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10 PROJECTIVE–RECURSIVE TECHNOLOGY AS A PREDICTOR OF EFFICIENCY IN ENGLISH LANGUAGE TEACHING

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ABSTRACT

The work is devoted to the analysis of intellectual resources of projective-recursive technology in teaching English.

The authors highlight the essential dimensions and basic characteristics of metacognitive activity: planning, cognitive monitoring, control as mechanisms for regulating intellectual activity by subjects of foreign language learning. The importance of the active position of education seekers in the areas of monitoring and control of knowledge and skills of learning English is emphasized. The role of recursive mechanisms in organizing thought-speech patterns and ensuring productive feedback in bilingual communication situations is substantiated. The experience of using projective-recursive technology in teaching English metacognitive schemes of various types in teaching English is presented: schemes of grammatical sequence, conceptual, algorithmic and mental schemes. The effectiveness of the use of metacognitive schemes in the logic of projective-recursive technology of teaching English has been proven.

KEYWORDS

Metacognitive activity, metacognitive monitoring, projective-recursive technology, metacognitive schemes, foreign language teaching.

10.1 CONCEPTUAL PRINCIPLES OF METACOGNITIVE ACTIVITY OF THE INDIVIDUAL WHEN LEARNING A FOREIGN LANGUAGE

The polymodality of rapid changes, the total digitalization of all segments of the modern information society lead to a prolonged modification of the worldview concepts of humanity, predictors of the sociolect of subjects of linguistic consciousness, which form the conceptual space of the mental continuum of the 21st century. Representatives of the new generation – the Internet-Generation, whose cognitive life-creation strategies are consonant with the variable matrix of the world order of the information society and the unbridled dynamics of the present, are especially sensitive to the latest trends in the development of the space-time chronotope of civilization. Powerful digital technologies, the availability of information and artificial intelligence services, the possibility of integration into a wide network space express the subjective resources of the new generation of humanity, directing young people to the constants of *soft-skills* of personal development programs. At the same time, the intellectual models of the Internet generation are becoming increasingly widespread: clip-like thinking, a superficial approach to information analysis and decision-making, simplification of logical-semantic constructions of speech, orientation to the test format

for monitoring the quality of knowledge [1, 2], neglect of scenarios for the formation of hard skills, and in particular — in mastering a foreign language. Therefore, the current contradiction between the challenges of intensive digitalization of the socio-cultural space of the 21st century and the tendency to simplify cognitive strategies for the Internet generation's understanding of models of the world order necessitates a rethinking of the paradigmatic meanings of the cognitive development of young people, and primarily in the area of improving the teaching of the foreign (English) language.

The world scientific community is constantly discussing the issues of monitoring and contextual designation of indicators of multidimensional quality of foreign language teaching [2], emphasizing the need for integrity and multi-vector perception of educational reality, which provides adequate learning experience and stimulates the formation of cognitive interest of students in learning a foreign language [2, 3]. We are absolutely aware of the fact (and this is confirmed by the analysis of scientific and methodological literature and our own experience of teaching English [4]) that only a meaningful attitude to learning a foreign language with systematic mastery of language material and consistent language practice formats prolonged analytical-synthetic and cause-and-effect relationships that contribute to the development of foreign language thinking and coherent speech and guarantee high-quality language mastery. Similar ideas are also expressed by Y. Jiani, Zh. Fusheng, Li Hongying [2], M. Angelini, A. García-Carbonell [3], focusing on the importance of the development of language activity in accordance with the grammatical schemes and semantic connections of the foreign language system, which determines the formation of full-fledged language and communicative competence of students. R. Gardner [5] emphasizes the importance for the full formatting of language consciousness and language competences of the development of language activity of students in accordance with the grammatical schemes and semantic constructs of a foreign language (Second Language). And the concept of metacognitive activity of subjects of language consciousness seems to us the most adequate in the context of the above.

The concept of metacognitive activity is a relatively new construct for psycholinguistics. The conceptual foundations of the study of metacognitive processes and metacognitive activity of the individual as a whole are associated with the research work of J. Flavell, who was the first to use the concept of "metacognition" to denote a special class of integrative processes, aimed at regulating cognitive activity [6]. In modern cognitive science, the most well-founded are primarily the following theoretical models of metacognition: the cognitive monitoring model of J. Flavell [6], the process-oriented model of metacognition of J. Borkowski [7], and the two-level model of metacognitive regulation of T. Nelson and L. Narens [8].

According to the theoretical and methodological conclusions of the scientists, the semantic registers of metacognition determine special integrative (in the unity of cognitive, psychosocial, psycholinguistic, linguistic markers) processes, aimed at regulating cognitive activity [6–9], in particular: forecasting (goal setting), planning, monitoring and control.

Functionally, metacognition resonates with the paradigmatic vectors of reflection of the sensory-perceptual, mnemonic, intellectual and communicative-interactive segments of conscious self-realization by the subject. Recognition of information objects, phonological and semantic coding and decoding of speech syntagms, expression of semantic constructs (especially when learning a foreign language by students of different levels of education) fall under meta-level control and normotypic assessment of the quality of metacognitive activity. T. Nelson and L. Narens, for example, note that metacognition makes the educational process

more effective, influencing the cognitive actions of students at different stages of the process of mastering knowledge and skills — from the actualization of the stimulus to the final understanding of the information content [8]. Accordingly, metacognitive activity means a general paradigmatic continuum of comprehension by the subject of knowledge of the predictors of his/her own mental reflection of reality, which consists not only in the reflective contemplation by the person of his/her internal mental reality, but also in the ability to manage his/her cognitive processes: the ability to consciously formulate the goal of cognition, analyze the conditions of the task, evaluate and choose the most effective strategies for solving the problem issue, and also evaluate the success of the work performed. Therefore, we can interpret the concept of "metacognitive activity" as an intrapsychic mechanism for regulating cognitive and metacognitive processes through positive implicit beliefs of the individual regarding his or her own cognitive sphere and the intensification of the main parameters (purposefulness, expediency, speed, productivity, flexibility, awareness) of cognitive activity [9–11].

Perceiving the metacognitive activity of subjects of educational activity as the most perfect way of conscious management of intellectual activity, tracking the sequence and essential aspects of cognitive actions (goal setting, planning of mental actions and control over their course), we can state a two-component perspective of metacognition, which is realized in the integrity of the content-regulatory and functional-regulatory segments of metacognitive activity. The implementation of the content-regulatory aspect of metacognition determines the awareness by the student of the meaning of his/her own cognitive processes, monitoring the level of mastery by means of their regulation and improvement, understanding his/her own resources on the way to the goal of cognitive activity. The functional-regulatory segment of metacognition expresses the metacognitive (and therefore — conscious and controlled) involvement of the student in the educational process, acceptance of the goal of the educational system, the meanings of the educational program, the ability to control the results and reflect on the course of the cognitive process. Metacognitive control in combination with implicit judgments of metacognitive monitoring (in particular, such as awareness of gaps in knowledge and the need to resolve the problem, awareness of the significance of certain information for correcting errors; motivational judgments and guidelines necessary for understanding and managing learning, etc.) determines the procedural features of planning and distributing learning time, using effective learning strategies and techniques, and assessing the progress of one's own achievements (for example, [4, 7, 8, 10]).

An important role in building the competences of metacognitive activity of education seekers, their awareness of the essence of their own cognitive activity and its results is played by metacognitive monitoring — a complexly structured combination of cognitive actions, aimed at tracking the sequence of the process and results of cognition during the performance of tasks and the assimilation of experience. The dimensions of metacognitive monitoring record not only the understanding by education seekers of the procedural coordinates of learning and the results of their own cognitive activity, the ability to track the specifics of internalized experience, but also organize and systematize the skills of analyzing their own cognitive actions, the conditions for applying the necessary educational strategies, and explicit judgments in the perspective of the holistic development of the mental structures of the personality. According to the statement of Yu. Vatan (which we fully share), reflective processes, thanks to which a person receives information about his/her cognitive activity, give a person the opportunity to influence the dimensions of cognition: to adequately perceive, process, store and reproduce information, plan and predict the results of

cognitive actions, control and adjust the process and the cost of personal and intellectual resources [9, 12]. Thus, the metacognitive activity of subjects studying a foreign language appears as a basic predictor of the management of intellectual activity, the fundamental basis of which is not the objective, but the subjective reality of a person's mental reflection and worldview. Therefore, there are grounds to study the metacognitive activity of a person as a special segment of self-consciousness, focused on understanding the personified formants of the mental and speech constructs of human experience and the prospects of learning in general. For example, in the planes of P. Tarricone's taxonomy of cognitions [11], two groups of critical markers of the development of the personality and consciousness of subjects of activity are expressed:

1) metacognitive knowledge: awareness and metamemory of a person about him/herself and others (knowledge about motivational drives, identity and self-awareness of subjects of cognitive activity, universal knowledge about human interaction), knowledge about the cognitive task, its contextual characteristics and solution strategies. The level of metacognitive regulation of the information field and coordinates of a person's cognitive experience also concerns strategies for processing information, its planning, monitoring, control, critical evaluation and reflection;

2) metacognitive skills: skills of self-regulation, monitoring and control of self- and inter-regulatory aspects of cognitive processes; skills of decision-making and choosing effective metacognitive strategies for solving a problem. Metacognitive information processing skills are considered by P. Tarricone as a necessary condition for improving the learning outcomes of schoolchildren and students of different age groups [11].

Pragmatic structures of regulatory functions of metacognitive activity of subjects of learning, and in particular — on the path of mastering a foreign language, play a special role in the thought-speech continuum of subjective human experience, which is explained by the intentional nature of the feature and is operationally expressed in various ways, among which we consider the most effective projective-recursive technology of organizing English language learning.

10.2 ESSENTIAL FEATURES OF PROJECTIVE–RECURSIVE TECHNOLOGY IN ENGLISH LANGUAGE TEACHING

The multilingualism of the living environment of representatives of the modern Internet generation determines the need to develop the ability to understand and independently model textual constructs of a foreign language, and therefore — to form a secondary linguistic personality, which generates vectors of synergistic worldview and life creation at the cross-cultural level of being. The axiomatic scenario for the development of the linguistic consciousness of the individual (in particular, when learning English as a foreign language) can be recognized as the content of the actualization of metacognitive processes in the system of development of reflective and metacognitive forms of intellectual activity. At the same time, the problem of linguodidactic substantiation of strategies for improving the metacognitive skills of pupils and students is still on the periphery of scientific research. Starting from the initial stages of teaching a foreign language, students are traditionally focused on the completeness and accuracy of perception and reproduction (recall) of information, and not on the development of competent solution of semantic, problematic tasks in the discourse of the language being studied. While imitative, mainly passive-mechanistic models of teaching English cannot

guarantee the development of speech and thinking skills of metacognitive activity of the individual in accordance with the grammatical schemes and semantic connections of the foreign language system. Therefore, we consider it necessary when modeling the educational environment for teaching a foreign language for specialists to focus on formatting the metacognitive skills of the individual — the ability to independently build the semantic structure of a speech utterance, understanding the textual constructs of a foreign language; to focus on the significance of developing metacognitive aspects of dynamic communication, which is conceived as a multilevel process, focused on the self-configuration of meanings in the dialogue of cultures.

An interesting experience of expressing an integrative approach in the practice of teaching English, taking into account the concepts of metacognition, is, for example, the Content and Language Integrated Learning (hereinafter — CLIL) system, which is based on the awareness of the content continuum of the English language (see the works of D. Coyle, Ph. Hood, and D. Marsh [12]) and outlines the triad of sense formation: language as a tool of cognition (language of learning), language as a means of communication (language for learning) and language as a subject of study (language through learning). This allows teachers to focus on mastering the lexical and grammatical segment of the foreign language when teaching English, and at the same time to model a developmental educational space that stimulates the development of foreign language culture and metacognitive abilities of students. The vector of development of metacognitive (mental) skills in the CLIL system is directed from procedural cognitive formations (systems of knowledge, logical mechanisms of creation and understanding of speech constructs) to skills of analytical-synthetic activity [12], which contributes to the development of cognitive and metacognitive potential of the individual.

Scientific psycholinguistic research of the authors of this project [4, 13] led to the adaptive inclusion of projective-recursive technology, the most common in the field of programming and computer literacy training, into the integrative system of teaching English.

The composition of the innovative projective-recursive technology of teaching a foreign language was carried out taking into account the psycholinguistic principles of algorithmic analysis and recursive synthesis of pragmalinguistic speech formulas in the plane of projective strategies for the development of communicative competences of beneficiaries. In particular, it was noted that the content of the projective teaching strategy is quite effective for open systems with a certain degree of unpredictability in development, the functional significance of which is revealed in situations of uncertainty and cognitive dissonance — and this is exactly what the foreign language teaching system is.

The outline of the essence of the projective philosophy of foreign language teaching is based on the awareness of the coordinates of a time-limited purposeful change of a separate system (pragmalinguistic formula of foreign language content) in accordance with the established requirements for the quality of results and the expected expenditure of subjectively significant resources. In general, the term "projection" (from Latin *projectio* — "throwing forward") is actively used in mathematical sciences to denote the image of spatial figures on a plane, as well as in psychology — to denote the specificity of a person's perception of his/her own mental processes as properties of an external object through the unconscious transfer of his/her subjective impulses, maxims, and experiences to it. In the context of didactics, the semantic field of definitions "projection", "projective" reflects the integrative synthesis of both semantic constructs and can be considered as a promising aspect of personal modeling by the subject of cognition of the image of the desired result of metacognitive activity.

At the same time, human thinking regularly demonstrates recursive properties (functions, repeating fractals of self-similarity of features), to which language sequences are functionally adapted, which demonstrate the ability to produce nested sentences and speech constructions that expand the conceptual sphere of concepts and multilingual constructs. Therefore, recursive didactics involves constructive immersion in the discourse of the nonlinear-communicative paradigm of the post-nonclassical model of cognition.

Recursion (from Latin *recursiō* — "return") can be interpreted as the basis of metacognitive activity of subjects of the educational space, which allows building an individual cognitive map of a person's cognitive experience, creating "nesting" of some ideas into others on the border of objective stimuli (external educational instructions) and subjective (internal, internalized) schemes of understanding. Such a "recursive encounter" determines the format of the thinking and communicative processes of the authentic depth of mastering a foreign language, allows for the implementation of metacognitive patterns of thinking and speech events, taking into account the effect of the conscious involvement of the pupil and/or student in a specific language situation. The field of attention of the carriers of language consciousness is not the formal situation, but the subjective attitude of the individual to it, which specifies the metacognitive dimensions of a person's perception of textualized events, his/her personalized attitude to the development of the situation, awareness of markers of thinking and speech constructs, and behavioral patterns.

A thematic review of scientific discussions allows us to interpret the recursive model of cognition as a new direction in cognitive psychology, designed to describe the functioning of the psyche in various situations of social interaction; in particular, the recursive model denotes the coordinates of modeling human experience, how the subject evaluates situations, makes decisions, rethinks past experience, etc. Professor A. Anisimov, who has been involved in research on recursion in various spheres of human activity, defines this phenomenon as a way of organizing a system, in which the system at certain moments of its development creates its own modified copies, includes them in its structure and interacts with them [14], thereby activating human intellectual activity.

Recursive technologies for organizing the educational space are characterized primarily by the flexibility of describing educational and descriptive tasks, which allows in the dynamics of mastering a foreign language to vary logical sequences and language constructs (to complicate and/or simplify lexical formants, speech syntagmas, texts as a whole) in accordance with the rules of the educational program as a self-organized system. Therefore, in the dimension of building a projective-recursive model of cognition, there is an opportunity to avoid unfounded simplification of the thinking-speech content and the involved language resource and, at the same time, stimulate the metacognitive activity of the knowledge seeker, aimed not only at the reproductive recreation of the foreign language segment of experience, but also at the balanced production of informative constructs in order to achieve the planned goal and rethink previous experience in the perspective of bilingual text creation.

The operational sequence of learning a foreign language and the projective-recursive technology of building metacognitive skills in the context of the above appear as a tool that opens up a fractal-recursive psychological reality for a person, contributes to the development of personal reflexivity and the improvement of the resourcefulness of communicative feedback, necessary for the implementation of metacognitive monitoring and evaluation of the language experience, acquired by pupils and/or students. Accordingly, projective-recursive technology is deployed as a predictor of effective English language teaching, which is based on the formation of such metacognitions as:

— comparison of new information with previously acquired patterns of thinking and speech experience (knowledge and skills of the bilingual or multilingual continuum);

— selection and conscious use of optimal thinking operations for performing a certain task: building situational sequences, chronotopes of behavior patterns; categorization and comparison of objects of analysis; formation of cause-and-effect relationships, etc.;

— planning, monitoring and evaluation of procedural markers of foreign language constructions and communicative texts;

— providing congruent feedback in bilingual communication.

Deepening the meanings of recursion in the planes of a person's metacognitive activity guarantees the structuring of internal synergies of metacognition on the basis of repeated recursive actions with information.

Thus, recursion launches a sequential cycle of self-organization of thinking-speech patterns of learning a foreign language, where each previous stage creates the prerequisites for the next; projective-recursive technology harmonizes the synergies of the mental, thinking-speech and perceptual-interactive segments of the cognitive activity of the individual. The visualization of the above-mentioned cognitions in English language teaching is facilitated, in particular, by the use of metacognitive schemes.

10.3 DEVELOPMENTAL POTENTIAL OF METACOGNITIVE SCHEMES

One of the important attractors of improving the methodology of teaching a foreign language in the resource dimensions of projective-recursive technology is, in our opinion, the correspondence of the proposed teaching practices to the mental characteristics of the beneficiaries. This is determined by such principles of educational process management as:

— taking into account the socio-cultural context (L. Vygotsky) of the personal and intellectual development of subjects of metacognitive activity;

— orientation on markers of age development and sensitive periods of the genesis of personality existence, which specify the resource possibilities of mastering by consumers of educational services of a new generation of grammatical formulas and semantic constructs of a foreign language (R. Gardner, N. Tokareva, M. Tsegelska, A. Cleeremans, D. Achoui et al. [4, 5, 13, 15]), productive strategies of subject-subject communication and patterns of adequate behavior (N. Tokareva [1]);

— understanding of the tendencies of amplification (deepening and enrichment) of metacognitive development of the personality in the plane of continuous mental formation of subjects of activity (A. Cleeremans, D. Achoui [15]);

— awareness of the dialectical unity and asymmetry of the identification of emotional and intellectual vectors of mental development of the individual (L. Vygotsky) in the continuum of the principle of unity of consciousness and activity (S. Rubinstein), which determine the target representations of the first order in the educational process;

— recognition of the role of sign-symbolic patterns (semiotic structures of the word, meaning, mythologems) in the mediation of knowledge, skills, metacognitive experience of the individual as a whole;

— consideration of combining mechanisms of internalization (transfer of external, objective actions to the internal, intellectual plane — modeling of images, concepts, reasoning, inferences) and exteriorization (transfer of thoughts, ideas, images to the real plan of implementation — realization of metacognitive actions, behavioral patterns) of educational actions in the system.

Teaching English in a specially created open space of mental search, which allows students to conceptualize and expand the linguistic picture of the world, promotes consistent study and understanding by students of the mental structure of the foreign language, develops metacognitive skills of consciously building, controlling and monitoring the information model of the pragmalinguistic formula of foreign language content.

The approximate basis for teaching English with the use of projective-recursive technology is successfully formatted by metacognitive schemes (or maps), developed on the basis of the private enterprise "Interclass Educational Center" (Kryvyi Rih, Ukraine), certified as an institution of extracurricular education in the humanitarian direction [4, 13]. The complex of educational and developmental schemes has a powerful heuristic and developmental resource: schemes help structure students' thinking, enrich vocabulary, improve skills in categorization and classification of lexemes, contribute to the formation of speaking skills; they are the basis for the implementation of meaningful memorization.

Metacognitive schemes perform the functions of a graphic organizer of thematic context, sense formation and recursion of the logical-semantic discourse of the language being studied in the process of teaching English as a foreign language. With each subsequent level of training, pragmalinguistic formulas of schemes become more complicated, which allows implementing a broad logical sequence of formatting knowledge and skills of metacognitive activity in the ontogenetic and sociocultural dynamics of the development of the psyche of schoolchildren and students of different age groups.

Building a denotative graph and creating a corresponding pragmalinguistic formula (*perception of information — memorization — internalization, assimilation of knowledge — initiation of metacognitive activity, use of thinking and speech skills in the practice of bilingual communication*) in the linguistic consciousness of students of "Interclass" determines the systematicity of metacognitive perception and understanding of articulatory-grammatical, semantic and syntagmatic connections between concepts in the structure of the language field. Metacognitive schemes, modeled in the logic of projective-recursive technology, are divided into the following groups according to typological markers of their purpose:

— educational "grammatical rulers";

— conceptual schemes ("image schemes"), which specify information about a certain concept and its conceptual features in the coordinates of the corresponding thematic field;

— algorithmic schemes;

— mental schemes, the modeling of which occurs around a generalized idea in the dimensions of a certain language field.

Metacognitive schemes of the "Grammatical rulers" type are elementary sign systems — pictograms that visualize the sequence of construction of grammatical or syntagmatic constructions of the language being studied (**Fig. 10.1**).

Metacognitive schemes of the grammatical ruler type create the supporting foundations for mastering the logic of foreign language discourse and practicing the skills of adequate formatting of statements.

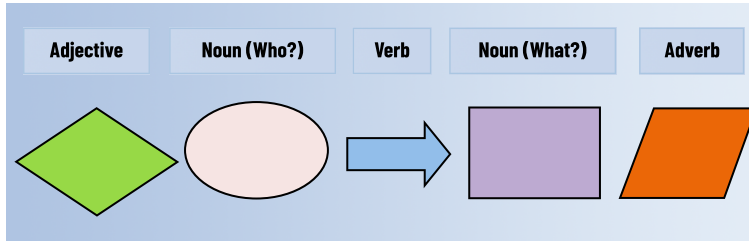

Fig. 10.1 An example of an elementary "grammatical ruler" – a scheme for designating the logical-semantic structuring of a sentence

Metacognitive schemes of the conceptual type perform in the process of teaching English the function of sense formation and construction of students' ideas about identified objects and the structure of the studied concept sphere. As a result of generalization and systematization of symbolic information, a mental denotative graph is built in the linguistic consciousness of students, which ensures understanding of grammatical connections between concepts in the structure of a specific linguistic field (**Fig. 10.2**).

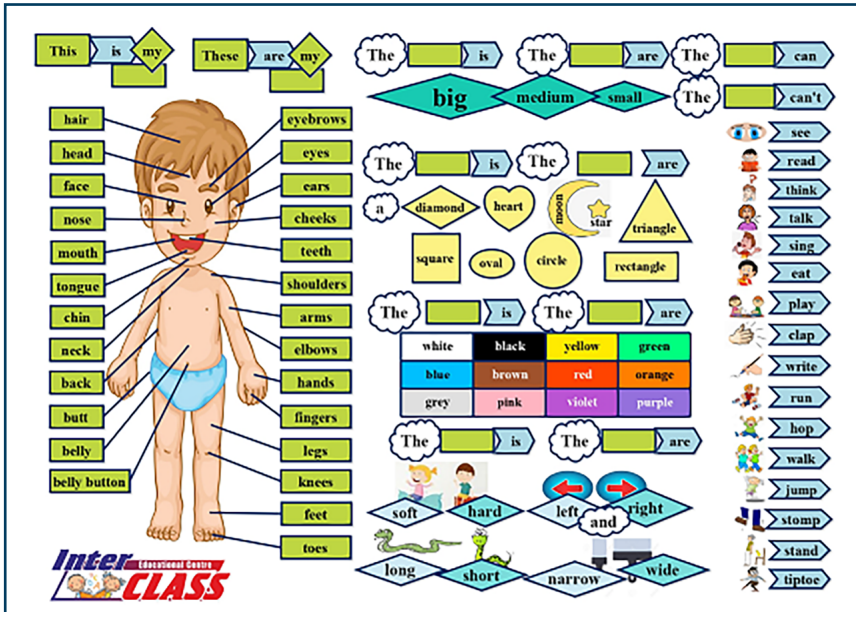

Fig. 10.2 Example of a metacognitive scheme of the conceptual type

Conceptual schemes are built similarly to a spidergram (from English *spider*) — a divariant model of the conceptual sphere of a certain notion, reflecting elementary logical-grammatical discourses of attributive language formations. Metacognitive schemes of the conceptual type ensure the formation of students' vocabulary, mastery of the experience of word formation, assimilation of new knowledge into the structure of linguistic consciousness.

More complex tasks of teaching English can be solved using *metacognitive schemes of the algorithmic type*, reflecting the systemic content of the metacognitive experience of the individual (from basic algorithmized structures — direction, branching to template schemes, patterns). Such metacognitive schemes contribute to the effective and conscious structuring of information, understanding of logical dependencies and coordination of elements of mental denotative graphs of different orders in systems of expansion (linguistic recursion) of the conceptual sphere of the studied notions. Algorithmic metacognitive schemes (**Fig. 10.3**) visually, using images, signs, differentiated color solutions, ensure the assimilation of a logical model and the formation of skills for building a language pattern in the system of foreign language syntax.

When assessing the resource of effectiveness of metacognitive algorithmic schemes, it is worth considering that they express the procedural sequence of metacognitive processes, integrating the dimensions of perception, thinking, and speech in a holistic pattern; Such schemes can suggest information that is missing for building a logical-semantic formula of a text construct (new, forgotten, or insufficiently learned), can become the basis for a heuristic strategy of a person's metacognitive activity.

The most complex form of metacognitive teaching schemes are integrated *mental schemes* (or mind maps), the model of which generalizes language fields and combines them into integral modules, which allows pupils and/or students to more consciously use the broad discourse of a foreign language in a multi-vector continuum of syntagmatic formations (**Fig. 10.4**).

For the purpose of formatting a mental scheme, you can use the projective-recursive content of metacognitive schemes of conceptual and algorithmic type; the processing of schemes of this type can be carried out in different vectors:

1) vertically, for example, in working with the mental scheme "Press" (**Fig. 10.4**) systematic development of metacognitive processes of perception, categorization and assimilation of the concepts "press product format", "size", "content", "illustrations", "details", etc. is ensured;

2) horizontally, for example, a mind map visualizes the sequence of composing and paraphrasing sentences, ordering syntagmatic constructions, presents the possibilities of establishing and varying logical-semantic connections between concepts, and provides examples of the algorithm for building linguistic maxims.

The positive experience of the "Interclass" educational center in teaching English to schoolchildren and/or students with the involvement of projective-recursive technology and metacognitive educational schemes, created on its basis, confirms the effectiveness of the principle of naturalness of the formation of bilingual (or even multilingual) competences in harmony with the metacognitive context of the development of associative thinking and skills of conscious structuring of thought-speech formulas of foreign language discourse in general. Such structures dynamically develop in the temporal dimension of the genesis of the existence of the individual, complementing and organizing information flows in schemes of internalized

experience and strategies of metacognitive activity. Accordingly, metacognitive teaching schemes can be used both when learning new material and to monitor the understanding of the markers of the pragmalinguistic formula of foreign language discourse, the completeness of the perception of information in the logic of English as a foreign language and the improvement of communicative skills.

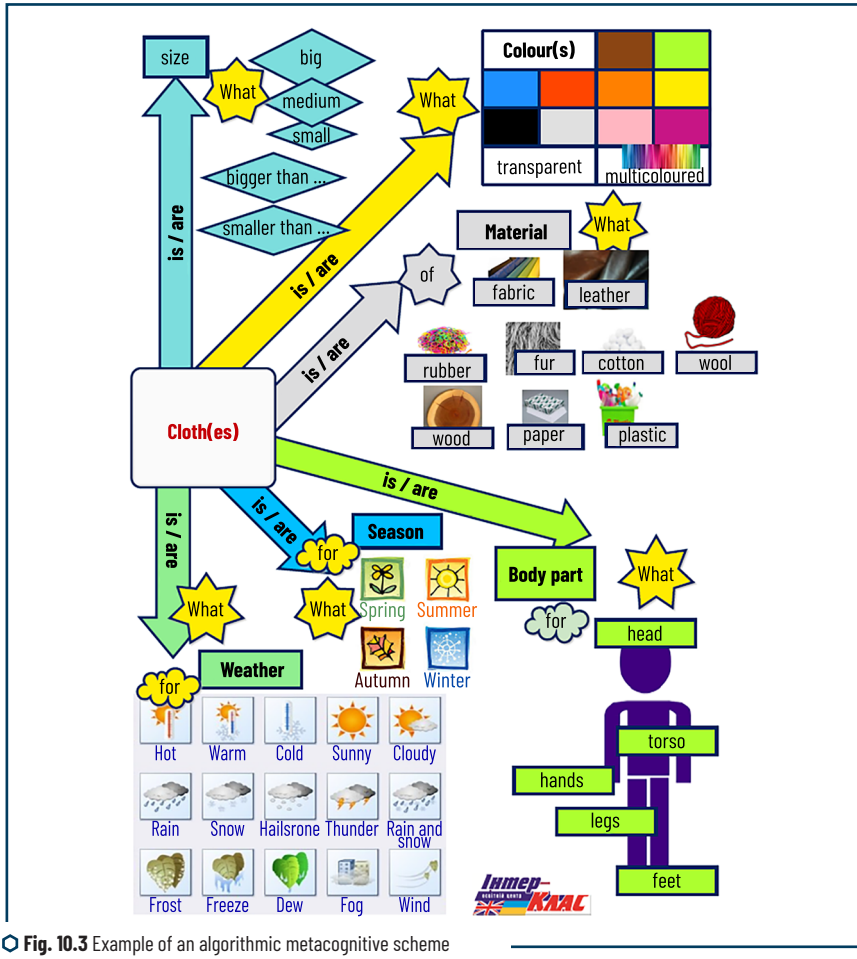

Fig. 10.3 Example of an algorithmic metacognitive scheme

The use of metacognitive teaching schemes in the English language teaching system is also consistent with the resource architecture of the age development of individuals who are engaged in learning a foreign language with the involvement of projective-recursive technology. In particular, the mental development

of preschool and primary school children is characterized by the emergence of higher mental functions (L. Vygotsky) and the intensive development of the sign function of consciousness: children are oriented towards mastering the symbolism of signs as a product of social development and a means of regulating mental activity. This makes children as susceptible as possible to working with metacognitive schemes in the development of personal and thought-speech constructs in the space of bilingual communication (for example, when synchronizing the study of their native language and foreign (English) discourses).

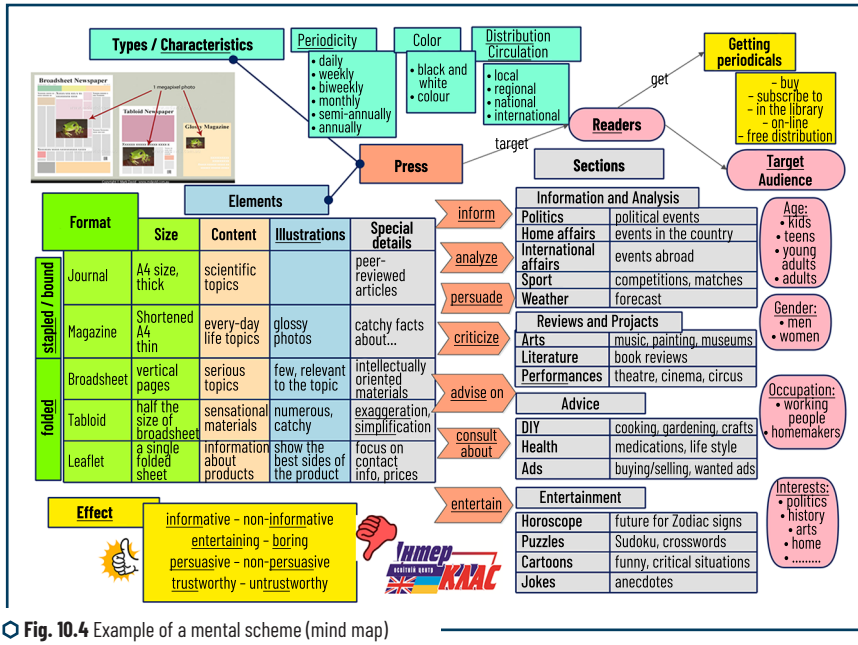

Fig. 10.4 Example of a mental scheme (mind map)

The system-functional integrative approach to teaching preschoolers and younger schoolchildren English as a foreign language with the involvement of projective-recursive technology and metacognitive educational schemes created on its basis allowed:

– to model the educational content, usual (and therefore comfortable) for children of the Internet generation, (multimedia presentations, augmented reality, didactic, role-playing and simulation games, animation, etc.), in the space of which the constant cognitive interest of children in learning is supported;

– to visualize didactic information in a form accessible to children (in the form of a visual-figurative presentation), which corresponds to the age characteristics of preschoolers and younger schoolchildren: the predominance of involuntary attention, visual-figurative thinking, the need for reference schemes when solving cognitive tasks, sensitivity to speech development and the formation of bilingualism experience;

— to stimulate cognitive activity and motivation of children, creating a situation of success in communicative situations by means of educational and developmental programs.

Preschoolers and younger schoolchildren, involved in the innovative programs of the educational center "Interclass", quite easily master the logical and grammatical formulas of a non-native language, harmoniously adapt to the bilingual continuum, confidently format speech constructions, implementing a personal intellectual resource, which implicitly contributes to the development of students' linguistic and communicative competences in the problem field of English as a foreign language. In general, in working with children of preschool and primary school age, metacognitive schemes provide the opportunity for conscious construction of the semantic field of knowledge of the foreign language, effective mastery of new bilingual experience in the chronotope of success in accordance with the child's current level of awareness in the field of thematic constructs and personal level of metacognitive development. Relying on the supporting schemes of structured foreign language content, children in particular perceive the educational environment and learning situations of foreign language acquisition as relatively safe, and therefore do not resort to unconscious protective barriers that block psychological and pedagogical influences and make it impossible to internalize new information without conflict.

The effectiveness of the use of project-recursive teaching technology is also confirmed by the results of metacognitive monitoring with further analysis of markers of speech competences of primary school pupils. The main research method was the method of selective observation with recording of qualitative indicators of respondents' mastery of English as a foreign language in conditions of artificial bilingualism. The sample of respondents (the empirical research group) was formed randomly; it consisted of 38 pupils (6–7 years old) of primary education groups of the educational center "Interclass" (Kryvyi Rih, Ukraine), whose English language (L2) teaching took place in the format of the active use of project-recursive technology and metacognitive educational cards. The control group was formed from first-grade pupils (35 people 6–7 years old, randomly selected) of a comprehensive primary school (Kryvyi Rih, Ukraine). Foreign language teaching of junior schoolchildren in the control group was carried out in the format of a passive model of artificial bilingualism with an orientation to the grammar of speech.

In particular, the following were subject to analysis: representations of foreign language knowledge (denotative representation of content units, adequacy of ordering of syntactic constructions, skill in producing formal (grammatical, lexical, syntactic) constructs), skills of perception and understanding of messages in the foreign language, competent text creation in given conditions of bilingual discourse. In the process of the study, normotypical speech constructs of the corresponding semantic and/or grammatical series, the repetition of lexemes and syntactic constructions in the speech of junior schoolchildren, the frequency of typical speech reactions among the respondents (the absolute frequency of the method of meaning formation, adequate text formation, congruent dialogue) were calculated. This allowed to reconstruct to some extent the vectors of formatting the linguistic consciousness of first-graders and to identify the level of activity of younger schoolchildren in using English as a foreign language. The results of the statistical analysis of the research project data showed that the differences between the experimental and control groups of younger schoolchildren in identifying markers of linguistic consciousness are reliably significant in relation to individual predictors of the logical ordering of speech-thinking constructs (at $p \leq 0.05$). The respondents in

the empirical study group demonstrated statistically better results in listening (0.038 = $p \leq 0.05$ and 0.001 = $p \leq 0.05$), understanding the content of oral utterances in a familiar everyday context (0.041 = $p \leq 0.05$) and in identifying communicative competences: the ability to create simple messages in real time using several short sentences (0.017 = $p \leq 0.05$) and the ability to interact with other people in various communicative situations (0.005 = $p \leq 0.05$). At the same time, the results of the study allow us to state the absence of statistical differences between the respondents in the pronunciation and stressing of commonly used words.

The comparison of the results of the included observation of work in different research groups proves that the students of "Interclass" behave more confidently in educational situations, meaningfully solve complex tasks (listening, perception, understanding) taking into account the given conditions of bilingual culture; mastering the grammatical structure of the foreign language, they use their personal intellectual resource and adequately format the logical-semantic and systemic-functional predictors of text messages in English. Therefore, the use of metacognitive schemes in the continuum of project-recursive technology of teaching English to preschoolers and younger schoolchildren can be considered as a productive linguistic-didactic method, since it turns students into active creators of personal experience.

Similar trends are also observed in the study of English by adolescents (secondary and high school students and students of higher education institutions). Systematic observation of markers of cognitive activity of adolescents and youth [1, 13] allows us to state the dominance of clip thinking among the strategies for solving cognitive tasks, which is characterized by a tendency to use visual (figurative) models of substantiation of statements, impulsivity (rapid reaction without detailing arguments and often without involving formal logic of proof) in the context of multiple choice; decisions by adolescents and young adults are made on an intuitive basis, without proper analysis of possible options for cognitive and behavioral scenarios of self-realization. In conditions of absolute accessibility and global information overload, the attention of representatives of the Internet generation — Generation Z — focused primarily on the information content that they consider to be rationally important, concisely presented and visualized (visually presented or supported by visual means). At the same time, it is worth considering the contradictory nature of metacognitive strategies for the mental development of schoolchildren and students of adolescent and young age in the 21st century. The clip-like nature of thinking, the tendency to ergonomics and collage of information content, and the total partialization of language constructs of representatives of the modern adolescent community determine the disposition of young people to perceive information in small portions, simultaneous processing and understanding of texts mainly in the number of characters, placed on one screen of gadgets (in accordance with the principles of algorithmic and programmed teaching), and at the same time, young people of the era of high technology are able to successfully solve complex, multifactorial tasks. In this context, the axiomatic scenario for the development of the resource potential of schoolchildren and students of adolescent and young age (including when learning English as a foreign language) can be recognized as the content of the actualization of metacognitive processes in the system of development of reflective and metacognitive forms of mental activity. Metacognitions appear as markers of personal cognitive processes of adolescents and youth, which perform the functions of active control, voluntary regulation and conscious metacognitive monitoring of cognitive resources of learning subjects. Therefore, structuring the thinking and speech experience of schoolchildren and students with the involvement of grammatical, logical-semantic formulas of

educational metacognitive schemes complements and organizes information flows in the strategies of metacognitive activity of adolescents and youth when learning English as a foreign language, contributes to the development of metacognitive skills of bilingual communication. Thus, the organization of the educational process implements the principle of integrity and multi-vector perception of the bilingual socio-cultural space, which is guaranteed to project an adequate experience of education seekers [2, 3, 13], stimulates the formation and development of metacognitive activity of schoolchildren and students when learning a foreign language.

10.4 DISCUSSION OF THE RESULTS OF SECTION 10

The essential characteristics of a linguistic personality on the path to mastering a foreign language are modeled in the continuum of mastering the linguistic picture of the globalized world by the subject of education, the conceptual-linguistic universe, which expresses the markers of the sociolect of a person of the 21st century in the system of development of reflective and metacognitive forms of speech and thought activity. The predictors of the linguistic picture of the world and the content characteristics of metacognitive activity, perceived by the subject of learning, determine the vectors of self-expression and self-realization of a person.

Understanding the results of this theoretical and empirical study confirms that the phenomenology of metacognitive and bilingual development of a personality in the modern dynamic information society appears as an ambivalent system-forming content of educational innovations. Purposeful formatting of metacognitive activity and language culture of youth of the 21st century determines the effectiveness of the dimensions of mental modeling of reality and successful self-realization of life-creating subjects in conditions of prolonged uncertainty.

Stimulating the heuristic resource of metacognitive activity of schoolchildren and students necessitates the creation of a progressive developmental educational environment full of examples of constructive thinking and speech activity and objectively new ways of modeling the skills of implementing this activity. Special attention in the context of multilingual development of pupils and students must be paid to the ability to independently build the semantic structure of speech utterances, understanding the textual constructs of a foreign language, awareness of the logical-semantic formula of textual constructs in the space of bilingual discourse, and above all — the perception and understanding of analytical and cause-and-effect relationships that produce long-term mastery of a foreign language and successful experience of artificial bilingualism.

One of the scenarios for effective teaching of English as a foreign language is an integrative system-functional approach to the educational process with the involvement of projective-recursive technology and metacognitive educational scheme, created on its basis. Many years of experience of the educational center "Interclass" (Kryvyi Rih, Ukraine) allows us to state that the use of projective-recursive technology in teaching English is well combined with the traditional teaching system, as well as with any rationally modeled innovative educational technology, and therefore allows us to improve the process of developing students' linguistic consciousness and significantly expand the age coordinates of the respondents' metacognitive activity. Projective-recursive technology involves building a metacognitive denotative graph,

performs the function of sense formation and modeling mental interpretations in the minds of students. As the content of the studied concept (or logical-syntagmatic formula) is mastered, children form a holistic vision of the trends in the development of metacognitive systems of the language field, an individual thesaurus is compiled, and an understanding of logical-semantic and grammatical connections in the language continuum of the studied foreign language occurs. The advantages of projective-recursive technology as a predictor of effectiveness in teaching English should be considered such features as:

– high efficiency of the educational process, determined by increasing the motivation of students and diversifying teaching techniques;

– optimal feedback in the format of a dialogue, which confirms the effectiveness of mastering a foreign language and allows you to adapt teaching to the specific needs of educational subjects;

– systematicity of the teaching process, because thanks to the use of metacognitive schemes, students can continuously be in the process of learning a foreign language, improving the skills of metacognitive activity.

The practical use of metacognitive strategies for structuring bilingual (or polylingual) experience in learning English involves metacognitive comprehension by pupils and students of lexical and grammatical norms of a non-native language, metacognitive visualization of mental strategies, as well as reflective metacognitive interviews taking into account B. Bloom's taxonomy of higher-order metacognitive skills, which allows for control and correction of the competence development of the intellectual resource of children and youth. The conclusions, presented for review by the scientific community regarding the resource dimensions of projective-recursive technology as a predictor of effective English language teaching using a system of metacognitive schemes, in our opinion, can contribute to solving a wide range of theoretical and practical problems related to understanding the dynamic context of the architectonics of supporting the multilingual development of the personality.

The conducted research does not reveal all aspects of the problem of using metacognitive schemes in the continuum of projective-recursive technology of teaching English to children and youth, but it opens up prospects for further study of trends in metacognitive and multilingual development of the personality in the changing information world. In particular, a promising direction of research may be the content definition of cognitive-affective mechanisms of development of language consciousness in the educational space of the unstable present.

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