PRACTICAL WORK WITH THE LANGUAGE OF MATHEMATICS IN THE MODULE IN ENGLISH FOR SPECIAL PURPOSES AT THE UNIVERSITY OF MINING AND GEOLOGY "ST. IVAN RILSKI"

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ABSTRACT. The article presents practical work on the issue of *The Language of Mathematics* on the curriculum for the module in English for Special Purposes (ESP) offered to students in different courses of studies at the University of Mining and Geology "St. Ivan Rilski": those trained in English in the second level within the "streamed" language groups and those "out of the stream" within the course of studies in *Computer Technology in Engineering*. The objective of the activities offered in class is for students to produce and lay out training translation of sentences with the variants of the measurement units from the imperial and metric (SI) systems, using the opportunities that are provided by the embedded tools within the higher versions of Word (Word 10 and above). The focus is on tasks on forward and back translation, term production, word processing, multiple variants. Work is targeted at translation stylistics and visualisation. The implementation of the tasks includes preparatory work in the Internet environment, independent work with a general English dictionary and a dictionary of terms, conversion of mathematical units of measurement. Errors, difficulties and achievements in the student work on the issue are analysed. The results of the activity are discussed.

Keywords: ESP, multiple variants, terms, language of mathematics, translation

ПРАКТИЧЕСКА РАБОТА С ЕЗИКА НА МАТЕМАТИКАТА В МОДУЛА ПО СПЕЦИАЛИЗИРАН АНГЛИЙСКИ ЕЗИК ЗА СТУДЕНТИ ОТ МГУ „СВ. ИВАН РИЛСКИ"

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РЕЗЮМЕ. Статията представя практическа работа по темата „Езикът на математиката", включена в учебната програма за модула по „Специализиран английски език" за студенти от различни специалности в МГУ „Св. Иван Рилски", обучавани във второ ниво поток и в специалност „Компютърни технологии в инженерната дейност" извън потока. Целта на предложените на занятията дейности е студентите да оформят учебни преводи на изречения с вариантите на мерните единици от имперската и от метричната (SI) система, използвайки възможностите, предоставени от вградения инструментариум във високите версии на Word (Word 10 и нагоре). Акцентът е върху задачи по прав и обратен превод, производство на термини, текстообработка, даване на варианти. Работи се за стилистика на превода и визуализация. Изпълнението на задачите включва подготвителна работа в среда Интернет, самостоятелна работа с речник по общ английски и терминологичен речник, конвертиране на математически единици. Анализират се грешки, затруднения и постижения при работата по темата. Обсъждат се резултатите от дейността по задачите.

Ключови думи: специализиран английски език, многовариантност, терминология, езикът на математиката, превод

Introduction

Our research work touches on two fields of foreign language training: the methods of ESP training and the theory and practice of term translation.

The study of technical terminology at the University of Mining and Geology "St. Ivan Rilski" is part of the overall tuition hours for foreign language teaching and is included in the curriculum for all courses of studies. Gaining skills in working with technical terminology is crucial because of the fact that the materials which re used by the students in the process of their university education followed by their occupational fulfilment contain a high percentage of terms, and terminology is a means of conveying scientific facts and knowledge in the engineering courses of studies. Using the right terms increases the accuracy of speech and eliminates ambiguity. Therefore, the quality of work with terminology guarantees the quality of communication among specialists in various fields of engineering. We have covered this topic from different perspectives in a number of our works, e.g. in Purvanova et al. (2011, 2014, 2017).

We have entered a period of physical social distancing and isolation which have brought about a prolonged spell of distance training of students. As lecturers, we have been faced with the need to plan different types of educational activities in foreign language teaching. The lack of auditory classes has transformed our outlook on the offered training materials and activities associated with them under the conditions of no direct, face-to-face contact with students.

Methods

In this article, we share our experience from practical activities in the module in ESP. We present practical work on the issue of "The Language of Mathematics" which is on the curriculum offered to students in various engineering courses of studies at the University of Mining and Geology "St. Ivan Rilski". We give examples of how to plan and apply

pedagogical and methodical criteria during preparation of training materials, as well as of how to give freedom or impose restraints when working with the training terminological materials.

Objective

The objective of the activities offered for class work is for students to produce properly laid-out training translation of sentences with the variants of the measurement units from the imperial and the metric (SI) systems. The focus is on tasks on forward and back translation, term production, word processing, multiple variants. Work is targeted at translation stylistics and visualisation.

Target group

The activities are directed to students trained in English in the second level within the "streamed" language groups and to those trained in the second, third and fourth year within the course of studies in *Computer Technology in Engineering*.

Tools

The opportunities provided by the embedded tools within the higher versions of Word (Word 10) are offered to use for the implementation of the educational tasks.

Algorithm of work

To fulfil the training activities, the following steps are followed that comprise:

- preparatory work within the Internet medium;
- independent work with a general English dictionary and a dictionary of terms;
- conversion of mathematical units of measurement.

During and after the performance of tasks, we have also considered including an analysis of errors, difficulties and achievements in student work on the issue.

Scope

Students from the three faculties at the University of Mining and Geology "St. Ivan Rilski" are included in the training activity. They are distributed as follows:

- 9 first-year students trained in English in the second level within the **"streamed"** language groups; their distribution in faculties is the following:
  - from the Faculty of Mining Electromechanics - 2 students
  - from the Faculty of Mining Technology – 5 students;
  - from the Faculty of Geology and Exploration – 2 students;
- and 43 students from the Faculty of Mining Electromechanics trained in English **"off-stream**" within the course of studies in *Computer Technology in Engineering*; their classification in courses follows:
  - second-year students – a total of 14 colleagues:
    - 8 from the low level subgroup
    - 6 from low level subgroup
  - third-year students – a total of 14 colleagues who are:
    - 8 from the low level subgroup
    - 6 from the high level subgroup
  - fourth-year students – 15 colleagues.

Activities

Preparation. The activities were offered to students taking the course of studies in *Computer Technology in Engineering* on the first class within a series of online classes intended to complete the work started in the second semester of the 2019-2020 academic year. The students trained in English in the second level within the "streamed" language groups did the training activities at the end of the series of distance learning classes.

Since we are in an unconventional health situation which influences all educational aspects, we have transformed the educational process in good time. We prepared the classes offered by putting an accent on the ***activity "Work in the Internet medium"*** and practicing two of the skills in foreign language teaching: reading and writing. The basic **source for reading** has been an article published in the Annual of the University of Mining and Geology for 2016. We have also offered steps for locating the article and the way to the source is indicated to every student who has taken part in the activities, namely:

Website of the UMG → Research activity → Сборник с научни доклади → Annual of the University of Mining and Geology →Part IV: Humanitarian Sciences and Economics → article "A Computer Approach to the Issue of Multiple Variants in Foreign Language Teaching" written by a team of authors well-known to students within the course of studies in *Computer Technology in Engineering* (Purvanova et al., 2016)

The students have been encouraged to read in detail the mentioned article whereby the advantages and disadvantages of each of the computer decisions is traced and illustrated. It has been explicitly stated that the text attached is for reading and comprehension, in the same manner as a lecture material or a manual is read. Within the context of considerable computer load in the virtual classroom, when a lecture and a seminar material are sometimes delivered to students by different lecturers remotely and frequently at the same time, students' motivation to read all materials offered is of particular importance. Therefore, during classes, we aim at giving the trainees confidence that the conscientious reading and consideration of the material offered, along with the implementation of tasks, is not going to take longer than a regular class will take, and that students' work on the course unit in *English language* will not be at the expense of the duration of work on other course units. From this point of view, we have guaranteed the tasks implementation. However, we presume that occasionally some students may be overburdened with on-line tasks and, therefore, busier with work on other subjects; that's why we have also attached just the excerpt of the quoted article in our material assigned (ibid., 135, col.1, lines 33-136, col.1, line 48).

The stage of initial explanations. Students have been offered explanations about the objectives of the task. The focus hereby is that we outline the students' practical skills, too, that are based on their knowledge acquired in the module in computer literacy. The task is connected with ***giving lexical and syntactic variants*** in the training translation from and into a foreign language.

Layout is a problem with multiple variants in written exercises, homework assignments, etc. A number of computer solutions to this problem are offered that are in conformity with the team of authors' current knowledge and command of word

processing. Our activities are based on the word processing resources of the Microsoft® Word 10 programme. The examples given are from texts for translation from and into English that are employed within the module in English for Special Purposes at the University of Mining and Geology "St. Ivan Rilski". We have used the possibilities for inserting mathematical parameters, particularly equations. The algorithm of work is as follows:

Insert is chosen from the list of tasks → Equation → two parameters are set from the drop-down menu:

а) → the type of brackets (Brackets)

б) → the type of matrix.

The examples offered are generally applicable to the remaining courses of study students at the University of Mining and Geology, regardless of the foreign languages taught or the training levels of language. The example sentences for seminars / exercises / homework assignments / control are connected with the **issue of "The Language of Mathematics"** which is obligatory on the curriculum for the module in English for Special Purposes (ESP) offered to students in all engineering courses of studies who do foreign languages at the University of Mining and Geology "St. Ivan Rilski".

The assignment. Using the Google classroom platform, the following task is assigned to students for homework together with a table of explanations:

Exercise №1 (forward translation, from English into Bulgarian):

Translate the following sentences into Bulgarian for the needs of the Bulgarian audience∗:		
№	**English**	**Bulgarian**
1.	The outside diameter of the pipe is 6 inches.	
2.	The length of the pipeline is 100 yards.	
3.	The distance between Sofia and Athens overland is 490 miles.	
4.	The size of room 135A is as follows: L 20 ft , W 15 ft, H 12 ft.	
5.	The wall thickness in room 301Ais half a foot.	

Exercise №2 (back translation, from Bulgarian into English):

Translate the following sentences into English for the needs of the British/American audience∗:		
№	**Bulgarian**	**English**
1.	Хеликоптерната площадка е с размери 20x25 м.	
2.	Той е 1,70 м. висок.	
3.	Дебелината на стената на тръбата е малко над 1 см., а вътрешният диаметър е 12,5 см.	
4.	Морското дъно е на 500 м. дълбочина.	
5.	Платформата е с площ 450 м^2.	

∗i.e. give variants in the imperial and in the metric systems; for the sake of facility, convert with approximation using the following conversion guidelines:

1inch	=	2.54 cm	≈ 2.5 cm
1 foot	=	30.48 cm	≈ 31 cm ≈1/3 m, i.e. 1m is approximately equal to 3 ft
1 yard	=	3 feet = 0.9144 m	≈ 1 m
1 mile	=	1.609 km	≈ 1.5 km

An example of translation with variants:

Участъкът е 10 м. дълъг = The section is 10 m long.

= The section is about 30 feet long.

To perform the task, it is of paramount importance to offer students methodical assistance in the form of:

- *a table with units of measurement* or links to this type of table (we list here only a fragment of the links available:

https://www.google.com/search?q=convert+imperial+measurements+into+metric&rlz=1C1AOHY_enBG709BG711&oq=convert+imperial+into+metric&aqs=chrome.2.69i57j0l5.17992j0j7&sourceid=chrome&ie=UTF-8

https://www.metric-conversions.org/measurement-conversions.htm

https://www.calculator.net/conversion-calculator.html

https://www.mathsisfun.com/metric-imperial-conversion-charts.html)

- *examples* of converting measurement units from the imperial and from the metric (SI) systems;

- *the communicative value* of the task – such measurement units should be added in the written communication with English-speaking colleagues / contacts / subordinates or employees that are used by the audience reading the translated sentences and that make the mathematical discourse more comprehensible; the acquiring, practicing, and future automation of the skill for quick conversion with approximation would make the oral discourse quick/effective.;

- *the objective* of the activity – that it is not an end in itself, nor is it in arithmetic with the help of Google translator; but that it is for converting feet into the approximate centimeters, inches into the approximate centimeters, yards into approximate meters, miles into the approximate kilometers. Or vice versa: from meters into the approximate feet/or in case students are better-versed in the imperial system into feet and inches, from centimeters into the approximate inches, and so on;

- *the expected results* – thinking about how to make use of the possibilities offered by the higher versions of Word 10 and the embedded tools, the sentences in the target language should be produced with variants using matrices wherewith the measurement units of the imperial and the metric (SI) systems will be visualised.

Only then can students proceed to the implementation of the tasks stage by stage.

The stage of the initial (tabular) implementation of the assignment. Just as we had expected, most of the students did the exercises following the general pattern of "read and directly translate in the table enclosed". This was most often achieved with the help of Google translator which, very mischievously, mind you, offers such brilliantly puckish variants as:

5.	The wall thickness in room 301Ais half a foot.	Дебелината на стената в стая 301А е половин **крак**.

or as the following variant which diligently employs keyboard tools for listing variants (we have in mind the forward slash) that are absolutely inappropriate for our terminological purposes:

1.	The outside diameter of the pipe is 6 inches	Външният диаметър на **лулата/тръбата** е 6 инча.

Thus, students have totally ignored the subtasks for converting and giving variants in matrices. Some have even "conscientiously" provided translation variants with four digits (!) after the decimal point. Of course, the discussion that ensued has allowed them to reconsider the notion of approximation and work with the other measuring system.

At this stage, the correct implementation of the task for translation and conversion with approximation only in a tabular form would look like this (the variants are separated with forward slashes and are given in bold in order to make them more visible):

Exercise №1 (forward translation, from English into Bulgarian):

Translate the following sentences into Bulgarian for the needs of the Bulgarian audience*:		
№	**English**	**Bulgarian**
1.	The outside diameter of the pipe is 6 inches.	Външният диаметър на тръбата е **6 инча/около 20 см.**
2.	The length of the pipeline is 100 yards.	Дължината на тръбопровода е **100 ярда/около 100 м. /малко под 100 м./ 91,50 м.**
3.	The distance between Sofia and Athens overland is 490 miles.	Разстоянието между София и Атина по суша е **490 мили/около 740 км./790 км.**
4.	The size of room 135A is as follows: L 20 ft , W 15 ft, H 12 ft.	Размерите на зала 135А са както следва: дължина **20 фута/около 7 м.**, ширина **15 фута/5 м.** и височина **12 фута/4 м.**
5.	The wall thickness in room 301Ais half a foot.	Дебелината на стенитеа в зала 301А е **половин фут/15 см.**

Exercise №2 (back translation, from Bulgarian into English):

Translate the following sentences into English for the needs of the British/American audience*:		
№	**Bulgarian**	**English**
1.	Хеликоптерната площадка е с размери 20х25 м.	The heliport is **20 by 25 m/ about 7 ft by 8 ft**.
2.	Той е 1,70 м. висок.	He is **1.70 m/5 foot 7 inches/ 5 ft 7 in** tall.
3.	Дебелината на стената на тръбата е малко над 1 см., а вътрешният диаметър е 12,5 см.	The wall thickness of the pipe is **slightly over 1 cm/ half an inch** and its/the bore is **12.5 cm/5 inches**
4.	Морското дъно е на 500 м. дълбочина.	The sea bed is at a depth of **500 m/1500 ft/ a third of a mile**. or: The sea bed is **500 m/1500 ft** deep.
5.	Платформата е с площ 450 м^2.	The area of the platform is **450 square metres/about 400 square feet/4050 sq ft**. or: The platform has an area of **450 square metres/about 400 square feet/4050 sq ft.**

Here it is obligatory to pay attention to the following peculiarity when giving variants with brackets/slashes as in the translations presented in the table above: sometimes it is confusing because the variants of a word and of a separate phrase may be located in different parts of the sentence. This can be avoided by giving the variants with matrix from the Equation tools. By inserting a matrix with variants, the work is diligent and it is clearly seen where the variants of whichever word/phrase are in the sentence.

The stage of the subsequent (matrix) implementation of the task. In translation work, giving variants of words or phrases on the whiteboard is a frequent activity in class. The lecturer usually writes them down between two vertical lines. Variants of translated words/phrases given between vertical lines are also suggested by the lecturer when they hand out from translations of texts from homework or from five-minute flash tests. It is precisely the graphical presentation of such vertical lines that is the ultimate goal of our task. Similar activities are performed with a computer as those when writing mathematical equations with a computer, i.e. the appropriate keys are pressed and the relevant symbol from the menu is chosen. The menu is for mathematical equations in the package of Word 10 and above (**Word 10 → task bar → Tools → Equation tools**). In our case, the chosen symbol is the matrix. In the matrix, instead of inserting figures, we insert both figures and words/phrases which are synonymous in the translated sentence. The program itself arranges them one below the other. That's why we have included this class exercise as a word processing activity: this is not a mere translation, but a better shaped visual presentation of the output translation product with a slight tinkering with the equation menu.

In order to fulfil the task correctly, the students who have not read the preparatory material yet (at least the excerpt from the article cited above, if not the whole article), have to do that at last. Following the steps listed in the algorithm leads to attempts for giving variants after the method required.

The first students' attempts invariably contain lots of mistakes of the following type (the examples are from Exercise № 2 on back translation):

- *lexical* - as in

2. He is $\left|\begin{matrix}1.70m.\\ \left\|\begin{matrix}about\\ near\end{matrix}\right\| 5.60\ ft.\end{matrix}\right|$ tall.

where the adjective "near" has been used instead of the adverb "nearly";

- *grammar* – as in

4. The seabed's depth is $\left|\begin{matrix}500m.\\ about\ 1640\ ft.\end{matrix}\right|$.

where possessive case for animate nouns has been used instead of the "of-phrase" for possession of objects, as in "the depth of the seabed";

- *conceptual* – as in

5. The platform area is $\left\|\begin{matrix}450\ \mathbf{m2}.\\ about\ \mathbf{4844}\ ft2.\end{matrix}\right\| long.$

where the term "long" has been used and the student hasn't taken into consideration that area is not long but is measured in square meters, square feet, etc.;

- *syntactic* – as in

3. The thickness of the pipe wall is just over $\left|\begin{matrix}\left\|\begin{matrix}1cm.\\ 0.03\ foot\end{matrix}\right\|\\ and\ the\ inside\ diameter\ is\\ \left\|\begin{matrix}12.5cm.\\ about\ 0.41\ ft.\end{matrix}\right\|\end{matrix}\right|$

where the student has graphically presented the variants as one matrix with two sub-matrices. Yet, the correct syntactic order should have been in the form of two matrices with variants of the following type: the main sentence is *"The wall thickness of the pipe is just over*.... **(the first set of variants must be inserted here)** *and the bore, or inside diameter is*.....**(the second set of variants is inserted here)**".

The stage of the task implementation analysis. When analysing the work at this stage, it is obligatory to give instructions regarding the correct syntactic order of the sentences with the variants. Only those words / phrases / parts of sentences are placed within the matrix that are synonymous, and the sentence goes along the main line. Here is an example of such an explanation:

Външният диаметър на тръбата е .....
and after this part of the sentence, the matrix from the Equations toolbox is placed and the variants are inserted below each other, like this:

```
|6 инча          |
|15 см.          |
| ||около     ||  |
| ||приблизително||15 см. |
```

The example above is of a sentence from the homework assignment on translation from Bulgarian into English. The variants of the matrix and the sub-matrix are coloured to make the explanation clearer. The matrix comprises four variants. It is given with a pair of single vertical lines. Two of the variants are in a sub-matrix because they are parts of a similar construction and have a common part; this sub-matrix is placed within the basic one and is represented by a pair of double vertical lines.

Another mandatory explanation to give to students when working with the sets of variants is that they cannot be used in Google classroom, since they are not visualised there; instead, they can be implemented in a Word file. Therefore, the elements in the example above are not displayed in the homework submitted in Google classroom, but are clearly visible in the files sent by ordinary e-mail.

In order to assimilate the comments and consolidate the corrections made, the students can be given additional tasks, in the form of instructions, on the insertion of variants (the examples below are extracted from comments on the implementation of Exercise № 1 in submitted homework assignment on forward translation, from English into Bulgarian):

In sentence № 2

Дължината на тръбопровода е

```
|  100 ярда      |
|   91,5 м.      |
|  около         |
||приблизително|| 91 см. |
```

below "91 cm", you can even add the variant "1m." to the matrix (as part of the "приблизително 1м./approximately 1 meter" variant), because the word "около/приблизително/approximately" saves from accurate calculations or from annoying calculations with 2 characters after the decimal point; in this case, another sub-matrix within double lines is introduced immediately after the one with "около/about; приблизително/approximately";

In sentence № 3

Разстоянието между София и Атина по суша е

```
|    490 мили      |
|  788,4 км.       |
|  около           |
||приблизително|| 788 км. |
```

below "788 км", you can add "790 км" - again due to the life-saving "приблизително/approximately" and again inserted by means of an extra sub-matrix for the numbers.

The stage of the final implementation of the task. We offer the visualisation of the correct implementation of the exercises in order to present multiple variants in a digital form:

Exercise №1 (forward translation, from English into Bulgarian):

Translate the following sentences into Bulgarian for the needs of the Bulgarian audience*:

№	English	Bulgarian
1.	The outside diameter of the pipe is 6 inches.	Външният диаметър на тръбата е `‖около |6 инча‖` `|20 см‖`.

2.	The length of the pipeline is 100 yards.	Дължината на тръбопровода е
		`‖около |100 ярда‖`
		`|100 м‖`
		`‖малко под |100 м‖`
		`91,50 м |100 ярда‖`.

3.	The distance between Sofia and Athens overland is 490 miles.	Разстоянието между София и Атина по суша е
		`‖около |490 мили‖`
		`|790 км‖`
		`|740 км‖`
		`490 мили`
		`740 км.`
		`790 км.`.

4.	The size of room 135A is as follows: L 20 ft , W 15 ft, H 12 ft.	Размерите на зала 135А са както следва: дължина `‖около |20 фута‖` `|7 м‖`, ширина `‖15 фута‖` `5 м‖` и височина `‖12 фута‖` `4 м.‖`.
5.	The wall thickness in room 301A is half a foot.	Дебелината на стенитеа в зала 301А е `‖половин фут‖` `15 см.‖`.

Exercise №2 (back translation, from Bulgarian into English):

Translate the following sentences into English for the needs of the British/American audience*:

№	Bulgarian	English
1	Хеликоптерната площадка е с размери 20х25 м.	The heliport is `‖about |7ft by 8ft‖` `|20 by 25 m‖`.

2	Той е 1,70 м. висок.	He is 1.70 m / 5 foot 7 inches / 5 ft 7 in tall.
3	Дебелината на стената на тръбата е малко над 1 см., а вътрешният диаметър е 12,5 см.	The wall thickness of the pipe is slightly over 1 cm / half an inch and its / the bore is 12.5 cm / 5 inches.
4	Морското дъно е на 500 м. дълбочина.	The sea bed is at a depth of 500 m / 1500 ft / a third of a mile. Or: The sea bed is 500 m / 1500 ft deep.
5	Платформата е с площ 450 м^2.	The area of the platform is 450 square metres / about 400 square feet / 4050 sq ft. Or: The platform has an area of 450 square metres / about 400 square feet / 4050 sq ft.

Results accomplished

Following the implementation of the activities on the tasks assigned, we have established the achievement of the following results:

- Implementation of assignments on forward and back translation, requiring independent work with a general English dictionary and a dictionary of terms;
- Expanding students' knowledge and skills related to the production of terms and to the translation stylistics;
- Introducing students to the two systems of measuring units (the imperial and the metric/SI systems);
- Providing opportunities for concurrent work with both systems;
- Introducing students to the opportunities for applying the systems of the units of measurement in their communication with English-speaking colleagues;
- Acquisition of skills on the part of students to convert units of measurement from one system into the other;
- Improving these skills in order to quickly convert with approximation and skillfully handle both systems simultaneously;
- Creating conditions for a fast and efficient oral discourse;
- Introducing students to the features and functional capacities of the word processing program Microsoft® Word 10;
- Improved skills when working with the tools embedded in the Word 10 application;
- Applying the program for the purposes of the visualisation of a text with variants;
- Improving students' computer skills;
- Optimising the process of foreign language teaching at the University of Mining and Geology "St. Ivan Rilski".

Conclusion

In this article, the authors' team share the experience that they have gained during the practical educational in the module in English for special purposes (ESP) in the period of distance learning. The objectives of the activities offered in the class work have been fulfilled. The focus in the implementation of tasks was on the work with forward and back translation, on the production of terms, on word processing with the functional opportunities of the word processing program Microsoft® Word 10, and on giving variants of the units of measurement from the imperial and the metric (SI) systems. Students' knowledge has been broadened and their skills in working with terms have increased.

The authors' team expresses their hope that, from the educational point of view, the students have been satisfied with our mutual work in view of its contribution to their future occupational development and the increase in their competitiveness.

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