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Modern Scientific Communication and its Efficacy through the Prism of Science Education: Dialectic Interaction between Cognition and Discourse Phenomena

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Abstract

In recent decades, in the light of globalization processes particular role attributed to scientific articles as one of the most efficient means of cross-cultural cross-linguistic scientific communication dynamizing creation of new concepts, categories, theories, and scientific values, including those based on interdisciplinarity, has reinforced complex issues concerning equivalence of thesauruses of communication participants and structuring of the information flow, which are of special interest in what regards science education. Intensified multidimensional dialogue of cultures, scientific schools, and fields of knowledge inevitable requires flexible tools and instruments designed to standardize and structuralize written scientific discourse, inter alia, standardized connectors and compositional formulas or recurrent lexical and grammar constructions to be adequately perceived and efficiently applied by Ph.D. students. Analyzing the instruments and tools referred to above, what represents the aim of this article, we apply the following methods: comparative analysis, the method of translation and the questionnaire method which engaged Ph.D. students of RUDN-university (n-95) from different countries learning academic writing in different scientific fields where the English and the Spanish languages are used as a second foreign language by learners with different mother-tongue backgrounds. We conclude that, while providing a map for researchers' creativity or discretion in interpretation and linguistic representation of accumulated research data, recurrent standard constructions, which form part of the structure of text mechanism that reflects universal schemes of the processes of perception, comprehension, and representation of scientific phenomena and processes in their integrity and dynamics, enable the forming of Ph.D. students' own theoretical projections, models and approaches, as well as focusing on polylogue with other scholars in the context of scientific communication. This article is of practical value for cross-linguistic studies, language and translation teaching, foreign language acquisition, translation and interpretation studies.

Keywords: *scientific communication; cognition; discourse; equivalence of thesauruses of communication participants; interdisciplinarity.*

Introduction

Considered as one of the core semiotic concepts, discourse constitutes a modelling system that is oriented towards or tends to autonomy when viewed through the prism of semiotics and communication.Scientific discourse, communicative and cognitive parameters thereof characterized by specific linguistic forms of objectivization in different languages, plays important role in the transfer of cognitive information due to the fact that *per se* it constitutes linguistic form of new knowledge.

On the whole, discourse as a cognitive event (E. Kubryakova) not only correlates with a particular area of social practice, it deals with transferring, processing or operating with knowledge and structures thereof [1], involving similar presuppositions and implications that precondition adequate cognitive perception of the reality and the ways in which it is conceptualized and verbalized within a given context of cross-cultural scientific communication.

Discussion

As for unique character of scientific cognition science may be conceived as sphere where intertextual interaction takes place. Constituting special way to generate sense of new text throughout interaction between the author's and other researchers' sense positions, intertextuality embodies the core of mechanisms of the text-formation in science.

In general, the author's pragmatics and its discourse realization rest on virtual polylog with other scientists in what concerns the following aspects: framing practical and theoretical questions encompassed by the scope of his research in terms of current debates; expressing agreement or disagreement with the views or estimations of other researchers that represent different scientific

schools; finding relevant viewpoints in support of his own ideas and hypotheses; neutralizing communication gaps, differential in linguistic and extralinguistic knowledge, especially, in what regards scientific conceptual categories and verbalization thereof, along with representation of accumulated research data via corresponding means of the other language, etc.

Semantic, pragmatic or conceptual mismatches between the source language (SL) and the target language (TL) may often be revealed, especially in cases when two language systems meet in mediated scientific communication.

In translation arises the need for the new information regarding the objective reality to be reflected, to be matched with the data or facts known by the addressee, the need to show the result of the reference and objectively depict or capture the information about the world in the language of translation via, perhaps, different as compared to the source language linguistic means, and, finally, to accomplish the goal similar to the one that cognitive linguistics has in what regards exploring how cognitive and linguistic structures intercorrelate but at the level of contact between the two different languages where relevant factors, such as functional, social, pragmatic, and others, have their impact and manifest within mediated crosslinguistic cross-cultural scientific communication.

The author of scientific text, i.e., scientist, assimilates and integrates ideas, thoughts and textual realizations thereof within vast space of scientific polylog, for intertextuality phenomenon in scientific communication lays, *inter alia*, on the dialectical interaction between prior or already existing knowledge and the new one. Intertextual links are realized at the level of content, genre and stylistic peculiarities, structure, and formal verbalization of the information, constituting *per se* special way of building up new sense of a particular text.

Aspects related to the phenomenon of intertextuality and its manifestation in translation, along with linguistic means that are used to articulate intertextual links in what concerns a particular pair of languages, as well as issues concerning structuring of scientific information flow acquire special relevance for academic writing in foreign languages and science education.

Materials and methods

Analyzing tools and instruments designed to standardize and structuralize written scientific discourse, we apply the method of comparative analysis, the method of translation, and the questionnaire method which engaged Ph.D. students of RUDN-university (*n*-95) from different countries learning academic writing in different scientific fields where the English and the Spanish languages are used as a second foreign language by learners with different mother-tongue backgrounds.

Results

It is of essence of scientific article that it efficiently facilitates scientific communication and functionally embodies general peculiarity of linguistic world picture viewed in its scientific aspect, for it manifests extralinguistic features that characterize scientific discourse and scientific style in its particular forms, that are, among others, the folowing: generality, objectivity, preciseness and accuracy, consistency of logic, abstractedness, clarity, modality and evaluativeness. The referred to above stylistic features find their reflection in almost all universal typological categories of a text, scientific text (ST), in particular, such as coherence, integrity, structural composition, modality, sense and functional type preconditioning selection and usage of particular lexical and grammar means and constructions, along with special structural, logic, and compositional schemes that structuralize written scientific discourse.

The need to shape and modulate the usage of the latter strategically for different effects, to apply principles of coding and decoding of cognitive information is fundamental to the skills and competences of Ph.D. students in the context of learning academic writing in foreign languages, particularly, in what concerns establishing comparisons between two or even more different languages in order to meet scientific style requirements and prevent, among others, failures of disambiguation or adequate understanding and presenting of all sorts of information implicitly or explicitly given in scientific text.

The analysis undertaken in this research has demonstrated that, to a great extent, coherence in scientific discourse, while forming part of text structuring mechanism, rests on internal logic inherent to the object subject to research. Among the means of coherence contemplated by the most extensively used classification of means of coherence by the criterion of linguistic representation the following ones are of particular relevance for this research:

- lexical that include, *inter alia*, different kinds of reduplications, such as synonymic, contextual, periphrastic, full or complete ones, etc., along with pronominal substitution;

- lexical and grammar links, i.e. conjunctions, conjunctive or connective adverbs, parenthesis or incidental words and word combinations, that facilitate logic and compositional organization of the

text throughout a wide spectrum of relationship of conditional, comparative, concessive or other character;

- grammar links that are manifested in word order, syntactic parallelism, aspectual-temporal forms of verbs, etc.

Compared to the literary texts and viewed in the light of category of coherence realization, the ST reveals a number of peculiarities, such as the following.

• Lexical reiteration of a term when a lexical unit of a prior sentence is repeated in the next sentence so that clear and unambiguous interpretation of scientific text is ensured:

"It is 3D printing (3DP) technology however that offers perhaps the greatest potential to revolutionize the future of pharmaceutical manufacturing. 3DP was developed as a tool for rapid prototyping."
(https://doi.org/10.1016/j.ijpharm.2014.09.044)

•Usage of standardized linguistic means that precondition and facilitate compositional arrangement of text content. For example: Conclusion*: "concluding"; "by way of conclusion"; "in conclusion"; "in summary"; "summarizing results of the research/paper"*; *"to summarize"; "finally"; "in brief," etc.* (Eng.); *"concluyendo"; "en conclusion"; "en breve"; "por último"; "finalizando"; "por fin",* "*en síntesis",etc.* (Esp.).

• Normal or neutral word order that has the theme or thematic and already known information located at the beginning of the sentence and the rheme or core information that matches new, relevant and actual information - at the end of it. For example:

"In particular, the development of medicines personalized to the patient requires consideration of novel manufacturing technologies capable of fabricating small numbers of dosage forms, because current commercial technology only operates efficiently on a large scale".
(https://doi.org/10.1016/j.ijpharm.2014.09.044)

It is worth noticing that different languages have their particular specificities in what concerns information-bearing structure of the sentence or actual division of the sentence. In the Russian and the Spanish languages both theme and rheme reveal not fixed or free syntactical presentation. As for structural and syntactic level English theme in most cases correlates with the group of the subject (subject with its adjuncts) and rheme usually coincides with the group of predicate. The latter has special relevance, for it has direct impact on the way in which the notion of "novel contribution to the area" is represented in the sense structure of the text of research article predetermining efficacy of sense perception thereof. In contrast to the Russian and the Spanish languages where syntactic word order in the sentence is flexible to a certain extent, and may change in accordance with the requirements of semantic word order, the English language tends to manifest fixed or rigid order of sentence parts. It preconditions that change in the position of the subject within sense structure of the sentence in order for it to represent rheme position may be observed in rare cases under condition that special constructions are used to manifest sense articulation or segmentation, that, *inter alia,* are the following: indefinite articles, negation constructions that attract logic accent or stress, and other. Definite articles, personal, demonstrative, emphatic or possessive pronouns, etc., as well as the fact of previous mention in the speech situation or a particular context, along with low semantic and contextual burdening or load specify the reference to the sense group of theme.

• Grammatical category of tense has functions of segmentation and integration of scientific text content. Considered as distinctive character of scientific text conceptual time is represented both in forms of gnomic present tense and present time. It is notable that the Russian language demonstrates free transition from present to past tenses and *vise versa* while the English and the Spanish languages are strict in what regards sequence of tenses while arranging the tenses of successive verbs, particularly in conditional sentences, indirect speech or establishing relationship between main and subordinate verbs. For example:

"*This article focuses on the effects of bilingualism on the structure and integrity of the white matter (WM) of the brain and the factors that have been shown to affect it... The review of the available literature reveals that it is unclear what the causes of the WM effects in bilinguals are. Although it appears that WM changes are to be expected in early bilinguals, the evidence on late bilinguals is still inconclusive".*
(www.pnas.org/cgi/doi/10.1073/pnas.1414183112)

Conclusion

Scientific communication efficiency implies common knowledge of common cognitive schemes, stereotypes and connotations, so that referring to textual fragments of other authors encourages

virtual interaction within scientific community and facilitates openness to other sense systems interpretation and their interaction in what regards content or subject matter and, particularly, verbalization thereof. While providing a map for researchers' creativity or discretion in interpretation and linguistic representation of accumulated research data, recurrent standard constructions, which form part of the structure of text mechanism formation that reflects universal schemes of the processes of perception, comprehension, and representation of scientific phenomena and processes in their integrity and dynamics, enable the forming of Ph.D. students' own theoretical projections, models and approaches, as well as focusing on polylogue with other scholars in the context of scientific communication.

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