

INTEGRATED SUBJECT-LINGUISTIC APPROACH AS THE BASIS OF SUBJECT TEACHING MODELLING USING A FOREIGN LANGUAGE AT HIGH SCHOOL

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ABSTRACT

The author developed the model of subject teaching using a foreign language at high school on the basis of an integrated subject-linguistic approach, aimed at the development of a subject foreign language competence of a student. An integrated subject-linguistic approach in learning (CLIL - Content and Language Integrated Learning) is recommended by European Commission for the use at high schools, because, first of all, it provides students with the opportunity to study a discipline and a foreign language simultaneously; secondly, the study of a foreign language does not require additional hours in a curriculum, which contributes to the intensification of professional training at a high school. Theoretical foundations of CLIL are based on L.S. Vygotsky theory of thought and speech relationship, BICS/CALP J. Cummins theory and the taxonomy of Bloom skills, covering the cognitive area of learning activities. The model was implemented on the basis of the discipline "The fundamentals of data mathematical processing", lasting 72 hours (2 credits). To test the model effectiveness on the basis of the Kazan Federal University during 2011-2014 a pedagogical experiment was performed. The paper presents and analyzes its results.

Key words: bilingualism; integrated subject-linguistic approach; integrated subject-linguistic education; cognitive/academic language competence; thinking and speech

1. INTRODUCTION

In modern society, the trends of integration and globalization become more and more popular. These trends cause changes in the education systems of different countries, including Russia. According to the Russian Federation State program "Education development during 2013-2020" one of the priorities in the field of vocational education is "the internationalization of higher education in Russia". To solve this problem "you need to increase the number of educational programs in foreign languages, especially in English... to support the renovation projects of English language teaching in Russian universities" [1].

Practice shows that a foreign language in Russian universities as an academic discipline continues to be isolated from non-linguistic disciplines, causing a low efficiency of student learning. However, there is a great need for the knowledge of foreign languages among students, which is caused, first of all, by the development of academic mobility and integrative processes in the field of higher education.

In this context the appeal to one of the effective approaches of student teaching concerning subject knowledge in a foreign language in Europe becomes a relevant one - CLIL (Content and Language Integrated Learning). CLIL, translated in Russian language is called an integrated subject-linguistic approach based on the idea of subject and language integration in the course of vocational training at a high school. CLIL is recommended by the European Commission, because, first of all, it gives students the opportunity to study a foreign language and a discipline at the same time; secondly, one does not require extra hours in a curriculum to study a foreign language, which contributes to the intensification of vocational training at a high school.

Consequently, there is an objective need to study the international experience of subject knowledge learning in a foreign language on the basis of an integrated subject-linguistic approach and its application in Russian universities.

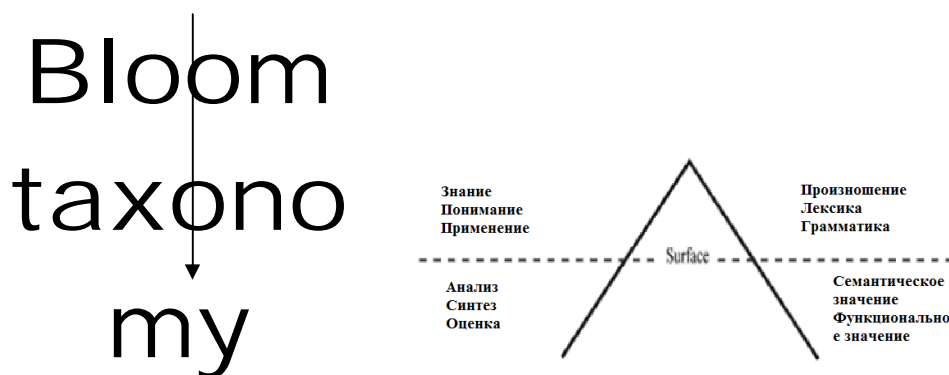
2. MATERIALS AND METHODS

For an efficient education of students in a foreign language, the European Commission proposed a so-called integrated subject and a language approach (CLIL). Among the variety of CLIL definitions, we relied on the definition given by its founders S. D. Marsh [2] and D. Coyle [3]: «CLIL - is an approach to learning that is focused on the achievement of a double goal, at which the second language is used as the means of subject learning and at the same time acts as an object of study». The idea of CLIL development emerged as the need of applied aspect use concerning a foreign language and the increased requirements for student proficiency in a foreign language at the limited time available to study it at a high school.

The theoretical foundations of CLIL are based on the theory of thinking relationship and L.S. Vygotsky speech, the theory of BICS/CALP J. Cummins and the Bloom taxonomy of skills, covering the cognitive area of learning activities.

The famous Russian psychologist L.S. Vygotsky [4] used the terms "inner speech" and "verbal thinking" in his speech. These terms tell about the relationship and the unity of thinking and speech using a second language and allows us to consider the use of language as a psychological tool during the performance of highest level cognitive activities.

J. Cummins [5] in his theory of BICS/CALP highlighted two aspects of foreign language competence for the difference between a spoken and an academic language - "BICS" (basic interpersonal communicative skills) - the basic communication skills of everyday communication and "CALP" (cognitive / academic language proficiency) - cognitive / academic language competence that is needed without the situations of everyday communication. In his scientific works, he uses the image of an iceberg to illustrate the differences between BICS and CALP (Fig. 1).



Знание - knowledge / Понимание - understanding / Применение - application / Произношение - pronunciation / Лексика - vocabulary / Грамматика - grammar / Анализ - Analysis / Синтез - Synthesis / Оценка - Evaluation / Семантическое значение - Semantic meaning / Функциональное значение - Functional meaning

Fig. 1. BICS/CALP J. Cummins theory

Basic communication skills of everyday communication BICS (grammar, pronunciation, vocabulary) are located on the "visual tip of the iceberg", and there is CALP competence at the bottom.

Besides J.Cummins uses the Bloom taxonomy of cognitive skills to illustrate the differences between BICS and CALP. There are low order cognitive skills above the surface such as knowledge, understanding and application, which are related to BICS, and there are higher order cognitive skills of the higher-order such as analysis, synthesis, evaluation, relating to CALP competence [6].

In the European context, the ultimate goal of CLIL is the development of CALP competence among students. After the study of L.S. Vygotsky and J.Cummins works, we concluded that CALP is the cognitive/academic language competence, the formation and development of which is directed to the synthesis of higher-order thinking skills (analysis, synthesis, evaluation) and the means of their verbalization using a second language [7].

In the course of studying the experience of an integrated subject-linguistic approach use in learning (CLIL) abroad its advantages were revealed compared to the communicative approach. Firstly, there is a full immersion of students in the language environment, as they process a fairly large amount of linguistic material. Secondly, a student's vocabulary is enriched due to subject terminology, his skills in the field of academic foreign language are developed. Thirdly, CLIL contributes to a better understanding of scientific concepts, it is easier for students to learn a scientific concept, since the acquisition of a term and its correlation with a corresponding scientific concept occurs simultaneously [7].

A positive experience of CLIL implementation in European education systems became an important source for our study. The Professor of Universität Osnabrück, Völlmer H. J. [8] states that students studying on the basis of CLIL, are able to express their thoughts more accurately, which in its turn leads to the stimulation of mental activity. Besides they work more persistently with the set tasks, show a higher tolerance for failure, and have a high level of academic competence. Nixon J. [9], implementing CLIL in Sweden, concluded that "teaching a subject through a second language, we imitate the conditions of non-formal communication in FL and we raise the student confidence and expand their knowledge, satisfy their curiosity and increase their motivation".

An integrated subject and language didactic approach is governed by didactic principles: Principle 4 "C" and the principle of integrated foreign language and the content of a studied subject. The basic principle is the the principle 4 "C", developed by CoyleD [3]. During the process of subject learning using a FL 4 components shall be integrated: content, communication, cognition, culture.

Pursuant to the pedagogical model structure developed in national teaching pedagogical science, it is represented by a set of target, substantive, procedural and efficient components.

The target component of the model is presented as a complex of strategic and tactical goals. The strategic goal of a designed model is the development of a productive Russian-English bilingualism among students in the conditions of an artificial language environment at a university.

The tactical goal is the development of the subject foreign language competence in the learning process of students - a subject knowledge for future teachers, in particular the teaching of the following mathematical discipline "Fundamentals of mathematical data processing" in English. We introduced the concept of "subject foreign language competence" (hereinafter - SFLC) is an integrative characteristic of a person, including the ability and the willingness of students to use a foreign language for teaching and learning activities in a subject area. Schematically, SFLC is at the intersection of two circles, where the first ONE is the competence of CALP in a foreign language, and the second one is the subject competence. SFLC criteria are shown in Table 1.

Table 1. SFLC criteria

Cognitive skills
Basic language skills
Academic language skills

The designed model procedural component was based on the strategies of an integrated subject-linguistic approach. The main strategy is «scaffolding» technology - a comprehensive student support, contributing to cognitive and linguistic load reduction in respect of a discipline studied with the use of a foreign language. In our practice we use the

language clichés, glossary, visualization material, mnemonics, supplied students with many examples of FL, which gave students an opportunity to perform tasks on their own.

The thinking skills development strategy of lower and higher order was implemented through a system of questions drawn up in accordance with Bloom's taxonomy. Thus, the activation and the development of understanding level is performed using the specifying questions, the purpose of which is to provide a feedback and the level of synthesis development is performed with the help of interpretation elements, the wording of which contains the elements of prediction conventions, assumptions and fantasies.

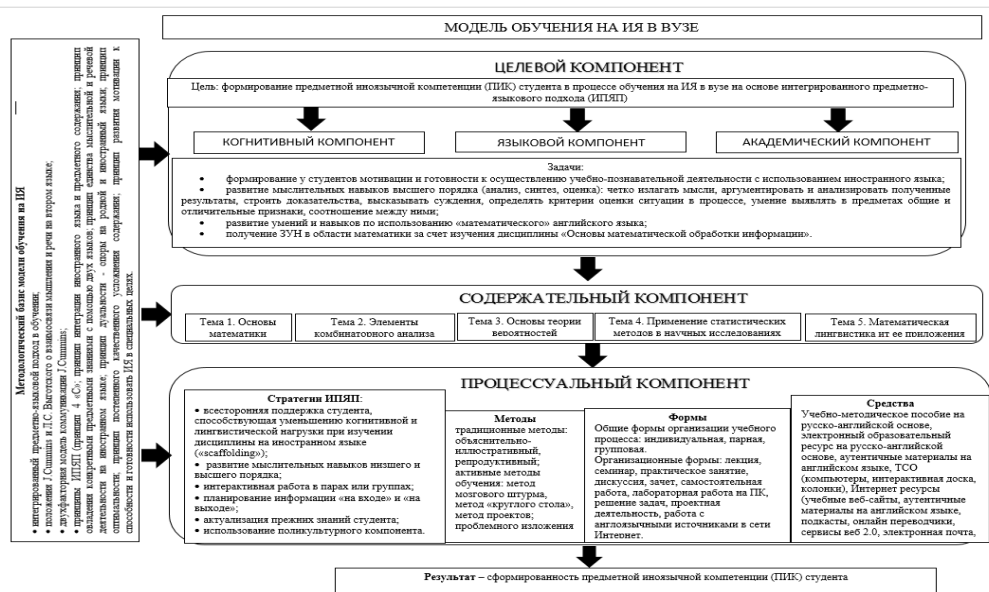
The use of a multicultural component in a classroom as the strategy of integrated subject-linguistic approach provided an opportunity to introduce students with various approaches to cover the same subject content in various learning and teaching cultures and to acquaint with the history of the development and the study of a concept or a phenomenon.

The study confirmed that the strategy of using pair and group activities in a classroom involves the participants in an active interaction. Using a "simplified" language, students acquire the "speech" independence and have the opportunity to practice using the subject vocabulary in the situation where they feel relaxed and confident [10].

The most important means of didactic learning using a FL is an electronic educational resource (hereinafter - EER) developed by us in Moodle system. EER as well as the course itself, includes 72 hours (2 credits). Thus, each lesson of the discipline is provided by EER, which is a necessary term due to the complexities and difficulties arising among students during the study of humanities. The training material of textbook has a common invariant structure: guidance for students, theoretical material, the problems with their solutions for an independent work. Each topic is provided with a glossary of key terms in English.

Besides, various educational Internet resources (podcasts, educational websites, online and electronic dictionaries), literature, movies in English, the project "Application of mathematical statistics and probability theory in theoretical linguistics problems" were used as the means of learning.

An efficient component proposed diagnostic materials and SFLC development correction procedures (Scheme 1).



Model of FL learning in a high school

Task component

Purpose: the development of the subject of foreign language competence (SFLC) of a student during the learning process using FL at a university on the basis of an integrated subject linguistic approach (ISLA)

Cognitive component

Language component

Academic component

- The development of motivation and readiness among students for the implementation of teaching and learning activities with the use of a foreign language;

- The development of higher-order thinking skills (analysis, synthesis, evaluation): to express thoughts, reason and analyse the obtained results clearly, to develop evidences, to make judgments, to define criteria for a situation assessment in the process, the ability to detect common and distinctive features in objects, the relationship between them;

- The development of skills concerning the use of "mathematical" English;

- The obtaining ZUN in mathematics at the expense of the following discipline study: "Fundamentals of data mathematical processing".

Content component

Theme 1. Introduction to mathematics

Theme 2. Elements of combinatorial analysis

Theme 3. Fundamentals of probability theory

Theme 4. Application of statistical methods in scientific research

Theme 5. Mathematical linguistics and its applications

The procedural component

ISLA strategies:
 - Full support of a student, reducing cognitive and linguistic load during the study of a subject using a foreign language ("scaffolding");
 - The development of lower higher order thinking skills;
 - Interactive work in pairs or groups;
 - Planning of "input" or "output" information;
 - Actualization of a student previous knowledge;
 - The use of multi-cultural component.

Methods
 Traditional methods: explanatory and illustrative, reproductive one; Active learning techniques: brainstorming technique, the method of "round table", the method of projects; problem statement method

Forms
 Common forms of educational process organization: individual, pair, group one.

Organizational forms: lecture, seminar, workshops, discussion, test, independent work on a PC, problem solving, project work, work with English sources on the Internet.

Means
 A teaching manual on Russian-English basis, electronic educational resource on Russian-English basis, authentic materials in English, TEM (computers, interactive board, speakers), Internet resources (training web-sites, authentic materials in English, podcasts, online translators, Web 2.0 services, e-mail).

Result - The maturity of a subject foreign language competence (SFLC) among students
 The methodological basis of a training model using FL
 - An integrated subject-linguistic approach to teaching
 - The provisions of J. Cummins and L.S. Vygotsky about thinking relationship in a speech using the second language;
 - Two-factor model of communication (J. Cummins)
 - ISLA principles (4 "C" principle, the principle of foreign language and subject content integration, the principle of mastering the specific subject knowledge using two languages, the principle of thinking and speech activity unity in a foreign language, the principle of duality - the support on a native and a foreign language, the principle of optimality; the principle of quality content gradual complication, the principle of motivation development concerning the ability and willingness to use FL for special purposes).

Scheme 1. Teaching model using a foreign language at a university

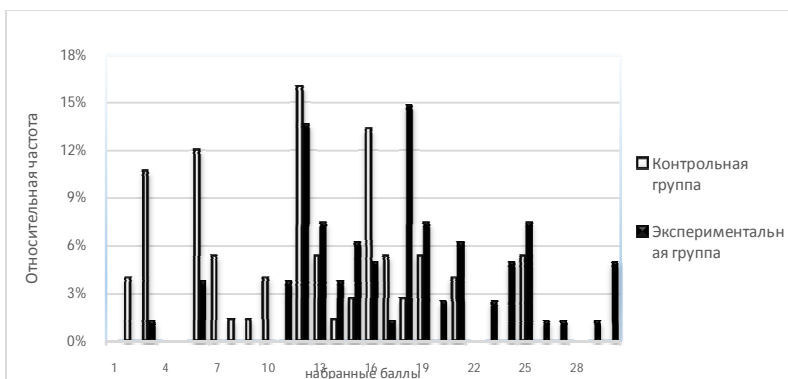
3. RESULTS

In order to test the effectiveness of FL teaching developed model in a university on the basis of an integrated subject-language approach an experimental work was organized, which took place for four years. The experiment involved first year students of Roman and German Philology department, studying the discipline "Pedagogical education", "Foreign Language (English) profile, and a second foreign language".

A control group (CG) and an experimental group (EG) were identified. The number of students in the EG made 81 people. The teaching of the subject "Fundamentals of data mathematical processing" was performed in English. In CG, consisting of 75 students, the teaching was performed in Russian.

To evaluate the effectiveness of the developed model concerning FL training in a high school on the basis of an integrated subject-linguistic approach, it was decided to compare the results of SFLC components development among CG and EG students. To do this, we developed the fund of evaluation tools (hereinafter - FET), which consists of three parts.

The first part of FET, the responses to which demonstrate the formation of SFLC cognitive component which consisted of 10 tasks on mathematics which were formulated in such a way that they had the minimum number of mathematical terms and it was not necessary to use special algorithms to solve them, and they could be solved logically. The results were evaluated according to the scale from 0 to 30 points. The results are presented on Figure 2.



Относительная частота – Relative frequency
 Контрольная группа – Control group
 Экспериментальная группа – Experimental group
 Набранные баллы - Score

Fig 2. Histogram of the relative distribution concerning the scores obtained in CG and EG according to the results of the first part of FET

A comparative analysis of the score shows that the number of students with poor performance in the EG is much less (33%) than in the CG. This fact allows us to conclude on the advantages of the experimental teaching for the development of a cognitive SFLC component.

Besides, the effectiveness of the training was also established with the help of result difference statistical assessment concerning the first part of FET. The statistical analysis of FET results was performed using the software package Statistica 6.0. The analysis of random variables distribution was performed in the sample. An arithmetic mean, mode and median were calculated for this. The significance of study result differences between EG and CG was evaluated using two-way Student t-test for independent samples. The differences were considered statistically significant at the significance level of $p < 0,05$.

The study of FET linguistic component development level was conducted through online testing aimed at verification of the FL knowledge general level in accordance with the European standards CEFR. It turned out that after the performed pedagogical experiment, most students in the EG (60%) speak English at B2 level and above, whereas at the beginning of the experiment their number made 54%. The third part of FET was aimed at checking of SFLC academic component formation and included assignments largely associated with mathematical terminology in English. The results of obtained score relative distribution in CG and EG according to the results of the second and third parts of FET are shown by Fig. 3 and Fig. 4. According to these histograms the students studying on the basis of an integrated subject-language approach achieved the best results in the level of language (10%), academic (55%) FET components development compared with the students who studied traditionally.

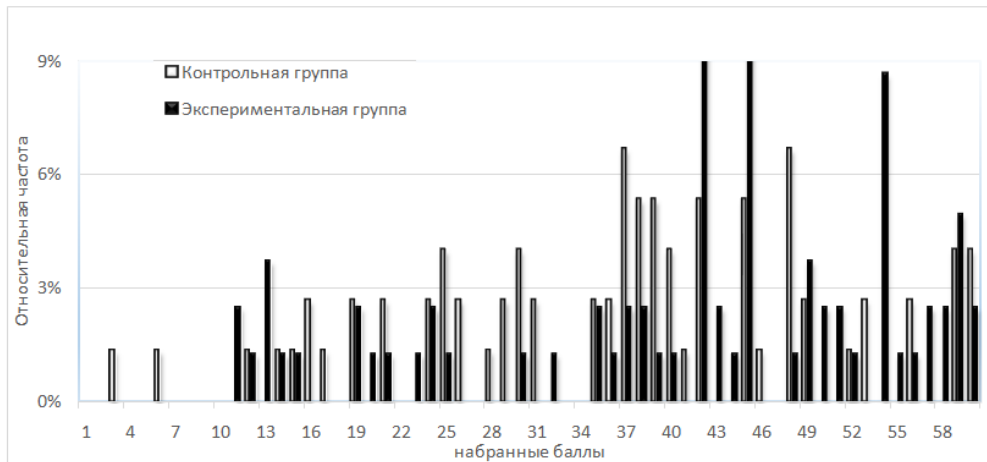


Fig. 3. Histogram of score relative distribution obtained in CG and EG according to the results of the second part of FET

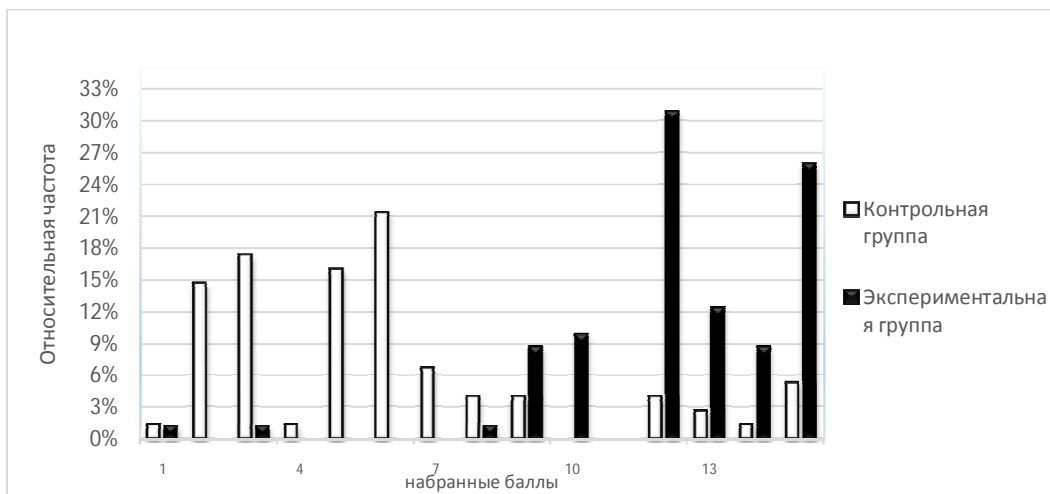


Fig. 4. Histogram of obtained score relative distribution in CG and EG according to the results of the tasks from the third part of FET

The statistical data obtained in the course of the experiment, and their mathematical processing similar to the first part of FET also show the effectiveness of the developed model of learning using FL for linguistic and academic components of the SFLC development.

4. CONCLUSION

Thus, the students of the experimental group showed a higher level of the main components development of the subject foreign language competence elements than the control group students. The positive dynamics of components development was characterized by the fact that the teaching of subject knowledge using FL was developed in accordance with the principles and strategies of an integrated subject-language approach. The cognitive activity of students was carried out with speech activity, and the mastering of subject content occurred simultaneously with the mastery of expression means in English, which greatly enhanced the quality of a discipline knowledge [7].

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