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PREDICTORS OF TEENAGERS' LEARNING AND LANGUAGE ABILITIES DEVELOPMENT

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Abstract

The study implements the interdisciplinary differential approach to the identification of predictors of learning, which explain the presence and development of linguistic abilities in teenagers and reveal the deep connection of language and speech in the formation of personal characteristics and in the assimilation of cultural and historical experience embedded in the language. The purpose of the study was to identify predictors of learning and development of language abilities in teenagers. Linguistic, psychological, pedagogical and psychophysiological aspects of learning are considered. The theoretical part gives a brief analysis of modern approaches to the dichotomy “language and speech”, “thinking and speech”, diachronic and synchronic approaches to language, highlights the problem of learning ability and learning outcomes, considers approaches to abilities in general and linguistic abilities in particular, defines their types. Biological (natural) and social (cultural) predictors are identified, which are divided into a) dichotic, gender and psychophysiological; b) communicative-speech (personal) and cognitive-linguistic. The study involves the proposed predictors, according to which the study methods were selected (testing, EEG, REC, scale, effective samples, academic performance in dynamics, etc.). The study results were processed using the SPSS statistical package by mathematical analysis methods (descriptive statistics, parametric and non-parametric criteria, cluster and correlation analysis). The evidence of the presence of predictors of learning and development of linguistic abilities depending on the level of training was obtained, psychophysiological, psychological, linguistic and social differences in teaching teenagers were identified.

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1. Introduction

Due to the rapid changes in the society, teenagers are subjected to increased requirements for the assimilation and practical application of cultural and historical experience, the transmission of which is possible only through language. The forms of learning are also changing: traditional forms are replaced by digital technologies, the use of which requires studying the natural and socio-psychological characteristics of students and the conditions of learning that affect its success (Kabardov & Osnitsky, 2019). One of the criteria for education success is learning inextricably linked to language abilities.

Before developing language abilities, it is necessary to determine what they include and what they do not imply. This issue requires identifying similarities and differences in understanding of “language”, “speech” and “thinking”. The dichotomy of “language” and “speech” is considered by modern scientists from various points of view, and a general approach “trying on” these categories has not yet been developed. There are two lines of justification for the authors’ view of the nature of language and speech. The first line includes a diachronic approach to language, where changes in the structure of the language are studied, which are found when comparing different stages of its development, analysis of the origin of language and speech is carried out and is often devoted to the study of their evolution and genesis (Chomsky & Berwick, 2018; Koshelev, 2019). In particular, the issue of a person’s innate or acquired ability to speak and perceive speech is discussed. Thus, Noam Chomsky believes that there is initially a speech mechanism, which is inherent only in humans. At the same time, his co-author justifies the point of view on expanding the boundaries of language development: songbirds already have the ability to soundproofing, which leads to the development of certain parts of their brain and contributes to both the perception and the transmission of special sound codes with a complex structure to their relatives. Hence, if a child develops musical hearing, then he will develop not only musical abilities, but also linguistic ones. There is another point of view, according to which the development of language and speech is associated with the thinking of a person, his social environment and his activities, and is determined by the culture of the people of which he is the bearer (Koshelev, 2019; Kuntay et al., 2017). In other words, a person is able to imitate his environment, he masters the activities that are characteristic of his community and correspond to the level of progress of the ethnic group. In this case, the development of linguistic abilities will fully depend on the development of activities and the degree of their complexity, which will inevitably affect the language. Following the logic of the authors, the development of new activities and their differentiation will contribute to linguistic development, which, in general, will affect the progress of the language – the emergence of new linguistic units, due to the progress of society and the development of its culture.

The second line reflects the synchronic approach, which involves the study of the systemic properties of language units at a certain point in its development and concerns the study of the relation of thinking and speech (Göksun et al., 2017). This approach is characterized by a set of factors that change the object of study. The approach is very fruitful. There are different movements and points of view on the structure of speech and the functioning of the language. Both a component analysis of the language and an assessment of its discourse – a full text and its surroundings are carried out. For example, Koshelev (2015) conducts a cognitive analysis of universal human concepts, in which the phenomena of language and thinking come together. He proposes a reference semantic theory in which both language

and speech function. They are not opposed to each other, but are combined in the meaning (concept) of a word. According to the author, semantic theory must satisfy the following conditions: 1) explain the mechanisms for the formation of new lexical words by native speakers; 2) explain the mechanism of formation of the first ideas about lexical meanings of words in a child; 3) in the definition of lexical meanings rely not on verbal descriptions (interpretations) recorded in explanatory or synonymous dictionaries, but on a special system of cognitive concepts that any native speaker skillfully uses (Koshelev, 2015). The problem that the author denotes is that when operated by the concept, he relies not so much on the visual representation (prototype) of a word but on its hidden functional characteristics (semantic kernel). The dual structure of the basic meaning of a word includes visual characteristic of typical referents (objects and actions) and an anthropocentric (comparable to functional) characteristic inherent in all direct referents of the word. In this case, language abilities and language learning will be able to distinguish the elements of this structure and their properties and establish relationships between them. Knowing the mechanism of education and assimilation of the word meaning, it is possible to identify the stages of development of linguistic abilities, which can also be attributed to their predictors. In the study of the language, traditional elements expressed in the language sign are also distinguished. However, what to consider a sign, what are its boundaries and properties are the issues that are currently debatable. For example, Kuznetsov (2019) considers the semiological and linguistic aspects of the language sign highlighting its arbitrariness and motivation. The study of the arbitrariness and motivation of lexical signs on the material of foreign languages concerns the relationship of abstract and specific, general and singular, virtual and current, wide-digital and narrow-digital; separation of arbitrariness and motivation. The author analyzes approaches to the motivation of the language sign, discusses its types (explicit and implicit). If explicit motivation is well studied, because it follows from the properties of the sign, the meaning of which follows from their morphological composition, then the implicit motivation of the lexical sign is a little-studied topic, which becomes a separate subject of study. According to the scientist, the sources of implicit motivation are the internal form, diachrony and etymology of a word. Motivation is represented in the language by hypo-hyponymic relations. The sources of hyponym signs are the features of lexical-semantic development and their cultural and historical conditionality. This point of view of the author on the properties of the language sign brings together opposite positions and opens up new opportunities for the use of language and speech in the development of linguistic abilities. Lakusta et al. (2017) complement semantic analysis and associate the semantic structure of a word with pre-verbal representations. To identify the structure and complex composition of the meaning of a word, modern methods of psycholinguistics are being developed and used (Pishchalnikova et al., 2019; Stepykin, 2016). Thus, a free associative experiment has become one of the main methods in domestic psycholinguistics for collecting empirical data when modeling an associative field, which, in turn, is used to solve a variety of theoretical and pragmatic problems. In an associative experiment, the activity attitude of a person to the world is found, represented by a specific connection of the stimulus and reaction under the conditions of a particular activity, including speech. This attitude (motive) determines the strategies of verbal activity relevant to the individual and indirectly – the specifics of conceptualization of the world. The use of an associative experiment allows identifying not only the explicit meanings of word stimuli, but also bringing its deep mental connections into consciousness. The method shows a way to actualize

the psychological meaning of a word as an object of activity of an individual. The preferences of the individual in the methods of acting with the word are determined by the specifics of his image of the world and the motives of activity, but they – both the image of the world and the motives – are formed under the influence of culture (Pishchalnikova et al., 2019). The content of the associative field is also studied, which is a product and tool for analyzing the meaning of words, the levels of its semantization are distinguished (Stepykin, 2016), the motif and its predicates in speech action are simulated and cognitive problems are considered when students learn a foreign language (Kosheleva, 2020) as an applied direction of the synchronic approach in the study of language and speech. In our study, we apply this approach, on the basis of which we selected research methods that allow fixing both the process and the result of training (based on the material of the development of linguistic abilities).

The learning process and its outcome depend on the didactic system in which it is carried out. It includes structural elements (who, why, what, how and where to teach) and assesses the learning outcomes in different ways. Any pedagogical approach requires its own teaching methods. It always relies on the level of knowledge about the subjects of the pedagogical process, its dynamics and results, which characterizes the development of society and its culture. For example, if you set educational tasks for a student, then you can evaluate the result of their performance, an algorithm, intellectual operations, the ability to apply the acquired knowledge in another situation, or the ability to set new tasks taking into account and without past experience. Considering the didactic system in which training is deployed involves modeling the educational environment (Panov, 2007). At the same time, it directly affects the understanding of linguistic abilities. Let us consider the problem of abilities in general and linguistic abilities in particular in more detail.

The problem of ability, personality and individuality has so far remained one of the most pressing in modern psychology. Until now, scientists have been interested in questions about the nature of innate and acquired abilities in nature, about the connection of the typological properties of the nervous system as the potential of abilities. A large number of works of world-famous scientists were devoted to this problem, such as I.P. Pavlov, V.D. Nebylitsyn, I.M. Sechenov, V.M. Bekhterev, V.N. Myasishchev, A. Anastasi, S.L. Rubinstein, A.N. Leontyev, B.M. Teplov and many others. Leading experts in the field of psychology and psycholinguistics (L.S. Vygotsky, A.R. Luria, A.A. Leontyev), psychology and psychophysiology of individual differences (E.A. Golubeva, M.K. Kabardov), who determined the modern approach to its solution, also made a great contribution to the study of this problem (Golubeva, 2005; Kabardov, 2013). Currently, both the structure of general and special abilities is being studied. The types of abilities are distinguished, the basis of the talent of children and teenagers in various fields of activity is studied (Arcishevskaya et al., 2011).

There are two directions in domestic psychology that interpret the problem of abilities. The first is psychophysiological, which explores the connections between the main properties of the nervous system (potential) and the general mental abilities of a person (E.A. Golubeva, M.K. Kabardov, V.M. Rusalov and others) (Golubev, 2005). Another direction is the study of abilities in individual, game, educational, labor activities (it includes supporters of the A.N. Leontyev's activity approach). To a greater extent this direction considers the activity determinants of the development of abilities, while the role of potential is either not considered or simply implied. The S.L. Rubinstein's school proposes a compromise point of

view on the study of ability problems. Scientists who share this point of view considered the abilities that arise in humans on the basis of the potential as the development of ways of activity. In this study, we will hold this point of view.

In modern psychodidactics, there are at least four psychological and pedagogical approaches to understanding abilities: 1) the idea of abilities as individual psychological properties of the individual that he currently has and which are characteristic of him “for the rest of his life”; 2) a view of the abilities of a student, which are necessary and can be developed; 3) the statement that abilities develop in the course of performing activities leading to a given age and 4) the idea that a student’s abilities may be present in a hidden, undeclared form (Panov, 2007). Depending on the chosen approach, abilities can be understood as the formed (given) property of the student’s psyche, as a property that can develop under certain conditions and as a potential property that can and should be shown and developed under the presence of appropriate conditions. Then the strategies of students learning and development will depend on the understanding of ability to select children according to the level of actual development of abilities of a particular type (for example, general, special); to select children according to the level of relevant development of abilities with the possibility of their further development or creation of conditions for potential abilities and their development. In our study, we analyzed the development of abilities in dynamics, the result of which was manifested in specially selected samples based on different predictors of learning and development of language abilities.

To understand the mechanism of development of linguistic abilities, let us address the interpretation of the learning concept, which in a broad sense means a complex dynamic system of individual properties of a person determining the productivity of educational activities, the speed and quality of mastering social experience or the readiness to acquire knowledge and ways of action, the readiness to transition to new levels of learning (learning here is understood as the achieved or planned learning outcome). According to Markova (1972), learning is a characteristic of the current development of a student, and learning ability is a characteristic of his potential development opportunities. The concept of “learning ability” was introduced into the science by Menchinskaya (1957) and is similar in meaning to the foreign-language term “ability to learn”. Initially, the term was applied to human thinking and included the properties of thinking. In the future, the meaning of the term has expanded to include the personal and social characteristics of a person. For example, Markova (1972) proposed such indicators of learning ability as orientation activity in new conditions, perseverance in achieving the set goal, susceptibility and readiness to help another person, etc. At the same time, a number of authors include psychophysiological processes in the characteristics of learning ability (excitement and slowdown and their ratio, performance, reaction rate, pace and rhythm of activity); sensory and perceptual processes (grasping or detailing the type of perception, its selectivity, sensitivity, features of the development of auditory or visual sensation), self-regulation of resistance, etc.

The Laboratory of Differential Psychology and Psychophysiology of PI RAE under the leadership of Kabardov (2013) fruitfully solves problems of linguistic abilities, combining the considered approaches. A systematic study of natural (innate) mechanisms ensuring the success of human activity – educational, labor, etc. are being carried out. Based on modern ideas about the nature of information processing, the problem of the ratio of two signal systems in the context of the interaction of general and

especially human properties of the nervous system and interhemispheric differences is investigated. The applied aspects of the typological concept associated with solving the problems of individualization and differentiation of training are extremely important. The introduction of theoretical approaches and diagnostic methods developed under his leadership in the Laboratory of Differential Psychology and Psychophysiology into the practice of education contribute to the creation of optimal conditions for the development of abilities and the realization of the creative potential of a person. The typology of linguistic abilities obtained by Kabardov (2013) is applicable to teaching foreign languages. As a result of an in-depth study of communicative qualities in the process of mastering a foreign language in conditions of intensive training, the scientist identified two types of mastery of a foreign language that have a different psychophysiological basis, or different neurodynamic characteristics, calling them a **communicative and non-communicative (cognitive)** type. The criterion distinguishing the two groups was the methods and techniques of mastering a foreign language, which determine the style of activity in the conditions of foreign language teaching. The parameters that differentiate the two groups include the following: the degree of awareness/unconsciousness of studying language phenomena, the arbitrariness/involuntary activity during communication training, the preference for a channel of perception of auditory or visual, synthetic/analytical approach to the studied phenomena, the lability/inertia of the nervous system, which determines the speed parameters of speech production. Table 01 presents psychophysiological indicators of the types of language abilities:

Table 1. Psychophysiological indicators of linguistic abilities

Communicative type		Cognitive type	
Labile type of the nervous system		Inert type of the nervous system	
High indicators	Low indicators	High indicators	Low indicators
Auditory perception	Visual perception	Visual perception	Auditory perception
Auditory memory	Visual memory	Visual memory	Auditory memory
Speech speed	Analysis synthesis	Analysis synthesis	Speech speed
Quality of articulation	Logical thinking	Logical thinking	Quality of articulation
Short latent period			Long latent period
Extroversion			Introversion

The literature analysis allowed identifying predictors of learning and development of linguistic abilities. We believe that there are biological (natural) and social (cultural) predictors that are divided into (a) morphofunctional, gender and psychophysiological; b) communicative-speech (personal) and cognitive-linguistic. In turn, communicative-speech contain the personal qualities of an individual, which contribute or do not contribute to his training. Cognitive-linguistic includes both general abilities (for example, intellectual) and the features of its cognitive development, which affects the level of language and speech proficiency.

2. Problem Statement

In addition to identifying the types of language abilities, it is important to highlight the predictors of learning that would allow not only stating the level of current development, but also predicting the level of potential development of students. Adolescence is the most favorable for study in terms of

formation and development of abilities in educational activities in school settings. With regard to the development of the linguistic abilities of teenagers, the study allows determining the level of their formation taking into account the identified predictors of learning (biological and social) and creating conditions for their further development.

3. Research Questions

Language is the most important communication tool, while speech is its implementation and is an individual version of speaking. The disclosure and development of linguistic abilities includes natural prerequisites and differences in the learning ability of an individual, as well as developed skills and qualities formed in the process of learning. We assume that the degree of language mastery depends on different predictors of learning, i.e. their favorable/unfavorable relationship:

1. The basic (initial) level of language proficiency will be dominated by natural predictors associated with the individual properties of a student, such as gender, psychophysiological and interhemispheric differences.

2. At the average level of language proficiency, social predictors will be formed, including cognitive-linguistic and communicative-personal characteristics of students, provided that the conditions, methods and means of learning remain relatively unchanged.

4. Purpose of the Study

The purpose of the study was to identify predictors of learning and development of language abilities in teenagers. We suggested that adolescent learning is associated not only with the biological prerequisites of linguistic abilities, but also with the socio-cultural personality neoplasms acquired by schoolchildren during the educational process.

5. Research Methods

The research procedure included a longitudinal study of language abilities of teenagers throughout the school year. The sampling covered 60 teenagers from 14 to 15 years old (average age 14.6 years, of which there were 30 boys and 30 girls).

The research methods included the identification of the following predictors:

A) natural:

- dichotic listening method proposed by D. Kimura to study hemispheric speech asymmetry. The method was first modified in Russian by Kok et al., then by a team of authors (as cited in Turovskaya et al., 1988). This method is based on the simultaneous presentation of verbal material on both ears through headphones in order to reproduce these words in between presentations. Under these conditions, the dominance of one of the hemispheres of the brain was determined depending on the number of reproduced words presented either in the right or in the left ear. This study used a new modification of this method. In each of the two series, the subjects were presented with seven sets of words consisting of four pairs of single-syllable words. Unlike the first Russian version, here the words in two series were not repeated in order

to exclude the possibility of remembering the words already presented in the first series. The number of words correctly reproduced separately from the right and left headphones was analyzed; the total number of correctly reproduced words as an indicator of the short-term memory productivity; the right ear coefficient (REC), positive values of which indicate the dominance of the left hemisphere in speech, and negative values – of the right hemisphere; close to zero (from 5 to –5 %) means symmetry (ambidexterity).

- gender differences were assessed based on the results of all methods.
- psychophysiological methods: data of EEG rhythms in the background and when imposing light flashes of different frequency (4–6 Hz; 18 Hz; 20–25 Hz). The EEG indicators of the nervous system (NC) properties were investigated, including characteristics of its three main properties: lability, weakness and activation of NC. Five separate activation indicators of the EEG background were used: alpha frequency, theta frequency, energy expression indicators of slow delta-, theta- and beta- and alpha rhythms taken for the left and right hemispheres separately.

B) social:

- Wechsler Intelligence Scale for Children (WISC) with subtests was conducted to diagnose intellectual abilities. With its help, the level of development of the general, verbal and non-verbal intellectual indicator (GII, VII and NII) was revealed. As is known, verbal subtests require the use of verbal-logical means, and VII is assessed by the speech responses of the test subject. Nonverbal subtests are associated with the manipulation of specific nonverbal material, and responses are assessed based on the results of solving image-like problems using visual perception (without a complete speech response). A characteristic feature of these subtests is that they strictly limit each task to time.
- complete personal questionnaire by R. Kettell (16 PF) designed for teenagers. It includes the following scales: A, B, C, D, E, F G, G, I, J, L, M, N, O, Q1, Q2, Q3 b Q4 combined into 4 general factors.
- tests of linguistic abilities measuring the dichotomous relationships “cognition-communication”, “language-speech”, “verbal-nonverbal” means, “arbitrariness-involuntary” forms of activity (speech fluency, word use, language analysis, etc.).
- average grades of academic performance at school during the school year that students received in the course of their studies. The grades were measured both for certain subjects and for a cycle of disciplines – language, humanities and separately for foreign language proficiency level.

The thought and speech sphere was studied by the indicator “lability-inertness” coupled with individual differences in the ratio of the first and second signal systems: verbality-nonverbality of intelligence, predominant expression of figurative-effective or verbal-logical style of activity.

The study results were processed using the SPSS statistical package by mathematical analysis methods (descriptive statistics, parametric and non-parametric criteria, cluster and correlation analysis).

6. Findings

The following results were obtained in the present study:

1. After checking the data for distribution normality, the cluster analysis was used to assess the main factors affecting learning and development of language abilities. The main groups combining the psychophysiological and psychological characteristics of students included the general activation of the nervous system and all its other properties, and personality properties. We explain this by the fact that in order to start learning, you just need to learn (be active). Learning has a physiological basis, but is directed by students.

2. To determine the level of development of linguistic abilities, the overall academic performance was divided into groups depending on the cycle of disciplines – language, humanities and separately according to foreign language proficiency level, as well as on the learning success (1st subgroup – average grades for the year from 4 points inclusive and higher; 2nd subgroup – below 4 points). Such subjects as Russian language, literature and foreign language belong to the language cycle; history and geography – to humanities. Foreign language grades were based on the average foreign language performance. The results of the study determined that:

2.1. according to psychophysiological indicators, the success of teaching humanities is associated with the strength of the nervous system: it is more difficult for teenagers with a weak type of NS to learn ($p < 0.05$). Students with high and low grades in language disciplines and foreign language do not show such differences (there are no statistically significant differences). At the same time, all three subgroups demonstrate reliable differences (depending on academic performance) according to the REC method: among successful schoolchildren, left-ear ones prevail, in which cognitive abilities develop more easily.

2.2. in the process of developing linguistic abilities, general and verbal intelligence develops and the difference between verbal and non-verbal intelligence increases ($p < 0.01$). The development of language abilities is characterized by an increase in awareness and vocabulary ($p < 0.01$), comprehensiveness ($p < 0.05$) and the general development of cognitive abilities.

2.3. the development of abilities related to humanities has a similar pattern, with the exception of enhancing cognitive abilities.

In the process of mastering a foreign language, not only cognitive, but also communicative abilities develop, differences in almost all indicators of linguistic abilities increase ($p < 0.01$). Schoolchildren who do well in foreign language, along with verbal begin to develop non-verbal intelligence.

The lack of development of spatial and effective skills that appear to develop later turned out to be typical for all subgroups.

3. Differences in the degree of expression of personality qualities are not statistically significant, which suggests that these qualities are only formed in teenagers and are characteristic of adolescence as a whole. However, there are significant correlations between personality properties and other indicators of language abilities, which reveals their type and explains the difference in the approach to teaching language disciplines (the significance level of differences ranges from 0.01 to 0.05).

4. Gender differences according to the studied indicators of cognitive and communicative development of linguistic abilities are expressed in the fact that girls, compared to boys, show greater lability, which is possibly explained by the natural age characteristics of teenagers ($p < 0.05$). However, differences can be observed in the expression of personal traits: girls are more sociable, soft-hearted and emotionally stable, and boys are more closed, harsh (tough) and variable ($p < 0.05$). An interesting fact turned out to be an empirical fact in which boys form an activity component faster than girls (“fulfilled” and “coding” techniques), which requires an individual educational approach taking into account gender features ($p < 0.05$).

5. The final results of the study prove different approaches to the development of linguistic abilities, which are associated with the level of training and on which the learning ability of teenagers depends. The predictors of learning and development of their language abilities are reflected in Table 02.

Table 2. Predictors of teenage learning and language abilities

Zero level	Initial level	Average level	High level
General activation of the nervous system	Natural predictors Left and right hemisphere	Natural and social predictors Gender differences	Social predictors Personality properties Types of language abilities (cognitive and communicative) / according to M.K. Kabardov
Learning motivation	Lability / inertia of the nervous system	Certain components of language abilities (extension of the dictionary, understanding of the meaning of words, awareness, understanding of instructions, etc.)	

7. Conclusion

Changing the conditions and methods of training in the modern world, the emergence of new opportunities for personal and professional development requires, on the one hand, taking into account the individual characteristics of students, and on the other, identifying laws related to the stages of training. These include predictors of learning and the development of language abilities, which make it possible to diagnose not only the level of current development, but also the potential.

In the future, it is planned to study the depth of mastering the semantics of a word, identify its motivational basis and cultural specifics. The expansion of the activity component will make it possible to continue the study of the ratio of predictors at subsequent levels of language and speech and the realization of the desire of students to bring it to perfection when teaching the language taking into account psychophysiological, psychological and social characteristics of students.

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