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DOI: <https://doi.org/10.24195/2414-4665-2018-1-9>**Tetiana Kravchyna,***PhD (Candidate of Psychological Sciences), associate professor,**Department of Foreign Languages,**Khmelnitsky National University**11 Institutaska Str., Khmelnytsky, Ukraine*

## UNDERSTANDING OF FOREIGN SCIENTIFIC TEXT AS FACTOR OF PROFESSIONAL DEVELOPMENT OF FUTURE MECHANICAL ENGINEERS

*The article is dedicated to the study of the necessity for understanding the foreign scientific text in order to develop the intellectual culture of future technical specialists. It is found that the foreign scientific text has peculiarities of a language – namely, the ability of words to name, indicate and describe aspects of reality. Consequently, its main function is informative (message, explanation, clarification, elucidation, substantiation, classification of concepts, systematization of knowledge, reasoned argument); its task – the transfer of information. A foreign scientific text is a means of representing foreign scientific information, the result of scientific research. It necessarily reflects a certain problem, puts forward hypotheses, orients to new knowledge. It is characterized by expediency and rationality of all principles and orientated towards achieving research aims and objectives. It has a rational nature, consists of judgments, inferences, constructed according to the rules of the science and formal logics. The article describes the specifics of understanding and interpreting the foreign scientific text, examines the psychological peculiarities of the interpreter. For the qualitative understanding and interpretation of foreign scientific texts, the following components are necessary: a) vocabulary (native and foreign languages), in particular, use of scientific terminology; b) the general intellectual level (the higher the level of intelligence is, the more effective the process of understanding is); d) abilities (the combination of the learned and new information, its effective application, formation of a holistic view of the interpreted information); e) semantic-lexical proximity of the language of the foreign text to the interpreter's language (Slavic languages, in particular, Russian; and the influence of the cultural and historical peculiarities of the habitat of the interpreter); e) motivation to operate information (need for high professionalism characterizes the reasons for understanding and usage of information). As a result of the conducted empirical research there have been defined the levels of interpretation (scientific, emotional-sensitive, creative) as a component of understanding the foreign scientific text, the precondition of which is the level of intelligence; the dependence of the success of mechanical students' academic and professional activity (high, medium, low) on the interpretation levels of foreign scientific text through the indicators of anxiety has been observed.*

**Keywords:** *understanding, text, intelligence, speech, language*

### Introduction

The issue of understanding foreign scientific texts is complex and multidimensional, quite topical for the educational process of higher educational institution. Firstly, the foreign scientific text is the basic form of the existence of scientific knowledge (in which human thought is materially fixed), on the mastering of which university study is focused. Secondly, it is a linguistic expression of the intellectual capabilities of an individual, and, being a product of the intellect, the text can be relevant and meaningful only for the intellect. Thirdly, the foreign scientific text is a product of speech and the main object of its perception and understanding.

The study of the psychological peculiarities of understanding the scientific texts by technical students is still relevant, as the extra-linguistic conditions of perception and understanding, the requirements for the structure and linguistic parameters of the language of scientific texts, the conditions of the formation of students' skills and abilities change. In addition, knowing the peculiarities and difficulties of understanding the text, methodical measures can be taken (to remove or facilitate the process

of perception and understanding). This makes it possible not only to find out research methods correctly and exactly, but also to make meaningful valid conclusions.

### Aims and Tasks

The aim of the article is to reveal the influence of the process of understanding the foreign scientific text on the success of future mechanical engineers' academic and professional activity. To achieve the given aim, the following tasks were specified: to reveal the essence and peculiarities of the process of understanding the foreign scientific text in foreign and domestic literature; to find a complex of psychodiagnostic methods of studying the process of understanding and interpretation levels of foreign scientific text; experimentally investigate the influence of the process of understanding the foreign scientific text on the success of future mechanical engineers' academic and professional activity; analyze the results of the theoretical and empirical research.

### Research Methods

The following research methods were used to implement the given tasks in the article: a) theoretical (anal-

ysis, comparison, generalization); b) empirical (testing, comparative, correlation and quantitative analysis).

The empirical research was conducted at Khmelnytsky National University. 123 students of the 1<sup>st</sup>-5<sup>th</sup> years of study at the mechanical engineering faculty of Khmelnytsky National University participated in the experiment. The representativeness of the selection of empirical research is ensured by the fact that the psychological characteristics of students who participated in the experiment, in general, are identical to the psychological characteristics of technical students.

The constitutive part of the research was conducted in 2017. The first stage of the research involved the assessment of readiness for interpretation as a component of understanding the foreign scientific text, the precondition of which is the level of intelligence. It is for this purpose that a modified intelligence structure test TSI (R. Amthauer) was used. The study of interpretation levels (scientific, emotional-sensitive, creative) was carried out by using the method of free descriptions (on the relevant topic). At the second stage we retraced the relationship between the success of academic and professional activity and the interpretation levels by using correlation analysis. The success index of the mechanical students is the level of anxiety studied by the anxiety self-assessment test (C. Spielberger, J. Khanin).

### **Theoretical Research Results**

The understanding of the foreign scientific text is a two-way process, defined, on the one hand, by objective characteristics of the text (structure, complexity, volume, etc.), and on the other hand, by individual peculiarities of processes of memory, attention, formation of skills of the semantic perception of the message.

The foreign scientific text has a structural organization that includes the connections and relations between the text units (sentences), the system of units from the “micro themes” to the large parts that are distinguished by functional characteristics, and, of course, the properties which the text has as an integrity. The foreign scientific text is a hierarchical organization and all its elements: words, phrases, sentences, statements are certain dependencies. All these elements, apart from a whole statement, do not make sense in isolation from each other. The meaning arises at the junction of several sentences. There can be two adjacent sentences of the text, but if “integration does not appear, the next adjacent sentence is taken, and this process lasts until the moment when the semantic connection between these sentences appears” (Zhinkin, 1982).

The architectonics of foreign scientific texts is subordinated to the principle of one-dimensional semantics and it is less hierarchical than, for example, a fiction text, characterized by polysemy, polysemanticity, in the process of decoding of which understanding happens (where the plane of subtext, context, conception plays a great role and assumes different text interpretations). The scientific text has a number of specific characteristics: monologue character, lack of subtext, strict sequence and close con-

nection between separate sentences. These texts are fundamentally oriented at uniformity, and they, socially, unite individuals of understanding: everyone should understand identically.

We can assume that the inner meaning of the foreign scientific text is realized by the author with the help of the plan and the program that help to achieve a clear construction of the text in the form of a single logical line, and make the text coherent and integral. When the reader perceives and comprehends the text, he or she goes through the same stages that were used during the production of the text, and which help him/her to discover the meaning and understand it (Philips, 2016). Apparently, this is the semantic structure of the text. The author’s meaning, being embodied in the structure of the text, becomes the subject of analytical-synthetic processing, as a result of which the student selects scientifically meaningful objects from the text, i.e. informational facts. The selection and comprehension of these objects, during the reception, are also accompanied by the process of their denomination (in the form of a convolute text). The same happens when contextual relations between the selected objects are formed.

The foreign scientific text as a certain semantic system, contains subject-thematic, disciplinary and scientific knowledge. Besides, we can retrace the presence of the methodological knowledge in the scientific text. V.P. Zinchenko and S.D. Smirnov consider that the structure of methodological knowledge is complex and consists of several levels: 1) the level of philosophical methodology; 2) the level of specifically scientific principles; 3) general scientific principles and forms of research; 4) methods and techniques of research (Zinchenko & Smirnov, 1983).

The foreign scientific text also includes a style of thinking, a worldview, ideological, socio-psychological and other aspects that characterize it as a representative of a certain time. The texts contain the thematic information which makes them more informative. With the help of the semantic analysis, we can, as if, look beyond the text and see something more, which gives us the opportunity to understand it deeper (Syzonov, 2017).

The text is not only created by the subject, but also perceived by him/her; it has its inner world, which, being an extra-textual factor, also influences the understanding of its meaning (Harley, 2008). “Meaning is always a personal attitude of a particular individual to the text contents” (Sorokin et.al. 1979).

Unlike literary texts, the foreign scientific text has its addressee, i.e. the text is initially directed to an equivalent partner. The scientific text is created for the same specialist (the addressee with the same capabilities) (Radzievskaya, 1984). To some extent, this is true, but there can not be a real equality, because the author gives his or her point of view about an object, process or phenomenon that no one else is familiar with. Moreover, there can not be an equality in the situation, when students (young people), just preparing to become specialists, become addressees. Therefore, this addressing makes

it difficult for students to understand scientific texts and requires knowledge of special techniques for scooping up information and understanding the text.

G.P. Shchedrovitsky and S.G. Jacobson think that understanding acts as a semantic organization of the sign form of the text: this form of organization is nothing more than the renewal of the meaning structure, contained in the text by the process of thinking. Accordingly, as clear formulation of the problem is absent while understanding the text, the process of thinking (to a great extent) passes externally in a convolute, automated form. However, in fact, the process of comprehending the text requires an active cognitive activity from the learner (Shchedrovitsky & Jacobson, 1995).

The understanding of the text is aimed at the formation of a holistic view of the described objective reality. When creating the text, the author always believes that the reader has some knowledge. A.A. Brudnyy notes that when we talk about understanding of the text, “we must first of all keep in mind that a part of its contents is already, or at least, should be in the mind of the reader. This means that at least some facts used by the author of the text should be previously known to the reader. If they are not completely familiar to the reader, they can not be absolutely alien to him/her: some information basis is necessary for understanding”, “in order to understand the book, you need to know more than it says” (Brudnyy, 1988). Therefore, in the text, a problem situation is always present in a hidden aspect. L.P. Doblavey confirms that there are several types of such problem situations: for example, the novelty of the expressed thoughts (the need for their disclosure, clarification), the contradiction between them, the incompleteness of the expression of thought in the texts (Doblavey, 1972). Thus, the reader must fill in the gaps (missing information in the text) with the words in order to obtain a common comprehension of text contents. How well gaps are filled in, depends on the reader's personal experience, his/her thesaurus – a coherent set of information that is “ready for use” and comes alive in the person's memory at the right moment. The understanding of words, word combinations, interrelations between them, leads to the filling in gaps, scooping out the meaning of the text – an operation that the reader, the student must possess. “A text is a mechanism that controls the process of understanding” (Brudnyy, 1988), and the scientific text is a rigid mechanism of control.

The understanding of the foreign scientific text requires the development of a number of intellectual operations, which constitute such a complex indicator as ability for learning. Peculiarities of generalization and abstraction of ideas, economy of thinking, independence or critical thinking, flexibility (or inertia) of thinking, awareness

of actions are referred to the intellectual operations. This list can include such indicators as: the ability to transfer, search by analogy and work out the generalized strategies that are a prerequisite for the generation of ideas.

Every individual has the above mentioned indicators, but they are differently expressed (stronger or weaker) and differently combined with each other. Their presence is necessary for solving scientific text problems in the learning process.

Besides, emotional experience is also the individual psychological peculiarity of the interpreter. Anxiety experience is success index of the use of interpreted foreign scientific information (Marcos-Linas & Garau, 2009). The optimal level of anxiety is necessary for an effective adaptation of the personality to reality. Excessively high level, as well as excessively low level, are indicatives of a maladaptive reaction, lack of knowledge integration (acquired in the process of interpretation). They are indicators of unfavorable personal development.

Thus, a combination of individual peculiarities of the interpreter and characteristics of the text is the main factor of successful perception and understanding of the foreign scientific text.

Interpretation is a result of understanding the foreign scientific text. The understanding of the foreign scientific text is an important component of students' academic and professional activity. The process of understanding reflects the degree of integration of new knowledge into a general system of knowledge and influences on the success of students' academic and professional activity.

#### **Empirical Research Results**

*First stage.* The aim of R. T. Amthauer's Intelligence Structure Test (TSI) was to identify the distribution of intelligence components (verbal, mathematical, constructive, theoretical-practical abilities). The modification involved testing: 1) in the conditions of academic and professional activity and; 2) after interpretation of the foreign scientific text. The discrepancy between the situation of the perception of academic and professional information by the language of the interpreter and the foreign text enabled us to define the dominant intelligence components during the process of interpretation.

The results of the analysis of the indices, obtained by the use of (modified by us) R. Amthauer's method (TSI), revealed the following:

interpretation levels of foreign scientific text: scientific – 50,4%; emotional-sensitive – 30,8%; creative – 18,8%.

Indices of the interpretation levels of the foreign scientific text and components of intelligence were compared and this allowed to obtain an integrated picture of understanding the foreign language text (Table 1).

Table 1.

**Representation of Relations Between Indices of Interpretation Levels of Foreign Scientific Text and Components of Intelligence (in %)**

№	Level of Interpretation	Components of Intelligence			
		Verbal abilities	Mathematical abilities	Constructive abilities	Theoretical-practical abilities
1	Scientific	47.1	73.2	39.8	19.3
2	Emotional-sensitive	16.4	9.1	32.9	24.9
3	Creative	36.5	17.7	27.3	55.8

It has been found out that the students focused on the scientific level of interpretation, implement the most successful strategy, which manifests itself in deep and qualitative understanding the contents of the text. The quality of understanding information facilitates its successful integration into the semantic and logical structure of other theoretical knowledge and is expressed in the adaptation strategies of behavior. The students of technical specialties with the emotional and sensitive level have the deep understanding of the text mediated by emotions and feelings, unstable at different times, even in relation to the same text. This understanding is manifested in maladaptation strategies of behavior. The students, with the prevalence of creative level of interpretation, orient at the superficial contents of the text. In the process of the understanding, information is integrated into the superficial level of knowledge and is realized by means of

stereotypical strategies of academic and professional behavior.

*The second stage.* The use of the Anxiety Self-Assessment Test (C. Spielberger, Y. Hanin) involved the establishment of the relationships between the levels of interpretation and reactive anxiety as condition and personal anxiety as person's stable characteristics.

During the research we retraced the dependence of the success of academic and professional activity on the interpretation levels of the foreign scientific text. The success of the mechanical students can be due to reactive anxiety (the normal level of anxiety that occurs in response to external stimuli). Sustained anxiety is an indicator of low success caused by dissatisfaction and fears, in particular, in the field of academic and professional activity (Table 2).

Table 2.

**Representation of the Relationships Between the Success of Academic and Professional Activity and the Interpretation Level of Foreign Scientific Text Through Anxiety Indicators (in %)**

№	Success of academic and professional activity	Interpretation level					
		Scientific		Emotional-sensitive		Creative	
		Type of anxiety					
		Reactive	Stable	Reactive	Stable	Reactive	Stable
1	High	8.9	-	-	58.7	32.4	-
2	Medium/ Unstable	27.7	-	-	25.9	46.4	-
3	Low	53.2	-	15.5	-	31.3	-

The study of the relationships between the interpretation of foreign scientific text and the success of mechani-

cal students' academic and professional activity is shown in Table 3.

Table 3.

**Correlation Between the Interpretation Level and the Success of Academic and Professional Activity**

№	Success of academic and professional activity	Interpretation level					
		Scientific		Emotional-sensitive		Creative	
		Type of anxiety					
		Reactive	Stable	Reactive	Stable	Reactive	Stable
1	High	3.84	-	0.53	-	0.42	-
2	Medium/ Unstable	0.75	-	0.48	-	1.94	-
3	Low	1.71	-	1.78	-	0.44	-

There is a direct correlation between: a) a creative level of interpretation and medium / unstable success study; b) an emotional-sensitive level and low success; c)

the scientific level and the high success of academic and professional activity. Accordingly, the scientific and emotional-sensitive levels are characterized by high indicators

of interpreted information, while the creative level is characterized by the low indicator.

On the basis of the obtained results, it can be concluded that the scientific level is the indicator of the productivity of the interpretation of foreign scientific text, which is accompanied by high success of academic and professional activity.

### Conclusions

Summing up, we can state that theoretical and methodological analysis of the study of interpretation and understanding foreign scientific texts by students of technical specialties proves their interrelation with the success of academic and professional activity. The quality of understanding is related to cognitive strategies of the individual, in particular, intellectual and creative abilities. Understanding of the text is factor in integrating knowledge into the general system of scientific and professional knowledge.

Experimental study of the influence of the process of understanding the foreign scientific text on the success of

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academic and professional activity of the future technical specialist has proved the following: a) the culture of perception and interpretation of the foreign scientific text includes three levels: creative, emotional-sensitive and scientific – the highest level of understanding; b) components of the structure of understanding are as follows: creative (creativity is a prerequisite for understanding the text); emotional-sensitive (emotions and empathy are the primary components of the process of understanding); scientific (the level of development of intelligence contributes to the formation of a holistic image of interpreted information).

The prospects of further research are determined by the possibility of working out and testing a program for the development of scientific abilities in the process of understanding the foreign scientific text in order to increase the success of the academic and professional activity of students of technical specialties.

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### **РОЗУМІННЯ ІНШОМОВНОГО НАУКОВОГО ТЕКСТУ ЯК ЧИННИКА ПРОФЕСІЙНОГО СТАНОВЛЕННЯ МАЙБУТНІХ ІНЖЕНЕРІВ-МЕХАНІКІВ**

Стаття присвячена вивченню проблеми необхідності розуміння іншомовного наукового тексту як чинника професійного становлення та інтелектуального розвитку майбутніх інженерів-механіків. Виявлено, що іншомовному науковому тексту притаманні особливості мови, а саме – здатність слів називати, позначати й описувати явища дійсності. Отже, його основна функція – інформативна (повідомлення, пояснення, з'ясування, обґрунтування, класифікація понять, систематизація знань, аргументований доказ); завдання – передавання інформації. Іншомовний науковий текст – спосіб репрезентації іншомовної наукової інформації, результат наукового дослідження. Він обов'язково відображає ту чи іншу проблему, висуває гіпотези, орієнтує на нове знання, характеризуються доцільністю і раціональністю усіх положень, орієнтований на досягнення дослідницької мети та завдань. Він має раціональний характер, складається із суджень, умовиводів, побудованих за правилами логіки науки і формальної логіки. У статті описується специфіка розуміння й інтерпретація іншомовного наукового тексту, розглядаються психологічні особливості інтерпретатора. Для якісного розуміння й інтерпретації іншомовних наукових текстів необхідні такі компоненти: а) словниковий запас (рідна й іноземна мова), зокрема, оперування науковою термінологією; б) загальний інтелектуальний рівень (чим вище рівень інтелекту, тим ефективніше процес розуміння); г) здібності (поєднання засвоєної і нової інформації й ефективно прикладне застосування на основі формування цілісного образу інтерпретованої інформації); г) семантико-лексична близькість мови іншомовного тексту до мови інтерпретатора (слов'янські мови, зокрема, російська; й вплив культурно-історичних особливостей середовища проживання інтерпретатора); д) мотивація до оперування інформацією (потреба у високій професіоналізації характеризує причини розуміння та застосування інформації). В ході проведеного емпіричного дослідження: 1) виділено рівні інтерпретації (науковий, емоційно-сенситивний, творчий) як складника розуміння іншомовної наукового тексту, передумовою якої є рівень інтелекту; 2) прослідковано залежність успішності навчально-професійної діяльності студентів-механіків (високої, середньої, низької) від рівнів інтерпретації іншомовного наукового тексту через показники тривожності.

**Ключові слова:** розуміння, текст, інтелект, мовлення, мова.

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*Reviewed by Doctor of Psychology, prof. K. Oleksandrenko*