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### SECTION 21. Pedagogy. Psychology. Innovations in the field of education

## THE THEORY OF INVENTORY PROBLEMS SOLVING IN THE ESP COURSE

**Abstract:** The article considers one of the most promising innovation technologies in education – the theory of inventory problem solving (TRIZ) applied to teaching English for special purposes (ESP). The study includes a brief review of TRIZ methodology in educational practices with the focus on non-technical university programs. The work reveals didactic potential of TRIZ-based ESP courses which enable students to gain skills to solve open type problems related to the professional linguo-conceptual sphere. The article contains some examples of TRIZ-based assignments aimed at the acquisition of professional vocabulary within an ESP course for fashion designers.

**Key words:** theory of inventive problem solving, TRIZ, TRIZ-pedagogy, TRIZ based education, innovation technologies in education, English for special purposes, ESP, professional vocabulary.

**Language:** English

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### Introduction

The theory of inventory problems solving (TRIZ, derived from the Russian abbreviation) was elaborated by the Russian inventor G.S. Altshuller to provide an exact scientific algorithm for creative technical decisions [1]. It is based on the philosophy of Systematic Innovation that includes Contradiction (identifying and eliminating contradictions), Resource (using all components of the system to their maximum potential), Functionality (determining the main useful function), Space/Time/Interface (changing the perspective on problems) and Ideality (an ideal final result – benefits without cost and harm to the users) [2]. Altshuller suggested a list of 40 Creative or Inventive Principles which constituted basic methods of TRIZ for engineering problems [3]. Some of them are very specific but others turn out to be quite versatile (preliminary action, preliminary counteraction, periodic action, partial or excessive action, do it in reverse, segmentation, consolidation, extraction, dynamicity, new dimension, feedback, copying, asymmetry, universality, nesting, etc.) [4, 272-275]. Later on Altshuller and his followers developed these generic principles enabling their application in multiple areas of creative thinking [5-8]. Recent investigations on TRIZ also include scientific reflection about the essence of the TRIZ

principles and the ways they are applied to different creative tasks [9-10]. TRIZ obviously helps not only to overcome personal mental inertia but a commonly taught and perceived way of dealing with (un)standard problems. Since the second half of the 20<sup>th</sup> century TRIZ has been playing a significant role to exclude ‘the predominance of western creativity stereotypes within current scientific discourses’ [11, p. 500].

Today TRIZ has become a cross-disciplinary, generic methodology [12] that is being implemented worldwide in theoretical and applied creative practices such as engineering, design, management and education [13]. Growing interest in the methodological and practical potential of TRIZ resulted in its institutionalization. In 1997 International TRIZ Association (MATRIZ) [14] was founded by G. S. Altshuller in order to coordinate development of the international TRIZ movement. At the present, MATRIZ comprised of 87 regional TRIZ organizations including RATRIZ (The Association of Russian TRIZ developers, teachers and users [15]) is the most recognized union of TRIZ specialists in the world. In 1998 the Altshuller Institute for TRIZ Studies was established in Worcester (Massachusetts, USA), its mission being to grow productivity and innovation with application of TRIZ methods to



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medicine, agriculture, manufacturing and management [16]. The European TRIZ Association, ETRIA, founded in 2000 aims to 'establish a European TRIZ collaborative environment' through developing TRIZ theoretical basis and providing an exchange of knowledge on TRIZ based innovation technologies [17]. The ideas of TRIZ aroused great interest in Eastern academic communities, particularly in Japan where the national TRIZ Society strives for 'enhancing the TRIZ activities in Japan so as to contribute its empowerment of technology development and global competency' [18].

Special scientific events held annually in different countries are devoted to all aspects of TRIZ, thus the general topic of the 20<sup>th</sup> International Conference TRIZCON2018 (May 2018, Purdue University, West Lafayette, IN) is focused around "Celebrating TRIZ in Education, Industry, and Creativity" [19]. In addition to conferences proceedings, research articles and methodological training AIDS published, there is a monthly issued e-journal entirely dedicated to TRIZ, the TRIZ Journal, which serves as a discussion platform for TRIZ scholars and practitioners [20].

In spite of the fact that 'most of the concepts introduced in TRIZ are fuzzy, and most of the techniques are still heuristic and only partially formalized' [17] they contributed greatly to the General theory of strong thinking and the Theory of creative development of personality [21; 22]. This is especially valuable for developing innovation technologies in education.

### Objectives and Methods

#### TRIZ Pedagogy

Though the theory of inventive problems solving (TRIZ) was originally conceived for industry domains, especially for engineering, manufacturing and design, its principles appeared to be applicable for many other non-technical areas, including politics, management, social systems, interpersonal relations [23, 3; 24], advertising, architecture, art, music, poetry, etc. [25]. In recent years TRIZ has been increasingly used as an innovative technology in educational programs not only in engineering subjects but also in teaching social sciences, humanities and arts [26-31], making it necessary to work out TRIZ-methodology for teaching purposes referred to as TRIZ-pedagogy [32-35]. The TRIZ theory is being applied to various educational modules and topics [36-38] as well as 'to the existing teaching methods and techniques with the main objective of enhancing students' creativity skills' [39, 102]. Nowadays about 50 universities worldwide offer some form of TRIZ education at various levels [40, 269].

The main idea of TRIZ-pedagogy is creativity training which includes formation of creative

imagination, overcoming mental inertia, development of associative and system thinking [40, 269-270]. In TRIZ-based educational courses students gain skills and develop abilities to successfully fulfil open type tasks of the very different kinds [41, 486-492]. TRIZ-methodology becomes critically important in modern conditions when there is a lack of challenge as a crucial component in knowledge acquisition process because educational assignments tend to be made too easy and students are allowed to choose themselves the subjects and topics to learn. Students are not learned to struggle with difficult problems [42]. TRIZ allows 'creativity to be approached systematically, providing the opportunity to teach anyone to be creative and to develop creative ability in any area of human activity' through 'the freedom to work without instruction as to when the work should be done, how, in what order, etc.' [34].

The basic ideas of TRIZ pedagogy include:

- the study of any subject as an evolving system;
- the relationship between various subjects through the patterns of evolution of systems;
- teaching students to consciously apply creative problem-solving methods;
- teaching any subject via demonstration of the solving of creative problems;
- mastering the methods for overcoming psychological inertia [34].

One of the educational fields where TRIZ-based methodology is being adopted relates to higher schools foreign language courses [43, 160-161]. ETRIA-Group in Latvia concentrates on the issues of learning foreign languages, especially English, using TRIZ-tools such as TA (Thinking Approach method) which is presented as a result of the application of TRIZ to language teaching. The TA allows to make teaching mass and individual at the same time (Emphasis on Learner's Individuality), simultaneously put students into active and passive roles (Peer Teaching), present one and the same lesson as both student and teacher centered (Course Dynamics) and so on [44, 92]. The considerable didactic potential of TRIZ [45, 1109-1112] including such procedures as brainstorming, synectics, morphological analysis and others which exposit students' creative thinking can be successfully implemented in an ESP course, for example [46, 52-53].

#### TRIZ as an educational tool in ESP courses

A non-linguistic university course of English for special purposes (ESP) has a number of specific features related, on the one hand, to a low level of foreign language competency and of self-motivation to learn a foreign language among students, and on the other hand, to a limited number of hours allocated for the corresponding discipline in the



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educational programs of specialized areas of training.

At the same time, the requirements of the Federal Standard for Higher Education for mastering a foreign language in many non-linguistic specialties are quite high even at the bachelor's level. To a large extent these requirements are due to the fact that in modern conditions professional activity in many spheres of science and production is impossible without basic knowledge of a foreign language, without mastering the English-language thesaurus of a particular specialty. Thus, the study of specialized vocabulary is the most important task in any ESP course.

The problem of active knowledge and use of specialized vocabulary by graduates of non-linguistic high schools is among the most critical ones. Existing ways of studying and memorizing special vocabulary are based on the following methods: grammar-translative method, textual-translative, thematic, context-comparative [47, 102].

In essence, the main difference between these methods is in the introduction of special terms prior to working with textual material or after introductory reading; using direct translation into Russian or a glossary in a foreign language; determining the meaning of the word from context or using auxiliary visual or lexical material [48-50]. The success of the application of each of these methods and the didactic techniques based on them depends, first of all, on the initial level of students' knowledge of English.

The complexity of the linguo-conceptual sphere of a number of technical specialties makes it difficult for most students of non-linguistic universities to work with an English-language glossary, so the presence of a vocabulary in the training manual that directly translates new terms into Russian is often not only preferable, but also necessary. However, this does not exclude the possibility of using the remaining methods as auxiliary ones. Moreover, it is possible to integrate these methods in the ESP course when using elements of TRIZ pedagogy.

The didactic possibilities of TRIZ applied to teaching English for special purposes can be illustrated with the use of the associations method and the catalog method in ESP courses for specialties related to creative and technical sectors of the fashion industry.

One of the main tasks in teaching students specialized vocabulary is the formation of an integral semantic field from separate professional terms, a kind of individual thesaurus of the specialty. In such an individual thesaurus, which is constantly expanding as the ESP course is mastered, all terms are not disjointed and isolated, but are connected by some essential relationships: adjacency (*lace – shoe*), similarity (*blouse – shirt*) or symbolic allusions (*shawl collar*). It looks as if they fill the matrix of the professional linguo-conceptual sphere, occupying a suitable 'cell' in it. That's how they should be

remembered – along with actual semantic links that create stable 'routes' of memory in the learner's mental map.

Lexical units can act with respect to each other as substitute words, 'neighbors', antipodes, words-generators of associations, etc., that is, they may enter into a relationship of synonymity, antonymy, oxymoron, etc. For example, in the course of ESP for the 'Costume design' or 'Design of garments' specialties the term *casual* can induce such semantic chains: *casual clothes – casual wear, casual – festive, casual – seasonal, casual black tie costume*.

Effective exercises for memorizing and active use of special terms are based on the method of monolingual associations. In addition to updating passive vocabulary, they contribute to the development of creative thinking among students, and the catalyst is not their native language, but English semantic space where such creative solutions can arise that are impossible in another language reality.

Unlike mnemonic techniques for memorizing foreign words, in the chains of monolingual associations there are no intermediate semantic units from another (native) language and no switch from one language field to another, which later on increases the speed of extracting foreign terms from the long-term memory.

In monolingual associative chains it is possible to use all already known terms from other thematic modules of the ESP course, resulting in a constant transition of the passive vocabulary into the active one. The main requirement is that the associative chain should not go into the semantic space of everyday and general literary language, but it must remain within the framework of the professional linguo-conceptual sphere.

Here is an example of a monolingual associative chain for the ESP course related to design and technology of garments. Let the new term be 'seam'. The monolingual associative chain may look like this: *seam – straight seam – straight skirt – frilled skirt – frilled collar – shawl collar – woolen shawl ...* In the assignment a condition can be imposed on the minimum number of 'links' in the chain or, for example, the associative chain must be looped back. Another variant is to compose a monolingual associative chain with 'unconnected' or even contradictive terms at its beginning and end (*heel – ... – ... – ... – keyboard*).

Students are allowed to use dictionaries, synopses, tutorials and educational aids. Exercises can be performed individually or in groups; according to the results of a collective discussion of the options obtained, the 'most creative solution' can be chosen.

Another TRIZ method referred to as the focal objects method or catalog method consists in the transfer of the attributes of randomly selected

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heterogeneous objects from one to another and subsequent creative interpretation of the resulting (sometimes quite absurd) combinations. Its essence lies in the associative search and use of the heuristic properties of randomness. In the ESP course a dictionary serves as the catalog where the initial words for associative attributes are taken from. These random initial words as well as attributes thought up by the students may not belong to the professional thesaurus but the interpretations must be connected with it in some way. For example, the words from the 'catalog' turned out to be: 'secret', 'merry-go-round' and 'leaf'. Associative attributes related to them may be *top, personal, mission* for 'secret'; *attraction, children, high* for 'merry-go-round'; *fallen, autumn, dry* for 'leaf'. Then there will appear the following word collisions composed by exchanging attributes: merry-go-round mission, high leaf, attraction secret, etc. The task is to apply these

striking word combinations to the objects, issues or ideas correlating with students' speciality and to explain them in a reasonable way.

### Conclusion

TRIZ methods applied to in ESP courses not only provide cut-edge techniques of foreign language teaching but also contribute greatly to innovative educational technologies that are aimed at working up skills of creative thinking, overcoming mental inertia and developing imagination necessary for successful professional activity of future graduates. TRIZ techniques implemented in ESP courses enrich students' vocabulary through extending the semantic field of each term in their individual professional thesaurus. In some cases, associative chains and 'catalog' word combinations obtained at an ESP class can become a source of non-standard ideas for students' creative projects directly in their speciality.

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