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Some aspect of teaching Physics in English within the framework of multilingual education

Некоторые аспекты преподавания физики на английском языке в рамках полиязычного образования

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Мақалада Қазақстанның білім беру жүйесінде көптілді білім берудің жаңа парадигмасы қарастырылады. Берілген бағытта қазақ, орыс және ағылшын тілдерді ғана емес, сонымен қатар нақты ғылымдар пәндерін оқыту (жоғарыда берілген тілдерде) жолдары беріледі. Физиканы мысалға ала отырып, мақалада шет тілінде нақты ғылымдар пәндерін оқытудың мәнері, кейбір принциптері және оқытушыға сабақ барысын дұрыс ұйымдастырып, студенттердің қызметін физика пәнін және тілді тиімді игерудің дұрыс жолдарын ұйымдастыруға септігін тигізеді. Сонымен қатар авторлар көптілді білім беруді толық жүзеге асыру үшін педагогикалық кадрларды дайындау және қайта даярлау, көптілді білім берудің нормативті-құқықтық негізін жүзеге асыру, әр түрлі деңгейдегі білім мекемелерін оқу-әдістемелік қамтамасыздандыру сияқты мақсаттарды анықтаған.

В статье рассматривается новая парадигма образовательной системы Казахстана — полиязычное образование. В рамках данного направления осуществляется не только обучение казахскому, русскому и английскому языкам, но и преподавание дисциплин естественнонаучного направления на указанных выше языках. На примере физики в статье представлены некоторые принципы и подходы преподавания естественнонаучных дисциплин на иностранном языке, которые помогают преподавателю правильно построить ход занятий и организовать деятельность студентов с целью эффективного освоения ими как материала по физике, так и овладения языковыми навыками. Авторами также определены задачи, требующие дальнейшего решения для полной реализации принципов полиязычного образования, такие как подготовка и переподготовка педагогических кадров, совершенствование нормативно-правовой базы полиязычного образования и учебно-методическое обеспечение образовательных учреждений различного уровня.

The modern education system of Kazakhstan has undergone significant changes connected with the country's economic and political development and language situation which required specialists of new formation who are able to speak Kazakh, Russian and foreign languages. Therefore, the goal of the country's education system set by the President of the Republic of Kazakhstan is, on the one hand, the preservation of the best national traditions in education, on the other hand, the provision of the population with qualitative education corresponding to the international standards.

Having chosen the course of the integration in the world educational sphere in accordance with the principles of the Bologna Declaration, Kazakhstan's education system is being modernized from the two aspects: the improving of education in all study fields in order to meet the requirements of the international education standards and the improving of language education based on the idea of the cultural project «The unity of three languages» (Kazakh, Russian, English languages) which was put forward by the President of Kazakhstan Republic N.A.Nazarbaev in 2004. The latter has resulted in many scientific researches in the

field of language teaching and learning including the Concept of Multilingual Education Development aimed at developing students' linguistic competency of three languages (Kazakh, Russian, and English).

Presently multilingual education is regarded as an effective way for teaching young people and preparing them for life in the interconnected and globalized world. It is obvious that the creation of equal conditions for studying of the three mentioned languages within the framework of multilingual education does not mean equal sphere of their functioning, their equal functional work, and, at last, their equal status. This fact is explained by the unified political, ideological, cultural platform grounded in the cultural project «The unity of three languages» which is as follows: the studying of the Kazakh language as a state language, Russian as a language of international communication and English as a language of successful integration into the global economy.

The perfection of the legal base of multilingual education first assumes the reconsideration of the modern language education content whose designing should be conceptually grounded and its realization should be regulated by state standards, standard curriculums, scientifically grounded instructions and recommendations. It appears to be possible in conditions of the activation of scientific workings-out in the sphere of multilingual education that means carrying out of pedagogical, sociolinguistic, lingual and didactical researches for the purpose of the scientific analysis of language situation, the studying and the generalization of positive domestic and foreign experience of multilingual teaching and multilingual individual formation.

Undoubtedly, that the successful realization of multilingual education and multilingual individual formation is only possible with the involvement of all stages of the country's education system and successive teaching of languages to children at schools, universities and finally at the post-graduate courses. Though all stages are interrelated and cannot be omitted, each of them has its own goal to achieve. If to speak about language education at school, it is more oriented at the formation of basic language skills and competences which are to be developed further in universities but here one should never forget that multilingual education assumes both teaching of a language (Kazakh, Russian, English) itself and teaching of natural sciences and humanities in a language (in Kazakh, Russian or English).

Using a foreign language as a medium of teaching other subjects (disciplines) is a controversial issue which engendered vivid disputes. When this subject is a science like Mathematics or Physics, people tend to think that the foreign language could become a serious handicap. Yet, in this article we will try to show that English as a medium of teaching could be a high impetus and exciting motivator for learning Physics, if the instructional approach is adequate to the specific context. Far from considering exhaustive, there are some strategies which can increase the interest of students for studying Physics in bilingual or multilingual classes as well as enhance the degree of understanding physics concepts as we don't believe that using the medium, English language is the barrier but the way we use the medium itself.

Moreover, it is clear that teaching Physics in a foreign language (English) requires a specific pedagogy which supports learners in developing both subject-matter knowledge and the language skills which are the vehicle for acquiring that knowledge. A solution for solving this problem comes from CLIL concept, that is Content and Language Integrated Learning, and refers to any dual-focused educational context in which a second language, thus not usually the first language of the learners involved, is used as a medium in the teaching and learning of non-language content [1]. Shortly, the basis of CLIL is that content subjects are taught and learnt in a language which is not a mother tongue of learners. This relatively new approach represents a concrete opportunity for students to improve their proficiency in a foreign language without weakening the content subject. There is no doubt that learning a language and learning through a language are concurrent processes, but implementing CLIL requires a rethink of the traditional concepts of the language classroom and the language teacher. Even if the content subject is the primary focus in the CLIL classroom, it is obvious that a high proficiency in English is demanded from the teacher. Therefore, the collaboration between Physics and English teachers is very useful.

Teaching Physics in English as a foreign language involves some new things. The main one is that students are learning not only the subject-matter knowledge and skills, but also the specific language which is the vehicle for that subject. Thus, the efforts both from the part of teacher and students are higher.

To begin with, the teacher has to take into the consideration the fact how well course goals coincide with students' personal learning goals, interests and background knowledge. In case when the teacher chooses the course goals at an appropriate level with students' personal learning goals, capitalizes students' background and makes use of their interests, he takes a crucial key for successful education as the teacher is provided with good information about students what makes his job easier and directs him toward the most adequate ways of introducing teaching material.

In this regard, the teacher must implement various activities within the lessons. To be efficient, the questions, exercises and experiments should be gradated in terms of the six levels of Bloom's taxonomy: knowledge, comprehension, application, analysis, synthesis and evaluation. These activities may be used for «leading» purposes activities as well for assessment.

Physics is very rich in specialized words which have multiple meanings. Usually it is well to begin from the everyday meaning which is more likely to be known and to extrapolate it in Physics' field. To identify the key words is a very important task. In addition, word roots are very helpful to develop an understanding of the scientific meaning of the word. Initially, it can be given by teacher and then students can be guided to do it by themselves and to discover the common and scientific meanings of different words with the help of the dictionary. To teach them vocabulary along with the scientific content is the best way of acquisition scientific language but a good command of target language is also compulsory in order to have an accurate understanding of concepts

In our opinion, teaching Physics through the medium of English should not drive students away from the content of subject. Thus, the accent in such approach must be on Physics. However, there is a close interaction between the two fields (Physics and foreign language). Learning Physics includes learning the language of Physics. Thus, the teacher is responsible both for progresses in Physics and English fields and his aim is «using English to learn and learning to use English» [2].

As it is understood form what has been told above, the learning of a foreign language in universities for non-lingual specialists is not a main goal of education process but a tool of receiving information which is mostly available through the studying of other countries' experience in various science fields, new discoveries, technologies and other information of the world database which is not possible without the knowledge of world languages such as English. That is why the knowledge of English and translation theory and practice are to become elements of educating a specialist of Physics in higher educational institutions.

One of the advantages of teaching Physics through the English language is that teachers can borrow from the strategies specific for teaching foreign languages and effectively implement them at the classes of Physics, for example, the use of shorts excerpts from belles-lettres, newspaper articles, paintings, songs or movies (feature and documentary).

There can be a huge number of other examples in which we can create a bridge from language teaching methods towards Physics. Examining the role that Physics plays in literature, painting, and music can engender a positive emotional involvement of students in the class. Some quotes could also be start points for a concept. For instance, the well-known quote of Einstein: «Gravity is not responsible for people falling in love» can be a great clue for gravitational interaction and arouse students' interest in the topic. Each introductory presentation should be followed by discussions related to its content. The teacher should also notice the ways that students perceive it and guide them toward the correct meaning. Since the successful learning demands an active engagement of the students it is recommended that the introduction in each lesson to be based in a certain measure on students' previous knowledge. In some situation it can come from students with helping questions.

Far from being a burden, the tasks and homework could become exciting if they are diversified and related to students' interests and hobbies. Taking into account the profile of the class as well as students' abilities the teacher has to alternate the tasks in order to arouse students' curiosity and enthusiasm.

An important thing is to acknowledge efforts made with sufficient feedback to make students feel that it was worthwhile in reaching their goals. Positive feedback in class is rewarding and increase motivation. In addition, teacher should help the students to appreciate the satisfaction of having mastered material. It entails that students focus on learning as a goal rather than on grades.

Another aspects related to feedback is its frequency and the variety of forms. Frequent and diverse feedbacks renewed the students' enthusiasm. Allowing students to present their works, for instance, increases the motivation, because it permits them to shape the lesson in their own style and also to achieve their goals. Cooperative learning should also be considered in assigning the tasks. Working in teams provides more opportunities for all students. At the same time, collaboration develops students' social and interpersonal skills.

The effectiveness of teaching Physics through a foreign language is revealed by the multiple advantages entailed by it:

- building intercultural knowledge and understanding;
- developing intercultural skills;
- introducing the wider cultural context;

- preparing for internationalization, specifically EU integration;
- enhancing school and university profiles;
- improving overall and specific language competence;
- developing communication skills;
- deepening awareness of both mother tongue and target language;
- prepare for future studies and / or working life;
- developing multilingual interests and attitudes;
- complementing individual learning strategies;
- diversifying methods and forms of classroom teaching and learning;
- increasing learner motivation [3].

So, students studying Physics in English must be both fluent in every-day spoken English and English for special purposes including specific language vocabulary such as scientific concepts, technical vocabulary and terminology in order to understand texts in English and extract necessary information from literature sources. The basis of English knowledge is provided by subject of the English language at schools where the first stage of training future specialists in physics begins but, in regards to the university courses of the English language, it can be presented as a multi-level structure of the basic course of the English language (covering levels from A2 to B2) and the course of the English for special purposes, i.e. English for students of physics. As the process of learning English in universities embraces bachelor and master degree levels, they can be divided into three stages, and students are to master a certain set of competences and knowledge after completing each of them. The characteristics of each stage are as follows:

1. The first stage covering I-IV terms presupposes the mastering of the English at the B1 — B 2 level and physics terminology in English at the elementary level. This knowledge is necessary for further students' study and the creation of the basis of future professional activity of a physics teacher. During this period, students learn English as a compulsory subject according to the state compulsory education program and as an elective course provided by a university. A worked-out syllabus for the English language discipline must include a relevant discipline program, text-books, multilingual dictionaries, study guides, multimedia-based and electronic resources, and etc.

2. After completing the second stage (V–VII terms), students must possess the knowledge and skills of English and the methods of teaching physics in English allowing them to conduct their professional activity as a physics teacher in the foreign language. At this stage students must be able to comprehend and analyze the world experience in major and related field of physics science through studying resources in English and freely communicate in the foreign language in professional situations.

3. Having completed the third stage, the period of studying at the master degree course (IX-XII terms), students possess all knowledge necessary for the qualified and creative activity in situations of business partnership, mutual scientific and teaching work in English. Thus, a master degree graduate must be able:

– to determine a theme of his or her research, applied methods and be able to present research results at a scientific conference or in the form of a scientific article in the English language;
– to correspond in English with departments and organization on the question of researches, experiments and article publications;
– to teach the most difficult branches of physics in English during the realization of multilingual education in a higher educational institution.

It is necessary to pay attention that the successful realization of multilingual education is possible only in case of students' successful mastering of the necessary knowledge of a foreign language and a certain subject at all level of education system (primary school, secondary school, bachelor and master degree courses in a university), i.e. the knowledge without which the further students' training at the successive education level in accordance with the principles of multilingual education is not seen as reasonable.

This problem arouses the question of the need in qualified school and university teachers of subjects of natural sciences and humanities who are able to teach the subject in English and have to meet the following requirements of the language knowledge;

1. To possess the speaking skills including the skills of scientific speech and style typical for a subject.

2. To posses excellent reading skills, especially skills of reading specific literature on a subject while being ready to discuss freely text information, extract necessary information and make a summary in the form of a report or a review.

3. To possess the knowledge of specific vocabulary on a subject (terminology, scientific concepts and etc.).

4. To be able to make speeches, presentations, reports in English and possess the skills of public speech.

5. To participate in discussions connected with the questions of a subject, to be able to ask questions and answer, freely percept the English speech aurally.

6. To possess writing skills necessary for making presentations, publications, theses and corresponding in English with specialists from other countries.

7. To master the methods of teaching a subject in English, to study the world experience of teaching a subject in a foreign language in other countries of the world.

The system of listed criteria can serve as the formation indictors of multilingual individual of a teacher of physics who can teach at schools and universities and even achieve the level of the English language knowledge which allows conducting professional activity in a foreign environment. It is clear that the formation of a specialist — a versatile and educated individual possessing a fundamental training in physics — has to be started from the level of secondary schools but the realization of this stage can be possible in case of having a necessary number of school teachers of physics speaking three languages for whom a foreign language is a tool allowing them to expand the sphere and scale of their professional activity and self-education.

Due to the character of multilingual education caused by a modern language situation its organization and introduction demand not only target training of specialists but also activation of other forms of vocational training: retraining, professional skill advancement, and also self-education.

The vocational training of teachers is basic and the most effective but deferred in time. And if the purpose of such training is the formation of future teachers' readiness to the realization of multilingual education, it should include knowledge of languages (in our case knowledge of the three languages: Kazakh, Russian, English) whose level will provide a future teacher with intercultural communication skill, special knowledge in the area of contrastive and ethnic linguistics, ethnic pedagogics and ethnic psychology, linguodidactics and ethnolinguodidactics, theories and techniques of translation as well as teach him to be a subject of cultural dialogue [4].

Within the frameworks of existing state academic standards the realization of the set above objectives assumes the introduction of a number of elective courses in English, that is, the component of disciplines offered by a university must include enough number of courses taught in English. Course objectives include the formation, development and enhancement of communicative and professional competences, i.e. the mastering of the English language system with the purpose of improvement of the training and retraining system of teaching staff for the realization of multilingual education. These tasks are solved altogether by chairs of foreign languages and chairs dealing with the training of specialists in the fields of natural sciences and humanities. A curriculum has to be thought thoroughly in such a way so that the conducting of a discipline in English does not influence the quality of specialist training, in our case specialists in physics, and the introduction of the physics terminology in Kazakh and Russian should precede the introduction of this terminology in English.

So, we considered scientific and methodical basis of multilingual education from positions of training teachers who are capable to carry out their professional work in a complex covering sociological, cultural, historical, psychological, ethnological, linguistic, didactic and other aspects of teaching and learning languages.

The given basis of multilingual education will be extremely insufficient without being provided with didactic means presented in the form of syllabus which contain curriculums, textbooks, trilingual terminological dictionaries, other dictionaries, and also multimedia resources.

The working out of syllabi in English for the disciplines of a natural science cycle can be done on the basis of the analysis of syllabi on the same disciplines (mathematics, chemistry, physics) used in the countries of Europe of the USA as these disciplines make a non-national component of education content since there is no German physics (chemistry, mathematicians, etc.) which would differ from French one and etc. what cannot be said about language disciplines or disciplines of a social and humanitarian cycle: they are always ethnic; therefore, they make a national component of education content. Hence, the problem of creating didactic means can be solved by searching and working out mechanisms of creative reconsideration of foreign experience and adaptation of foreign syllabi in English to conditions of Kazakhstan (for all education levels and for all types of the education organizations).

Adaptation mechanisms should be elaborated with taking into account the requirements of the conformity to the state education standards of Kazakhstan Republic, selection of a teaching material, editorial execution of educational texts, etc. Here one should always mind an especially important thing, that is, the principle of the critical and creative borrowing excluding blind copying of other experience. In order to achieve

this purpose we should carefully analyze the concrete socio-cultural situation in which these or those didactic items of syllabi arose: a character of the social and state order, a paradigmatic basis of educational system, a conceptual orientation of its didactic basis, lexical and semantic features of a presented teaching material and etc.

To sum up, despite the criticism of teaching disciplines of natural sciences in English, we consider this new trend in education is very helpful with the condition of rethinking learning and teaching principles that aid in the acquisition of both language and content. There are many advantages of teaching Physics through the medium of Physics. In our opinion, the main one is that the approach is topic focused and that it offers the students the opportunity to develop the language through the content. Both Physics and English are enhanced. Moreover, when the teacher achieves interesting bridge between Physics and student's goals and interest, students may be more motivated than when the focus is solely on the nuts and bolts of the subject. Another factor, speaking for the benefits of teaching disciplines of natural sciences in English is that during the process of the multilingual education development and its realization there will be a natural active integration of Kazakhstan's specialists into the world science sphere, the enhancement of their professional communication skills needed for the realization of scientific, professional and business cooperation.

References

1. *Infante D., Benvenuto G., Lastrucci E.* Integrating Content and Language at Primary School Level: Ongoing Experimental Research // The International CLIL Research J. — 2008. — № 1. — P. 75–85.
2. *Secreast D.* Physics for English Majors // The Virginia English Bulletin. — 2010. — Vol. 59. — № 2. — P. 6–11.
3. *Airey J.* Teaching university courses through the medium of English: the current state of the art. — Gavle: University of Gavle, 2003. — 118 p.
4. *Zhetpisbayeva B.A.* Multilingual education: the theory and methodology. — Almaty: Bilim, 2008. — 350 p.