on English teachers who do not possess sufficient expertise in using e-technologies in distance learning.

Limitations

Although the focus of the study was to highlight, analyse and interpret the results of the pedagogical experiment on applying the authors’ teaching methodology to form students’ terminological competence in bilateral interpreting in the Moodle-based e-learning course, it does not provide a more comprehensive
picture of the process. Firstly, the study was limited by instructing the fourth-year students majoring in interpreting and translating. Hence, similar studies can be carried out in other subject domains as well as other age groups of students. Secondly, it would be advisable to develop a differentiated assessment rubric by levels of forming students’ terminological competence: low, medium and high level, which entails further study.

Conclusions

The comparison of the study results allows us to conclude that the proposed methodology for forming students’ terminological competence in bilateral interpreting in the Moodle-based e-learning course is effective, and presents the substantial increase in students’ proficiency in interpreting messages that contain interdisciplinary and industry-specific terminology. And distance education, in its turn, as a separate form of learning, both requires and promotes the development of students’ autonomy, which is central to student-centred educational process. Moreover, the opportunity to do the Moodle-based e-learning course from any convenient device (smartphone, tablet, laptop, PC) makes it easily approachable, and helps students improve their skills of autonomous learning and self-monitoring.

Furthermore, teachers of foreign languages in the sphere of instructing future translators and interpreters can be informed through our study about the methodology of effective forming students’ terminological competence in bilateral interpreting through computer-mediated instruction. Engaging students in simulation related to their future professional activity, e-technologies provide a gateway to the rapid influx of both, their specialised content knowledge and interpreting skills. Given the specifics of bilateral interpreting, when an interpreter neither has the proper amount of time nor conditions to check or choose an adequate equivalent of the term, the critical aspect is the development of terminological competence. This requires the development of psychophysiological mechanisms (memory, attention, and reaction), and knowledge of interdisciplinary and industry-specific terms.

The issue of methodology for developing future interpreters’ terminological competence in bilateral interpreting online is extremely complex and cannot be completely solved in this study stipulating further research. We envisage the scope of further research in applying the developed methodology in the process of forming terminological competence of future specialists of various branches of science.

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