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Pedagogical Implications of Teaching English for Science and Technology

Spiczéné Bukovszki Edit: Az angol műszaki szaknyelv tanításának pedagógiai vonatkozásai

Összefoglaló

A szaknyelvi angol (ESP) tanítása hagyományosan kontextus-vezérelt oktatási folyamat, arra a szakterületre összpontosít, ahol a nyelvet később használni fogják; az igényekre-reagáló, amennyiben megpróbálja meghatározni a nyelvtanulók igényeit és ehhez igazítani a tanítási módszereket; valamint tanuló-központú abban az értelemben, hogy a tanulási folyamatokat és a tanulói tevékenységeket nagyban befolyásolják az elérni kívánt tanulási célok. Ugyanakkor a napjainkban bekövetkező globális változások megkérdőjelezik a hagyományos tanítási módszereket alkalmazásának eredményességét. Jelen tanulmány célja, hogy bemutasson néhányat a legérdekesebb kihívások közül, amelyekkel a szaknyelvoktatóknak szembe kell nézniük, valamint lehetséges megoldásokat kínáljon ezek leküzdésére részben a kapcsolódó szakirodalom áttekintésével, másrészt sikeres gyakorlati alkalmazások ismertetésén keresztül. A szerző ezen felül megvizsgálja a felsőoktatás nemzetköziesedésével felmerülő pedagógiai kérdéseket, valamint bemutatja a tanulási stílusokra vonatkozó empirikus kutatása néhány előzetes eredményét.

Kulcsszavak: angol szaknyelv, igényfelmérés, felsőoktatás nemzetköziesedése, tanulási stílusok

ABSTRACT

Teaching English for Specific Purposes (ESP) has traditionally been context-driven, focusing on the special field in which the language is expected to be used; needs-responsive, trying to define language learners' needs and adapt teaching practices to these needs; and finally learner-centred, in a sense that teaching processes and learners activities have been highly influenced by the desired learning outcomes. However, due to recent global changes the conventional ways of teaching have been challenged. The paper lists some of the most intriguing pedagogical challenges for ESP practitioners and also recommends possible solutions to meet them, partly from overviewing related academic literature, partly from successful practical implementations. Pedagogical issues raised by the internationalisation of higher education are also investigated by the author and some preliminary results of empirical research about learning styles are presented.

Key words: ESP, needs analysis, internationalisation of HE, learning styles

1. CURRENT RESEARCH DIRECTIONS

The linguistic peculiarities of different fields of ESP, particularly English for Science and Technology (EST), have been widely researched and their basic findings are accepted by the academic community (Halliday 1994). More recently the focus of research has shifted towards the genres used (Swales 2009, 2011) and skills needed in professional communication and also on pragmatic considerations of disciplinary socialisation (Hyland 2006; Paltridge 2012).

Many investigations in the ESP field take a genre perspective, closely examining linguistic, rhetoric, social and contextual features of

different written and spoken genres (Paltridge-Wang 2011). There is also a growing number of studies dealing with advanced academic genres, with a special focus on the academic writing tasks that should be performed by undergraduate and graduate students (e.g., Bhatia 2008). Professional genres are also widely analysed, keeping in mind their pedagogical and didactic implications for curriculum planning and raising learner genre awareness (Tardy 2009, 2011). Different genre-focused research approaches are listed and synthesised by Flowerdew in his recent study (Flowerdew 2011).

Corpus studies enjoy particular attention as they offer a huge amount of data for analyses. (Belcher 2009). Ken Hyland's works are frequently cited as studies considering both the viewpoints of writers and readers of academic texts. His interpersonal model of metadiscourse has been very influential and triggered a great deal of text-based research in the differences of written discourse between "hard" and "soft" disciplines (sciences and humanities) and also in ESP teaching (Hyland, 2011). Issues related to using English as a lingua franca in specific purpose settings are also increasing in popularity (Belcher et al. 2011).

In recent years, classroom-based research seems to appear more often in research articles examining the changing roles of learners, teachers and implementations of innovative methods (Cheng 2011).There is a remarkable effort being made in ESP research to bridge the gap between scientific theory and pedagogical practice. One example of this is the special interest group of IATEFL, which publishes research reports (http://espsig.iatefl.org/) to enable ESP practitioners to incorporate these results into their teaching practice. Helen Basturkmen has also significantly contributed to dismantling the barriers between research and practice by publishing combined research on learning and pedagogy (Basturkmen 2006, 2010).

2. QUESTIONS AND CHALLENGES IN TEACHING ESP

English for Specific Purposes is a sprawling field of language teaching containing several sub-fields. The common core of these subcategories can be identified as the goal of the learners who want to use English in a particular domain. The most wide-spread subdivisions of ESP are the following: English for academic purposes (EAP), English for occupational purposes (EOP), English for vocational purposes (EVP), English for medical purposes (EMP) English for business purposes (EBP), English for legal purposes (ELP) and English for science and technology (EST). This latter area provides the context for the preliminary research findings presented in this paper.

As far as the pedagogical implications of teaching EST are concerned, the basic challenges might be posed by the heterogeneity of the language level of ESP classes and differences in students' learning goals. Some students are aiming at improving their language skills to be able to communicate in English in an international work or study environment. However, the majority of them have only a short-term goal of passing an intermediate-level professional language exam. This objective substantially determines the activities done in language lessons.

Another perpetual topic in teaching EST discourse is the professional limitations of teachers who work outside their own disciplines on a daily basis, in a sense that they typically are not members of the professional community whose language they are teaching. This fact requires them to make remarkable efforts to find the appropriate material, create the right context and highlight the necessary vocabulary. In addition, there is a gap between discipline-related genres and genres students are expected to perform during their language studies. Students are most often asked to write essays, formal letters, letters of application, less frequently summaries or translations into the mother tongue. However, in a real professional context they might face the task of writing

research articles, lab reports, progress reports, feasibility studies, project documentation, users' manuals and making professional presentations.

The internationalisation of higher education also poses significant challenges, along with socio-economic changes and the development of English as lingua franca. English-medium university courses have the dual aim of increasing the level of the content knowledge and also language development. Content teachers should be properly prepared for teaching in an international group, both linguistically and pedagogically, while local students may also require preparation to study among international students. Students must be encouraged to consider options outside of their own country, and trained to be able to study abroad or take professional courses in their fields in the English language (Hellekjaer–Wilkinson 2003).

Further questions arise concerning the role of the teacher in the learning process and the stance he/she takes. Do teachers consider themselves as exclusive sources of information that is transferred to students or rather as facilitators, advisors in the learning process which is executed by the learners themselves? The relationship and ratio of content and skills in teaching must be clarified in order to find the proper answer to the question of *what to teach?.* Closely related and of equal importance is identification of learners' needs. Not only should their language learning needs be identified, but also their learning styles and strategies. The mini-research I conducted recently with my students aimed at gathering information about the learning styles of students.

3. PEDAGOGICAL APPROACH IN TEACHING ESP

The Y and Z generation, "digital natives" of the Web 2.0 era, cannot be taught without renewing and readapting the traditional teaching methods. This generation uses info-communication and mobile devices gladly and confidently, shares content with on-line communities and learns in a connectivist way (Bessenyei 2010, Éger 2011, Magyari 2010). If teachers are to teach this generation successfully, it is urgently required that they should be familiar with the results of scientific research about learning in the fields of cognitive studies, psychology and education science. Otherwise Hungarian higher education, the results of which we could be proud so far, will fall behind international standards. Foreign universities are already challenging the Hungarian universities in terms of recruiting students. This tendency is strengthened by the global spread of 'open universities' and the globalisation of higher education (Berács 2009, Ollé 2010).

The main findings of education sciences should be also applied in teaching ESP. The most important concepts are described in the following based on an article by Gábor Halász (2009:11):

- prior knowledge is of decisive importance in the learning process
- -learning is constructive (as opposed to being linear)
- emotions and motivation fundamentally affect the learning process
- learning is a social activity
- the learning process is extremely complex.

ESP teachers should examine their teaching practices and reflect on them, keeping in mind these principles. Trivial as it may sound, we should ask ourselves whether we rely on our learners' prior knowledge. Do we consider ourselves as exclusive sources of knowledge or rather just one possible source? What type of learners do we teach? What are their preferences in learning styles and strategies? To what extent should we take affective/emotional factors into account when we make our decisions concerning the material and teaching methods? In the following section I introduce my investigation in the field of learning sciences in order to search for possible answers to these questions.

4. QUESTIONNAIRE-BASED RESEARCH

Randomly chosen students of BA and BSc courses (N=160) of the University of Miskolc – all of them studying English, either in optional or required classes – were asked about their language learning styles. Out of the respondents, 85 were engineering students from the Faculty of Mechanical Engineering and Informatics or tthe Faculty of Earth Science and Engineering. Another 75 were students of the Faculty of Law, Faculty of Economics and Faculty of Arts. In the paper they are referred to as non-engineering students.

The questionnaire used is adapted from the learning style questionnaire of Cohen et al. (2002). The original English version was translated and a bit shortened. The original questionnaire used 6-9 questions to reveal a particular field whereas in my version there were altogether 57 items, 3-6 questions gathering information about the following areas: to what extent learners use their different senses in the learning process; how much they are involved in learning; how they handle opportunities, uncertainties and deadlines; how they process and store information; and finally what their attitude to language rules is. The answers were given on a 5-point Likert scale. The results are evaluated by the methods of descriptive statistics. In the following stages of research further correlations might be revealed by the use of SPSS.

4.1 Preliminary results

The most relevant findings for the current study are those which show the differences between learning styles of engineering and non-engineering students. One major difference is that 73.34 per cent of non-engineering students prefer studying deductively: first they learn the rules and then find examples to support them. Among engineering students an inductive approach seems to be more preferred, as 83.53 per cent of them said that based on examples they can learn rules better (Figure 1). This information might have useful implication for EST teachers in curriculum planning and deciding on the sequence of language learning activities.

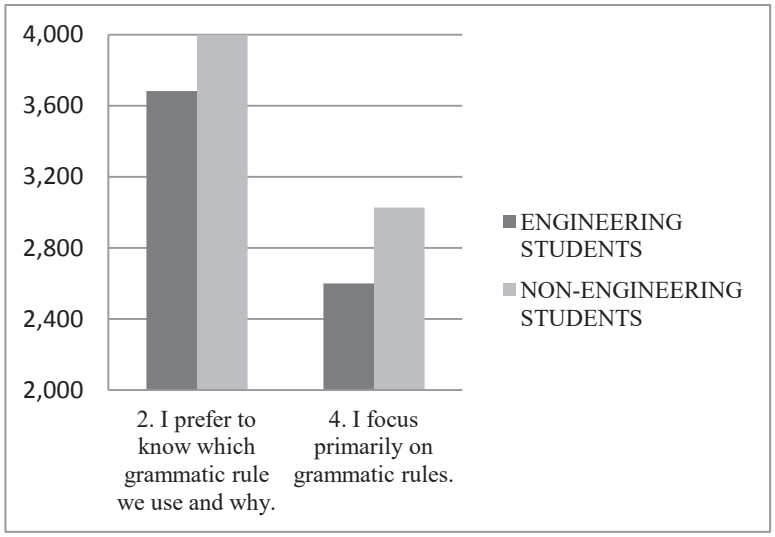

Figure 1. The learning preferences of students: inductive-deductive style
The diagram shows the means of the answers on a 1-5 scale

Another interesting difference between the learning styles of the student groups is in preferences for group work (Figure 2). Engineering students prefer learning in groups and like conversational exercises, while non-engineering students prefer working individually or in pairs in language learning situations, and do not like producing foreign language utterances in larger groups. We can conclude that (1) these preferences should be kept in mind when teaching groups of engineering versus non-engineering students, and (2) varied language learning activities should be provided for students, so that each person can find the one most suited for their learning styles, and also experience situations which make them aware of their own learning styles and enable them to adjust their learning strategies to new tasks and expectations.

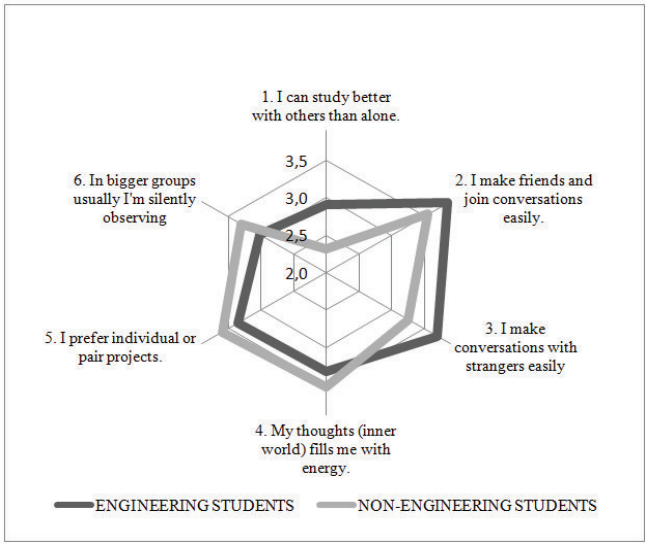

Figure 2. The learning preferences of students: extrovert-introvert style
The diagram shows the means of the answers on a 1-5 scale

It is hard to predict what kind of disciplinary knowledge the current generation entering the labour market will need in the future. But it can be seen what kind of skills would be essential (Nagy 2000). Also the ways and methods of acquiring knowledge can be predicted. My mini-research showed that a significant majority of students from both groups highly evaluate the visualisation of information, and 82.5 per cent of the respondents claimed that they themselves like writing down what they hear and require visual stimuli when learning (figures, charts, maps, drawings). So, when in ESP classes teachers should make use of them more often.

The next lesson to be learnt from the study is that learning is not a solitary activity carried out in the silence of libraries over books. It is rather an active, cooperative activity which takes places in a virtual community scaffolded by computer applications and on-line content. It turned out from the questionnaire that shared problem-solving and knowledge-sharing are the most typical features of learning processes. Out of the students asked, 79.3 per cent said that they are open to ideas from others and appreciate cooperation.

The characteristics of learning styles show a slightly different picture when it comes to language learning. Students of both engineering

and non-engineering faculties consider it very important to know the meaning of each foreign word (Figure 3). They do not tolerate uncertainty; they are afraid of language learning situations where they do not understand everything. They should be made aware of the fact that the success of communication does not depend only on semantic meanings. Pragmatics and contexts are of paramount importance as well. Without this awareness language learners will lack skills and strategies to handle situations where they should use the foreign language.

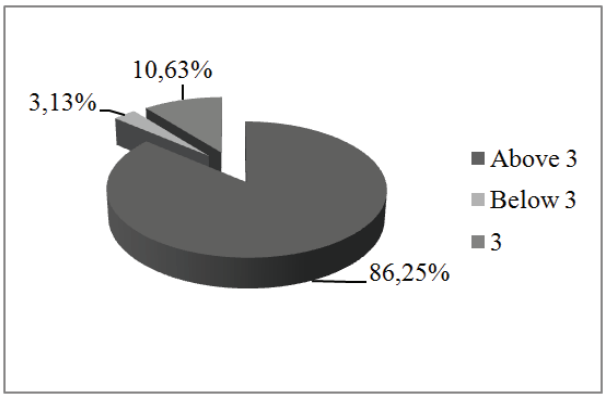

Figure 3. I prefer to know the exact meaning of the words
The distribution of the responses on a 1-5 scale

6. PRACTICAL IMPLEMENTATIONS

Below are some of the successful and scientifically proven methodological procedures that can be used in EST. These methods do not follow the traditional presentation-practice-performance scheme; instead, they rely on students to collect and process information and knowledge individually and build that into their own cognitive schemes. These autonomous, self-regulated methods and forms of learning feed on the interest and internal motivation of students and are based on the principles of constructivist pedagogy. Such methods include:

- cooperative learning (Lencse 2010)
- project method (Torgyik 2012)
- inquiry-based learning (Nagyné 2010)
- content-based language teaching (Bodnár 2009)
- 'Just-in-Time Teaching' (Spiczéné 2013).

During all these learning processes the students create their own applicable and adaptable meanings and interpretations and they can understand, apply and communicate the knowledge acquired on their own. The learner activities that focus on acquiring knowledge aim to improve creativity, autonomy and problem-solving skills and lead to better results (Zimmermann 2001). Depending on the contents of the specific subjects, these activities can include: field work, measurements in laboratories, case studies, interviews, individual and group projects, shadowing, and literature research. Another common characteristic of the innovative methods is that they are based on active student participation. The knowledge they form is relevant and adaptable knowledge that is acquired through a motivating and useful context. In these methods, student-student and student-teacher cooperation are essential for successful work. The methods require the use of learning strategies and at the same time teach and train learners in the strategies, make differentiating possible, activate prior

knowledge about the world, the topic and the foreign language. Integrating the academic content and the language results in deeper understanding and more permanent incorporation of the subject matter. The methods improve both social and social-learning skills. The result of the learning process and the process of gaining knowledge are equally important and both are evaluated.

SUMMARY

The paper gives a general overview of current research directions in ESP. The focus of the article is pedagogical issues related to English for Science and Technology. The fact that research findings should be incorporated into teaching practice has given the stimulus to carry out a mini-research project among engineering and non-engineering students in order to identify differences in their learning styles. The investigation revealed that engineering students prefer inductive ways of learning and are open to group activities. Some general trends in learning styles of students regardless of their disciplines are also introduced; considerable demand for visualisation of information, low tolerance of uncertainty and occasional uses of strategies. Similar conclusions are drawn by the author of a comprehensive survey carried out at another institution, which supports the validity of my research (Tar 2013). The implications of the findings are discussed and some teaching practices and methods are recommended for possible EST classroom use. The lessons from this research might also contribute to raising the standard and effectiveness of language teaching processes, paying special attention to the expectations arising from internationalisation trends in higher education.

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