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WRITING EXPERIMENTAL RESEARCH PAPERS IN ENGLISH: WHAT AND HOW TO TEACH

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Abstract: The paper considers some aspects of teaching writing experimental research papers in English at the postgraduate level of foreign language education. The authors argue for the cognitive-discoursal approach as a theoretical basis for designing a course. Components of instruction content are identified. Step-by-step procedure of teaching, techniques and classroom activities are described.

Introduction

Writing an experimental research paper in a native language is clearly a complex task for a junior scientist without any publishing experience. Writing an experimental research paper in English can be a real challenge for even senior scientists with great publishing experience. It demands a thorough knowledge not only of the subject, a researcher is writing about, but also of the specific rules and stereotypes of academic writing shared by the members of the world scientific community. Mastering these norms and conventions, however, is worth efforts and time, for as R. Day wrote: "Scientists become known (or remain unknown) by their publications" [1, p. 42]. Thus, from the perspective of professional success, developing effective scientific writing skills of EFL postgraduates seems quite obvious.

It should be stressed that writing scientific papers in a foreign language and translating them into a foreign language are thought of as two quite different activities. The author – a specialist in his discipline and its terminology - is free in formulating his ideas, hypotheses and findings; he knows what he means. The translator is bound to stick to the original: he does not have the same professional knowledge of the subject and has to translate unfamiliar words. So, while the translator needs a terminological dictionary, the author needs to know how to express his intentions idiomatically, coherently and in a stylistically adequate manner [2]. It is this knowledge and skills that should be embedded in teaching writing experimental research papers.

Recent decades have seen increased attention of foreign authors to the problems of teaching academic writing [3, 4] and writing for scientific purposes [5, 6]. These works provide a carefully structured and comprehensive programme of self-study which responds to the needs of both undergraduates and postgraduates. They are aimed at developing not only understanding of the mechanics of writing, but also raising awareness of broader principles of good writing, such as coherence, style, register, and format. However, most of them are designed in the form of guides or manuals

accessible to native speakers of English. Naturally, they lack recommendations and a variety of lexical-grammar exercises necessary for Russian speaking learners to acquire the material.

In the last few years there appeared a growing number of practice books of Russian authors designed for teaching English to postgraduates. The problem is that the section devoted to scientific writing which they contain is often limited to presenting sample texts from international scientific journals with short commentaries on their format [7]. They do not include detailed explanation of structuring information within the texts, nor do they contain any tasks aimed at practising in organizing information elements and linguistic means of their manifestation.

So the aim of this paper is to share authors' experience in designing a course for teaching writing experimental research papers in English based on the cognitive-discoursal approach. The course is being piloted with postgraduates at Tambov State Technical University.

Section 1 provides rationale for cognitive-discoursal approach as a theoretical basis for designing a course. In Section 2, we give the answer to the question: "What to teach?" i.e. what components should be included in instruction content. Section 3 answers the question: "How to teach?" i.e. how the process of teaching should be organized and what teaching techniques and activities should be used in the classroom with the aim to develop effective scientific writing skills.

1. Cognitive-discoursal approach to designing a course for teaching scientific writing

The course is based on an approach which emphasizes the discoursal and cognitive aspects of scientific writing [8]. Essentially we see scientific writing as a discourse activity of a researcher – a dynamic process of unfolding an idea into a text predetermined by a set of epistemistic and communicative factors. The product of this activity is a coherent scientific text of a definite genre adapted to the needs of the reader and the goals of the writer.

Cognitive-discoursal approach is estimated by a number of linguists as the most perspective one for studying conceptually relevant problems of scientific text, since it enables to determine how the text reflects: 1) regularities of research activity, 2) stages of developing scientific knowledge, 3) structures of scientific knowledge and 4) discourse processes of production and reception of scientific utterance [9].

The authors believe that cognitive-discoursal approach can be effectively applied for the purposes of teaching scientific writing in a foreign language.

The cognitive aspect of teaching implies: 1) forming awareness of research activity laws and scientific knowledge structures; 2) developing skills of operating different types of knowledge representing real world and particular area of research, including metacognitive knowledge about the content and structure of the scientific knowledge itself; 3) forming awareness of different types of scientific discourse, such as description, definition, classification, argumentation, etc. and different ways of organizing them within texts; 4) developing cognitive strategies of learners.

The discoursal aspect of teaching implies: 1) forming awareness of communicative parameters of scientific writing including intention, author, recipient, situation, result, product and the structure of discourse activity (the phases of orientation, planning, realization and control); 2) developing learners' discourse competence which can be presented as a unity of five components:

– strategic competence, that is the ability to realize the communicative intention (such as to convince, to prove, to inform, to criticize, to explain, to reason, to request, etc.) and to plan communicative event;

– tactic competence, that is the ability to analyze the communicative situation determined by the parameters corresponding to the questions: who? whom? why? what for? what? how? when? where? (e.g. laboratory experiment, scientific consultation, seminar, oral presentation, writing scientific papers and reports, discussion, correspondence) and choose adequate speech acts suitable for achieving the author's intention;

– genre competence, that the ability to produce and interpret professional research genres (e.g. abstracts, annotations, survey articles, experimental reports, research articles, reviewer's reports, reprint requests) and their cognitive structures, which represent the typical regularities of their organization;

– rhetoric competence, that is the ability to produce and interpret specific rhetorical functions (definition, description, generalization, classification, argumentation, instructions, visual-verbal relations) and to use rhetorical techniques (time and space order, cause and effect, comparison and contrast, analogy, illustration);

– text competence, the ability to produce and to interpret a text as a coherent and cohesive unit.

Having described the theoretical basis for designing a course aimed at teaching writing experimental research papers in English to postgraduates, let's move to the next stage, i.e. describing instruction content.

2. Conceptualization of content for teaching writing experimental research papers in English

The process of specifying instruction content is the process of figuring out which aspects of language learning are chosen and integrated in the course.

We argue that the instruction content for the course under consideration should encompass the following basic components.

1. *Organizational format of an experimental research paper.*

The organizational format for all experimental research papers is generally the same, regardless of the field of study in which the scientist is working. A typical experimental research paper contains the following sections in the order they are listed:

– Preliminary sections: Title, Abstract, Keywords, Nomenclature;

– Major sections: Introduction, Methods and Materials, Results and Discussion, Conclusion;

– Supporting sections: Acknowledgements, References, Appendices.

What separates these sections from each other is their functions within the paper. The Title and the Abstract help readers decide whether or not the paper is relevant to their own research interests and therefore worth reading**.** The Introduction provides a transition from a larger academic field to a particular experiment. The Methods and Materials section describes the particular experiment. The purpose of the Results and Discussion is to guide the reader from the particular experiment back to the larger academic area. Conclusion restates the author's contribution, proposes new research directions to prevent duplication of effort or to encourage collaboration.

2. *Rhetorical structuring of an experimental research paper.*

Organizational format or macrostructure of the research paper presented above is determined by its genre. It should be distinguished from the rhetorical structuring of the paper. Genre categorizes texts on the basis of external criteria, i.e. types of activities which regularly occur in society. Rhetorical organization demonstrates the way of sequencing information elements in the text, irrespective of genre. Thus, genre organisation co-occurs with rhetorical organisation and they implement each other.

From the rhetorical point of view the experimental research paper has *situation–problem–solution–evaluation* text structure. These elements are classified in terms of the communicative functions which they perform in relation to the text as a whole.

Situation answers the question: 'What are we talking about?'

Problem answers the question: 'Why are we talking about this?'

Solution answers the question: 'What is to be done?'

Evaluation answers the question: 'How good is the solution?'

Rhetorical elements are further subdivided into steps. Thus, for example, *situation* includes such steps as:

– *background information (*general field of research in which the problem is set);

– *previous research (*aspects of the problem already studied by other researchers);

– *indicating a gap in knowledge.*

Problem includes *purpose of study.*

Each of the steps fulfils its particular function within rhetorical element, e.g.:

– to establish a context to help readers to understand how the present study fits into a wider field of research;

– to review the findings of the researchers working in your area of interest;

– to indicate an area which has not been studied in previous literature;

– to formally announce the purpose.

In the same way *solution* and *evaluation* elements can be described.

Scientists do not always arrange these information elements in the order described above. Sometimes they interrupt one element with another, and then return to the previous one. However, the general strategy of structuring the Introduction presented above is common and advisable for a researcher-beginner to follow.

3. *Types of scientific writing.*

Alongside with *problem-solution* type of scientific writing, which demonstrates a basic pattern of the overall text structure of an experimental research paper, there are other writing types which appear within the text. They are *description* and *reasoning*. In our opinion, they correspond to the very structure of scientific knowledge consisting of two levels: empirical and theoretical. The empirical knowledge represents a set of statements about empirical objects formed by means of cognitive data processing of observations and fixed by certain language means. Theoretical knowledge is a set of statements about ideal objects constructed by thinking. Therefore the two interconnected invariant speech forms realizing functions of scientific research and communicative intentions of the researcher are *description* and *reasoning* aimed at fixing external and internal essential relationships of an investigated object respectively [10]. *Description* is further divided into three types*: physical description, function description and process description.* Reasoning is presented by two kinds: *argumentation* and *inference.* Description is basically used in Materials and Method section, while reasoning is inherent in Results and Discussion section.

4. *Basic rhetoric models of scientific writing.*

The above mentioned types of scientific writing are realized through its basic rhetorical models, such as: definition, classification, comparison and contrast, cause and effect, general and particular, generalization, exemplification, illustration, time order, space order, visual-verbal relationships. These elements are understood either as frames into which authors fit their information or the way in which information elements chosen relate to one another.

5. *Paragraph as the basic unit of scientific writing.*

Mastering paragraph structure and its attributes – unity and coherence – is the key to successful scientific writing. Therefore, various ways of achieving coherence, such as, repetition of key nouns and its substitutes, use of consistent pronouns, use of transition signals to link ideas, should be included in instruction content.

6. *Lexico-grammatical peculiarities of scientific writing.*

Without solid knowledge of grammar and scientific terminology, a scientist can not hope to develop into an effective writer; therefore, developing language competence

of learners is of primary importance. Special attention should be paid to topics which cause particular problems, e.g.: the use of articles with general and specific nouns, tense forms, passive constructions, modal auxiliaries, etc.

3. Organization of teaching process and teaching techniques

The whole process of teaching writing experimental research papers can be presented as a three-stage process.

The first stage is studying the rhetorical organisation of the research paper which includes the following steps:

1) getting acquainted with organizational format of research papers through presentation of paper-samples (only genuine materials without any alteration taken from a printed source are used);

2) analysis of rhetorical structuring of the overall paper-sample and each of the sections separately, including identification of information elements and the way they are arranged within the paper-sample;

3) analysis of rhetorical structure and lexico-grammatical means of realization of description and reasoning in paper-samples;

4) analysis of basic rhetoric models and linguistic means of their realization in paper-samples.

The second stage is writing papers from teacher-collected data under teacher's supervision. Post-graduates are offered to write short, four-paragraph research papers with one paragraph for each of the sections – introduction, methods, results and discussion – from available data. These data are taken from actual research papers in post-graduates' subject area. Providing post-graduates with an abstract and all important figures, tables and diagrams from the paper is very helpful. The post-graduates are supposed to write the methods and results section first and the introduction and discussion sections last. They write papers first in small groups, then individually.

The third stage is independent research paper writing from post-graduate-collected data (by means of pre-writing (rehearsing), drafting, editing (revising) and preparation of final version).

Realization of methodology being proposed assumes the employment of various *teaching techniques*, such as: identification, comparison, correlation, transformation, expansion, filling the gaps, reconstruction and completion.

To develop writing skills conforming to the norms and stereotypes of scientific discourse, the following *preparatory exercises* aimed at analysis and imitation of model papers are suggested:

– identifying information elements to reconstruct a section of a paper;

– identifying information elements within different sub-sections;

– reconstructing a deliberately deformed rhetorical structure;

– logical regrouping of information elements;

– using flowcharts or gap-filling exercises to represent the Problem-Solution pattern;

– comparing several examples to show the variation in rhetoric structure;

– identifying cohesion means (pronouns, conjunctions, markers, repetitions);

– analyzing grammatical features (tenses, articles, passive constructions, modal verbs);

– identifying key lexical phrases which are representative of the rhetorical structures;

– analyzing rhetoric models (general-particular, cause-effect, arrangement in space and in time, etc.).

To develop creative writing skills, we propose *speech exercises* assuming an independent choice of the subject matter, gathering information, its critical analysis, organization, draft writing and subsequent editing.

Conclusion

In this paper an attempt has been made to clarify some aspects of designing a course for teaching writing experimental research papers in English to post-graduates. The advantages of using cognitive-discoursal approach as an adequate theoretical basis for designing a course were discussed. Much attention was given to identifying components of instruction teaching, with rhetorical organization of the research paper being the most important. The three-stage model of organizing teaching process was proposed. Some teaching techniques and classroom activities were described. The model devised can be useful for university English language teachers who are charged with responsibility of designing specialized courses at postgraduate foreign language education level.

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Написание научно-экспериментальной статьи на английском языке: чему и как обучать

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Ключевые слова и фразы: когнитивно-дискурсивный подход; научное изложение; обучение иностранному языку аспирантов; приемы обучения и задания; риторическое структурирование; содержание обучения.

Аннотация: Рассматриваются некоторые аспекты обучения написанию научно-экспериментальных статей на английском языке на этапе послевузовского иноязычного образования. В качестве теоретической основы проектирования курса авторами предлагается когнитивно-дискурсивный подход. Выявляются составляющие содержания обучения. Описывается пошаговая процедура обучения, а также используемые приемы обучения и задания.

Schreiben des wissenschaftlich-experimentellen Artikels auf Englisch: in was und wie auszubilden

Zusammenfassung: Im Artikel werden die einigen Aspekte der Ausbildung im Schreiben der wissenschaftlich-experimentellen Artikel auf Englisch auf der Etappe der nachhochschuligen fremdsprachigen Ausbildung betrachtet. Als theoretische Basis der Kursusprojektierung wird von den Authoren das kognitiv-diskursive Herangehen vorgeschlagen. Es werden die Komponenten des Ausbildungsgehaltes festgestellt. Es werden die Schrittprozedur der Ausbildung und auch die anwendenden Verfahren der Ausbildung und die Aufgaben beschrieben.

Rédigion d'un article scientifique expérimentale en anglais: quoi et comment enseigner

Résumé: Dans l'article sont examinés certains aspects de l'apprentissage de la rédigion d'un article scientifique expérimentale en anglais à l'étape postuniversitaire de l'enseignement de la langue étrangère. En qualité de la base théorique de la conception du cours les auteurs proposent une approche cognitive discoursive. Sont déduites les composantes du contenu de l'enseignement, les méthodes et les devoirs employés.

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