

# Ecological education of students of oil and chemical technology majors

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**Abstract.** Tatarstan is one of the leaders of oil industry in Russia as well as chemical industry but has certain ecological problems such as pollution of the air, earth and water, destroying natural reservations and garbage throwing. The system of forming ecological style of mind of students of the region includes special subjects as well as a list of humanitarian subjects such as “English for special purpose” and “Literature”. The purpose of the paper is to present a system of forming ecological way of thinking of students of oil and chemical technology majors through lessons of English, paying special attention to formation of productive skills. The methodology of the study is based on a set of methods: the research method, the comparative typological method, and the heuristic method. The elements of ecological education are included in any stage of training English skills and the local ecological problems are reflected. The tasks in question are presented in the form of texts of ecological theme with open tasks and partially open tasks following. The climax is the defending of diploma work in English which includes ecological issues.

## 1 Introduction

The ecological situation nowadays is a question of great concern all over the world [1, 2]. That is why the importance of ecological education stands forward nowadays in many regions of the Russian Federation. Tatarstan is one of the leaders of oil extraction and processing industry as well as chemical industry in the country that leads to economic benefits as well as a real harm to the ecology of the region. As the leading industries in Tatarstan deal with oil and chemical products, these majors are the most popular in educational institutions of the republic (more than 300 graduates every year only in Kazan Federal University). It is obvious now that it is necessary for this group of students to be ecologically-minded, as the technologies used now are far from being green, and oil and chemical factories are the greatest pollutants.

The ecological situation in the republic is obviously worsening, so if contemporary students don't have a high level of ecological awareness, the situation will become irreversable soon. The following main problems in Tatarstam are caused by oil factories and other chemical factories:

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- Pollution of the air. The citizens of Kazan (capital of Tatarstan) always complain that they feel strange smell in the districts where chemical factories work, and according to local scientists the factories throw into the air harmful substances regularly.
- Pollution of the water and shallowing of the rivers. The main rivers of Tatarstan, the Volga and the Kazanka, which are the routes of navigation and the supply of water for the region, last year became so shallow that it became a question of great concern on the governmental level. As for the pollution, the water of the rivers has become dangerous not only to use but to swim as well.
- Building of houses in protected areas (reservations), destroying the natural habitat of birds, animals and etc.
- Garbage throwing. The main landfills in Tatarstan are full and building of litter-burning plant is discussed, but it is disputable whether it can make the ecology better. But still not only governmental organizations but common people throw garbage in the wrong places and it is the aim of ecological education not only to make students think on governmental level, but to know how to behave ecologically-friendly in everyday life.
- Producing safe energy. Building of nuclear station in Tatarstan that can bring a lot of economical profits has been discussed for 20 years but the idea is not welcome by common people as the disasters in Fukushima or Chernobyl are still remembered well.
- The karst holes in Tatarstan. They are formed because of the extraction of oil and in future my lead to problems in building industry.

The system of forming ecological style of mind includes not only special subjects devoted to green energy and ecological ways of oil processing but a list of humanitarian (optional) subjects. The first subject included in curriculum in 2021 was “Ecological aspects in works of Literature” and had positive feedback from students [3]. So, in 2022, ecological aspects were introduced into study of English, which is a compulsory subject in institutions of higher education today. Here, the purpose of training students during the lessons of English is not only to study, train, and consolidate lexical skills, that is teaching professional vocabulary, but to look at the industrial progress in their major from ecological angle with the help of using texts of ecological topics for reading and listening and developing productive tasks (taking part in the debates, introduce ecological aspects into the final project). Productive skills are really important here because it is for our students to explain the modern industrialists the importance of ecological situation as those who are into the industry now do not put the ecological situation on the first place and, as a result, the consequences are disastrous.

## 2 Purpose

The purpose of the paper is to present a system of forming ecological style of thinking of students who are studying at oil and chemical technology majors with the help of the lessons of English. As a result, the students must use their productive skills in English to voice the ecological problems and find the ways of their solution. As the research material, the partially online course "English for Special Purpose" was used, developed for Masters of the majors "Oil extraction and processing technology" and “Chemical technology”. These majors are the most popular in Kazan Federal University and are the most important for the industry of our region. In 2022, more than 200 students studied the course.

The tasks in question are presented in the form of texts of ecological topics with open tasks and partially open tasks following. In our opinion, productive skills are more valuable in the aspect of mastering a foreign language as well as ecological awareness, and also more complex as it is necessary for the students not only to understand the ecological problems of the region but to think about the ways of coping with them and present their ideas in English.

The climax (final assessment) of the course is the presentation of their ideas in English when defending their diploma work. Therefore, for its qualitative mastering, it is proposed to use cloze tests as a step of training productive skills. The working out of the system of exercises is based on B. S. Bloom's taxonomy (levels of recognition, understanding and production). The tasks presented for the development of productive skills have the following characteristics: integrative character, interdisciplinary character, training of logic and contextual guessing as well as vocabulary, training goes from simple to complex, additional training of grammar and spelling is processed.

### **3 Approach and methods**

A foreign language for graduate student of oil or chemical technology major may be used when talking to their colleagues, to read vital information in the Internet, to understand the instructions for the machines, the write business letters [4]. Thus, "English for Special Purpose" is a popular subject and has a possibility to include ecological topics into the curriculum, which is operated partially in online form. The problem is that master students mostly work full time and have no time to study off line, that's why a part of exercises is presented online, which let students develop their soft skills such as independent studies and critical thinking/ Traditionally, the Humanities ("English for Special Purpose" included) are studies for one term that is not enough to master skills in speaking, writing and fluent communication with colleagues using a foreign language. Thus, certain exercises are presented in distant form not to spend a lot of time during offline classes. In addition, thanks to international programmes of academic mobility of students, nowadays, a lot of foreign citizens have become a part of Russian student society which set additional challenges for teachers as the knowledge that they have acquired in their own country don't correspond to the curriculum of the educational institution of Russian Federation. These students need additional help and supplement training. The online part of the course let the teacher differentiate the study of the student, help them to master the aspects that they have insufficient level in. The student has a certain learning path, sometimes individual, that can, as a result lead to him passing a final exam with brilliant results at the same level as the students who has come to study with advanced knowledge of English. One of the goals of creating the courses "English for Special Purpose" is the possibility of using the course both as an autonomous learning system (for example during COVID-19) and as an online support, choosing the right modules which makes the study flexible.

The methods that are used in the study are the following: a research method, the comparative method, heuristic method. Besides, a group of methods traditionally used in linguistics are used: context-analysis method, method of selecting key information from the text, component analyses of terms, and etymological method that allows to look at the material from diachronic point of view.

The following methodological principles of forming ecological state of mind during the lessons of "English for special purpose" are used:

- The elements of ecological education are included in every stage of training English skills during the course.
- The most important thing is to train productive skills, because the student must express their ecological views and share them with other students successfully [6]. Productive skills of language learners have been underestimated in the process of language study in Russian system of education as the main attention has been paid to listening and reading tasks. It leads to the fact that after reading certain texts on the subject students aren't able to write an article or express their ideas on professional issues. [5]. Combination of receptive and productive skills can lead to advanced knowledge of the language. Productive skills are necessary not

only to communicate with the colleagues but to pass the exam which may consist of creating a group project that is supposed to be defended in front of the educational board.

- The information of local ecological problems is presented as they are close to students and the students will mostly work at Tatarstan oil-processing factories.
- The texts with information about the best ways of solution of ecological problems are presented and the examples of countries, such as Switzerland, that are the leaders of taking into account ecological issues, are given.

## 4 Results

The course “English for special purpose” consists of 6 modules, each module ends up with an open-type task, which demonstrates productive skills of a student. Each module is devoted to a certain type of leading industry in Tatarstan that are the reasons of most ecological problems: oil extraction, oil processing, polymer production, chemical production, textile industry, building of energy stations. In each module, there is not less than one task devoted to ecological problem that is caused by a certain industry of Tatarstan. The development of skills goes gradually, that is why the tasks in the first modules are easier. The formation of ecological mind should go in pace with development of productive skills and end with creative final task that can represent the knowledge of the major, the English language and ecological awareness of the students. Ecological education goes through three stages, or three group of tasks, aimed at developing productive skills as a result.

- Open task of the 1<sup>st</sup> type when a student must fill in the text using ready-made words. The task is thought to be of the basic level as the only task of the student is to watch a video and recognize the words that are supposed to be put into the text. The words to drag into are presented below the text, besides, they have to be studied in the module before (in “Vocabulary” part). The task is used for students to correlate the sounding of the word, its use in every-day speech and the way it is written. As an example, the task from module one “Ecological Consciousness” is presented.

*When it comes to the concept of “\_\_\_\_\_ consciousness”, Zaitseva argues that the main purpose of the texts of this discourse is to form this type of consciousness in the audience. According to L.S. Sukhorukov, ecological consciousness is a public consciousness that includes various ideas, opinions and \_\_\_\_\_ reflecting the “ecological side of \_\_\_\_\_”. It also includes rules and regulations governing behavior in order to achieve the optimal state of the “\_\_\_\_\_” system. Consequently, ecological consciousness, according to Zaitseva, not only encompasses human perception of the environment, but also includes the principles of interaction with it to achieve the “optimal state” of the society-nature system*

Words to insert: *concepts, society-nature, ecological, social existence.*

- Open task of the 1<sup>st</sup> type when a student must write the information by himself, having structured it before. This type of assessment demands not only understanding of the vocabulary but mastering of so-called “metastubject” skills that include logical thinking, finding connections, critical thinking and expanded world-vision. The words here are of ecological issues. They have been trained as well in the previous tasks, but some of them are not presented in “Vocabulary” part for the students to do their own search in the internet as when searching they can get additional information of the subject. They try to match the sounding of the word and the spelling by themselves that provoke additional critical thinking and revision of the knowledge that has been acquired in the previous modules. For example, a student should listen to the track “Anthropocentrism versus ecological way of thinking” and fill in the summary printing the right word. Here it is not necessary to cut off the words of the same part of speech, because the student can actualize the knowledge of grammar to help him.

*Criticism of \_\_\_\_\_ is very common in the ecological issues. This is due to the fact that this thinking lies in the fact that it is man who is the central figure of the whole world and all \_\_\_\_\_, that he has the right to use nature and its \_\_\_\_\_ as a \_\_\_\_\_ to meet his needs and achieve his goals. The authors of environmental texts believe that all living beings have equal rights, that nature is not just a resource and it's time for people to stop \_\_\_\_\_ it as a tool for enrichment. The nature is not only our mother, who loves and cares, but it can punish us in return.*

- Stage 3. An open task. The student has to do an open task based on the vocabulary he studied and use the knowledge of the major. Open task (writing, translation and speaking) is an example of using productive skills. Open tasks can include different types of activities. The most preferable one is a group work, that can unite students with different levels and from different cultures. International experience can improve our understanding of ecological aspects and show the ways of solving the problems. It is not necessary to show a sample response for students as it may prevent them from boosting their creativity. The main demand for the task is to use the topics of the professional interests of the students. The teacher must make the students look at issues of gas and oil industry from ecological angle, to show the consequences of the wrong and proliferent use of the resources of the country. In 2023, the following tasks were set for students:

- to describe a work in the recycling factory;
- to make up a business plan of developing ecologically-friendly industry;
- a role play: international specialists help to modernize the plant;
- a case-study: the workers of the plant have found the oil spill from the processing unit, the students have to find a way out;
- to write down an article for a journal on one of the ecological problems in Tatarstan;
- to present a research paper about ways of compensation of ecological damage in our region;
- to write a business letter about ecological problem in your region, etc.

In Table 1 the system of coordination of the topics, main ecological problems of the industry and the task to train is presented. The industries are rationed from the least important to the main important, the tasks as well.

**Table 1.** The structure of the course “English for special purpose” with ecological issues represented in each module

Module. Industry	Ecological problem in Tatarstan	Type of task
Module 1. Textile industry	Health problems – allergy to fabrics	Cloze test 1
Task 2. Energy stations	Shallowing of water in The Volga and the Kazanka	Cloze test 1
Module 3. Production of polymers	Garbage which is not recycled	Cloze test 2
Module 4. Oil extraction	Karst holes, pollution of the earth	Cloze test 2
Module 5. Oil processing	Air and water pollution	Open task
Module 6. Chemical industry	Air and water pollution	Open task

- Final project

The climax of the course is considered to be the final assessment which is carried out on the basis of an interdisciplinary approach, which involves the study of a professional foreign language and the control of the formation of relevant competencies. This group or individual work allows students to boost their creativity, to attract attention of the employers, to use their knowledge in professional sphere and their linguistic skills in practice [7].

Each year the final tasks are devoted more and more to ecology. It is strongly recommended for students to include into their project works evaluation of the problem from ecological point of view. In 2022, the following presentations that contained ecological agenda, were considered to be the best:

– Delivering on a low carbon future (OGCI member companies, number of investments in focus area and sectors were examined, the ways to limit ecological harm of accelerating decarbonization as well);

– Phosenezide Derivatives and Their Biological Activity (biologically active phosphororganic compound free of anticholinesterase activity and new ways of creating medicines on the base of phosphorylacetohydrazides are presented, pharmacological effects are analyzed);

– Influence of ecology of Tatarstan of Ethylene Production (technological scheme of ethylene production and its perspectives);

– Octane number (the main issues to discuss: motor gasoline and its octane number, 4-stroke internal combustion engine, knocking, the need for ON enhancement for ecological purpose);

– Supercritical fluid technologies: applications and advantages.

Other presentations that made the committee interested are the following: “Separation in Phase Dividers”, “Coalescing Filters”, “Oil-Water Emulsions”, “Enzymatic Catalysis”, “Carbon Catch & Storage”, “The Use of Surfactants in the Storage of Oil and Petroleum Products”, etc.

According the information presented, the system of mastering language skills of student of “Oil and gas industry” is characterized by the following aspects:

- The exercises and tasks are aimed at mastering productive skills as well as receptive skills

- The tasks should contain ecological agenda.

- “Metasubject” skills are trained as the students should use critical thinking a lot.

- Simple tasks go first in module structure of the course.

- The system contributes to successful passing of the exam in the form of group work that is devoted to professional issues including ecological agenda.

- The main industries are presented in combination with the ecological problems that the industries cause because that helps to form ecological awareness of students.

## 5 Conclusions

So, the forming of ecological state of mind is really important for the students of Tatarstan republic because chemical and oil industries operating here have made a bad impact on the ecology of the region. It should be formed not only directly but through additional subjects such as Literature and English. With the help of the tasks of the course the students start understanding that economic prosperity of the region can lead to disastrous ecological problems in future. The most part of time is devoted to training productive skills as the climax of the course is the final project which contain ecological agenda. A system of training using online test technologies (cloze-test) is used as preparatory stages for completing an open form task in the framework of each module. This system allows the students to prepare for the final exam and helps develop productive skills as it was proved analyzing the feedback of the

students. The feedback of the students is positive and in 2022, 30 students not only included the ecological topics in their diploma works but made the whole project devoted to ecological issues.

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