Interdisciplinary
Междупредметните връзки

BILINGUAL COURSE IN BIOTECHNOLOGY: INTERDISCIPLINARY MODEL[1)]

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Abstract. The requirements for expected results from studying have been clearly defined in the European Qualification Framework (EQF) and National Qualification Framework (NQF). Communication skills, including communicating in English, are key requirement for all professions. Herein, we report the creation of a new model for bilingual education in the engineering sphere. This model is successfully applied in Biotechnology education. Our experiment reveals that interdisciplinary modules give students the opportunity to realize meanings and connections of relevant subjects and great number of perspectives.

Keywords: bilingual education, English for specific purposes, interdisciplinary module

Introduction

The requirements for expected results from studying have been clearly defined in the European Qualification Framework (EQF) and National Qualification Framework (NQF). Communication skills, including communicating in English, are key requirement for all professions. For engineering specialities, this element, from the professional qualification has become crucial for job search and for the implementation quality of engineering tasks.

In response to the needs of the businesses for engineering staff with knowledge and competencies in a particular professional field, as well as in a broader spectrum, an experimental interdisciplinary course has been developed. The design of the course unites the ideas for development of individual experience, as set of competencies, related to more than one discipline; development of communication competencies in English in professional context and team teaching. The components and methodological approaches have been designed after needs analysis in English for specific purposes.

Materials and methodology

Specific teaching materials in English and Bulgarian for seminar and laboratory classes are designed providing opportunity to work in a bilingual environment.

A team of discipline teachers work together with an English language teacher, in this way they convey the learning of English for specific purposes in the learning process of some of the disciplines.

The works of three groups (36 students) in Biotechnology speciality at the University of Chemical Technology and Metallurgy are used to define the specific criteria related to the field (Table 1).

Table 1. Matrix of the activities of team teachers and the design of bilingual modules in engineering disciplines and English language

Activities	**Teaching/learning materials**	**Learning activities for contact classes and self-study**		**Assessment procedures**	**Learning outcomes assessment**	
		English language teacher (ELT)	**Engineering discipline teacher (EDT)**		**ELT**	**EDT**
Activity1 Content analysis	Scientific texts, training techniques and instruments for English language teaching and engineering subject/ discipline.			Key concepts in specific knowledge	Assessment object and assessment criteria	Assessment object and assessment criteria
Activity 2 Planning of learning materials	Short scientific texts in English Battery of questions and tasks in the scientific field.	Instructions, result sheets	Instructions Result sheets	Preparation for individual control	Listening and writing skills, self- assessment skills	Domain specific knowledge
Activity 3 Contact classes	Short texts in each unit, Laboratory equipment Case studies Practical assignment Experiments Instructions Manuals Professional guides	Experimental tasks, reading texts and instructions, laboratory work, practical training, learning concepts in the domain specific sphere. Case studies from the real scientific field, report writing for scientists and engineers. Taking part in discussions.	Reading and discussion Learning tasks performance Exercises in the contact class/laboratory relevant to the needs, attitudes and skills of the students. Repetition of activities from the contact class in accordance with the abilities and attitudes of the students.	Test-paper	Performance assessment (text writing, summary, matching. Increased technical vocabulary, improved reading and writing skills	

		Transfer of knowledge and learning experience from the fundamental discipline in engineering/technological context.	Practices, exercises, Applying key concepts in learning activities from the subject matter.		
Activity 4 Organization of extracurricular activities	„Handouts", learning tasks in engineering technological field, self- work assignments	Consulting		Performance criteria	Test
Activity 5 Assessment	Tests: choose the right answer, gap filling, matching terms with definitions, reading comprehension			External control and development of self- assessment in bilingual environment	Knowledge, skills, competencies and self-regulation of learning activities.
Activity 6 Joint discussion of the work in the module	Revised, discussed, updated teaching materials.	Updated activity plan		Updated assessment procedures	Updated assessment instruments

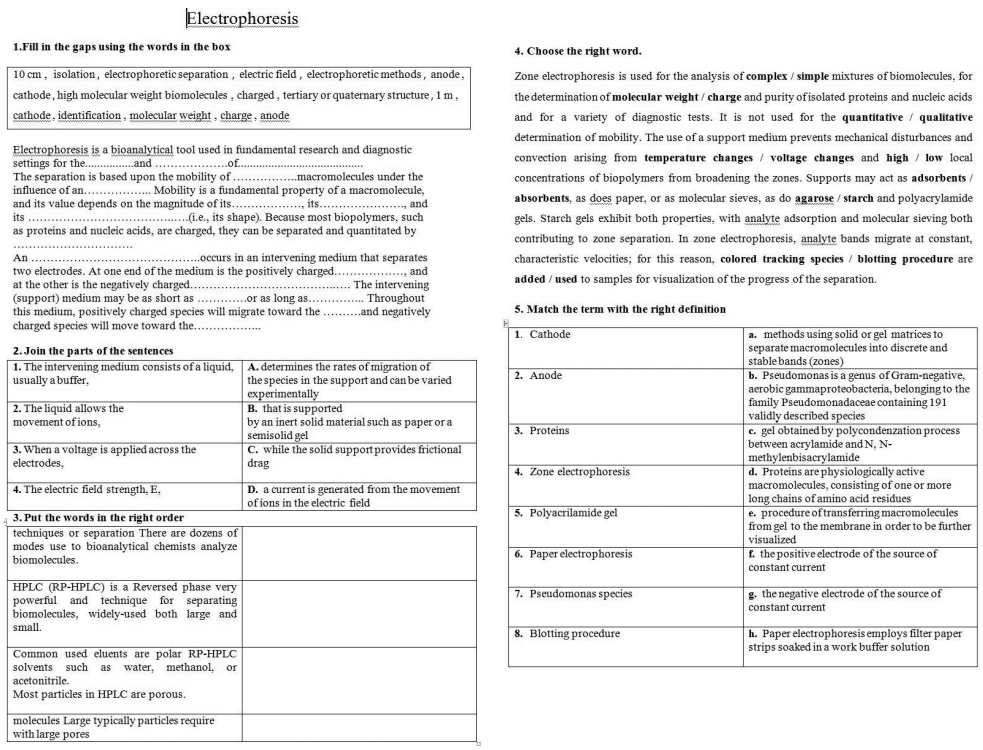
Results

Teaching materials in English and Bulgarian, for seminar and laboratory classes, which provide opportunity to work in a bilingual environment, have been developed. Academic programs at the university afford an opportunity to apply an unconventional educational approach which is a specific form of team teaching (TT), (Lee, 2008; Mohammed, 2012, Terzieva & Kolarski, 2015).

A team of discipline or fundamental teachers work together with an English language teacher, in this way they convey the learning of English for specific purposes in the learning process of some of the disciplines. Core moments of the TT organization are shown in Table 1.

Learning materials in Bulgarian and English are provided in the course so the students have the option to work in either languages and the experience shows that when they are given such an option they prefer working in English. Thus, during the classes students use educational materials in English and can communicate with their teacher and their fellow- students in English and Bulgarian. When students have accomplished

the tasks with specialized texts and laboratory work instructions, they present written reports. In addition, the results are assessed with specialized tests that check language progress and scientific knowledge. The model of handout that is used is presented in Fig. 1.



Electrophoresis

1.Fill in the gaps using the words in the box

10 cm , isolation , electrophoretic separation , electric field , electrophoretic methods , anode , cathode , high molecular weight biomolecules , charged , tertiary or quaternary structure , 1 m , cathode , identification , molecular weight , charge , anode

Electrophoresis is a bioanalytical tool used in fundamental research and diagnostic settings for the.....and ……of.....
The separation is based upon the mobility of ……..macromolecules under the influence of an…….. Mobility is a fundamental property of a macromolecule, and its value depends on the magnitude of its……., its……., and its ……..(i.e., its shape). Because most biopolymers, such as proteins and nucleic acids, are charged, they can be separated and quantitated by ……
An ……..occurs in an intervening medium that separates two electrodes. At one end of the medium is the positively charged……., and at the other is the negatively charged……..…. The intervening (support) medium may be as short as ……or as long as…….. Throughout this medium, positively charged species will migrate toward the …….and negatively charged species will move toward the……...

2. Join the parts of the sentences

1. The intervening medium consists of a liquid, usually a buffer,	**A.** determines the rates of migration of the species in the support and can be varied experimentally
2. The liquid allows the movement of ions,	**B.** that is supported by an inert solid material such as paper or a semisolid gel
3. When a voltage is applied across the electrodes,	**C.** while the solid support provides frictional drag
4. The electric field strength, E,	**D.** a current is generated from the movement of ions in the electric field

3. Put the words in the right order

techniques or separation There are dozens of modes use to bioanalytical chemists analyze biomolecules.	
HPLC (RP-HPLC) is a Reversed phase very powerful and technique for separating biomolecules, widely-used both large and small.	
Common used eluents are polar RP-HPLC solvents such as water, methanol, or acetonitrile. Most particles in HPLC are porous.	
molecules Large typically particles require with large pores	

4. Choose the right word.

Zone electrophoresis is used for the analysis of **complex / simple** mixtures of biomolecules, for the determination of **molecular weight / charge** and purity of isolated proteins and nucleic acids and for a variety of diagnostic tests. It is not used for the **quantitative / qualitative** determination of mobility. The use of a support medium prevents mechanical disturbances and convection arising from **temperature changes / voltage changes** and **high / low** local concentrations of biopolymers from broadening the zones. Supports may act as **adsorbents / absorbents**, as does paper, or as molecular sieves, as do **agarose / starch** and polyacrylamide gels. Starch gels exhibit both properties, with analyte adsorption and molecular sieving both contributing to zone separation. In zone electrophoresis, analyte bands migrate at constant, characteristic velocities; for this reason, **colored tracking species / blotting procedure** are **added / used** to samples for visualization of the progress of the separation.

5. Match the term with the right definition

1. Cathode	**a.** methods using solid or gel matrices to separate macromolecules into discrete and stable bands (zones)
2. Anode	**b.** Pseudomonas is a genus of Gram-negative, aerobic gammaproteobacteria, belonging to the family Pseudomonadaceae containing 191 validly described species
3. Proteins	**c.** gel obtained by polycondenzation process between acrylamide and N, N-methylenbisacrylamide
4. Zone electrophoresis	**d.** Proteins are physiologically active macromolecules, consisting of one or more long chains of amino acid residues
5. Polyacrilamide gel	**e.** procedure of transferring macromolecules from gel to the membrane in order to be further visualized
6. Paper electrophoresis	**f.** the positive electrode of the source of constant current
7. Pseudomonas species	**g.** the negative electrode of the source of constant current
8. Blotting procedure	**h.** Paper electrophoresis employs filter paper strips soaked in a work buffer solution

Fig. 1. The model of handout that is used in the current study

Discussion

The first results show that the approach for widening the field of English for specific purposes in academic disciplines is applicable for engineering education. It has been accomplished according to interdisciplinary principles (Esteban & Valejo Martos, 2002) at content level and learning activities level in order to improve the communication skills of students.

What follows is the creation and application of programs which are based on the capacity and consistency of integrated disciplines. These programs should be flexible

enough to form the educational syllabus in a way that corresponds to the needs of the students.

Conclusions

(1) Interdisciplinary programs are applied in order to overcome fragmentation, relevancy and to guarantee building upon knowledge; (2) Interdisciplinary approach should be developed under collaboration with the teaching teams - faculties and departments as the actual result is a product of the efforts of groups of teachers; (3) Interdisciplinary modules and courses follow students through constant putting the questions 'What is the knowledge in this science and what do we know?' and subsequent 'How to present this knowledge in this educational environment?'; (4) Interdisciplinary modules give students the opportunity to realize meanings and connections of relevant subjects and great number of perspectives.

NOTES

1. The paper was presented at the 6th International Conference of Faculty of Mathematics and Natural Sciences, University of Blagoevgrad, 10-14 June 2015.

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