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Original scientific paper

DEVELOPING NEEDS ANALYSIS-BASED ESP CURRICULUM FOR CHEMISTRY-BIOLOGY STUDENTS IN HIGHER EDUCATION

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Abstract. *This article focuses on the development of an English for Specific Purposes (ESP) curriculum tailored to the needs of students in the combined major program 'Chemistry and Biology' at Suleyman Demirel University in Kazakhstan. The case study aims to highlight the significance of conducting a needs analysis to identify the academic and professional needs, preferences, and deficiencies of chemistry and biology students in the ESP course offered at the post-secondary level. The findings suggest that the ESP course's goals, outcomes, and content should prioritise the needs of students with an A1/A2 level of English proficiency (according to CEFR) who graduated from public high schools where the language of instruction was either Kazakh or Russian. In contrast, students who completed their high school education in schools where science subjects were taught exclusively in English should focus more on EAP. Therefore, this paper argues that the ESP curriculum must be designed to provide equal opportunities for both groups of students to learn and enhance their English language skills at the post-secondary level.*

Key words: *chemistry-biology students, curriculum design, English for Specific Purposes (ESP), needs analysis (NA).*

1. INTRODUCTION

English for Specific Purposes (ESP) emerged in the 1960s to cater to non-native English speakers' need to communicate effectively in specific professional settings (Hutchinson and Waters, 1987; Strevens, P. 1988; Johns, 2013). Today, ESP has become an essential component of foreign language education at the secondary and post-secondary levels. Hutchinson and Waters (1987) identified three main reasons for ESP's emergence and growth: globalisation, linguistic revolution, and learner focus. Additionally, scholars like Strevens (1988), Robinson (1991), Dudley-Evans and St John (1998), and Dudley-Evans (2001) distinguished two significant features of an ESP course: absolute and variable traits. Absolute traits are goal-oriented and based on learners' needs analysis, strictly referring to

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the activities and skills required by the technical domain where English is used. Variable traits are designed for specific disciplines, using a methodology different from general English and aimed at adult learners in post-secondary education or professional working environments.

Needs analysis (NA) is crucial in ESP course design, as emphasised by Yong Chen (2015), who stresses the importance of defining students' needs and devising the ESP curriculum accordingly before material production. Studies also show that needs analysis can significantly influence the course design, encouraging instructors to create more suitable teaching materials (Čapková, Kroupová, 2017) and incorporate academic tasks into the ESP syllabus (Muhammad & Abdul Halim Raof, 2019). Bula and Diaz-Ducca (2017) suggest that ESP courses should prioritise communication and cooperation skills, incorporating authentic, effective, and purposeful tasks, pair and group work, and learners' desired activities. In ESP, needs analysis include examining learners' desired outcomes, preferences, motivations, requirements, wants, expectations, wishes, reasons for enrolling in a course, limitations, teaching and learning shortages, and knowledge gaps (Chambers, 1980; Beatty, 1981; Richterich, 1983; Brindley, 1989; Johnson et al., 1987; Benesch, 2001; Hyland, 2006). Thus, according to Raikhanova and Bakić-Mirić (2023) conducting a NA is a fundamental step in designing an effective ESP curriculum, as it helps educators identify students' learning goals, interests, and requirements. This process often begins with informal discussions between teachers and learners to determine lesson preferences and instructional approaches. Needs analysis serves as the foundation for course planning, guiding the establishment of objectives and desired learning outcomes.

This paper aims to identify language needs for future chemistry and biology professionals in Kazakhstan and offer suggestions for ESP instructors to improve their courses. The topicality of research is the lack of relevant studies on chemistry and biology experts' language needs. The majority of higher education institutions teach ESP as General English courses that is why this study aims to create a needs-based ESP course.

Needs analysis in ESP involves course design, which includes a Present Situation Analysis (PSA) to determine learners' competencies, such as their knowledge and ability to carry out tasks according to present requirements. In this study, PSA was conducted by analysing documents which answers the question (RQ1): ***What are the English language proficiency requirements for the future science students?*** The Target Situation Analysis (TSA) investigates the levels, skills, tasks, and activities that learners will use English for, as well as the teaching environment of the ESP course. TSA was carried out by collecting online open-ended questionnaires from English and content instructors to determine their attitudes towards the use of needs analysis in language teaching which responds to the second research question (RQ 2): ***What are the attitudes of ESP teachers towards the use of needs analysis in language teaching?*** The Learner Situation Analysis (LSA) focuses on learners' motivation, perception, and needs, based on their language proficiency, expectations, wants, and needs. LSA was conducted through a Likert-scale questionnaire to determine the specific needs of chemistry and biology students in the ESP course, which is the third research question of this study (RQ 3): ***What are the specific needs of chemistry and biology students in learning in the ESP course?***

The authors of this paper believe that ESP teachers who are informed of their students' needs can design effective ESP courses and teach them successfully.

2. METHOD

This research has been conducted to investigate and understand students' language needs and obstacles in language learning, problems that teachers face in teaching ESP and teaching outcomes. For the purpose of this study a comparative analysis was used for the first research question and disseminated to students. A working curriculum programme in the discipline "Foreign Language" for universities of non-linguistic specialties and a working curriculum POIYa 3207 Professionally-oriented foreign language for Chemistry-Biology specialty were used for the analysis. An open-ended online qualitative data collection method was used via SurveyMonkey for the second research question. To obtain better results in needs analysis the mixed method was used to determine the importance of specific personal goals in ESP classes. Thus, in order to investigate the third research question (What the specific needs of chemistry and biology students for learning ESP course?) an online open-ended survey from content practitioners and the qualitative data collection method were used. Furthermore, at the end of the course, chemistry and biology students were given the Likert scale questionnaire as a quantitative data collection method.

Participants of the study were General English language and ESP instructors as well as content teachers (N=13) and the first-year chemistry/biology students at Suleyman Demirel University in Kazakhstan (N=44). More than half of the students (N=24) were graduates of specialised schools as Nazarbayev Intellectual Schools (NIS) or Bilim Innovation Lyceums (BIL) who studied chemistry and biology subjects in English, and others (N=20) were graduates of public schools where either Kazakh or Russian language was the medium of instruction. Students' participation in the questionnaire was anonymous.

3. FINDINGS AND DISCUSSION

A subfield of English language instruction called English for Specific Purposes (ESP) concentrates on teaching English to students in order to satisfy their unique demands in their academic, professional, or personal life. The linguistic abilities and information that learners will require in their particular fields of study or employment will be taught to them in ESP courses. The aim of ESP courses is to provide students with the knowledge and language skills necessary for effective communication in their field of study or job. Needs analysis must be taken into account at every stage of ESP course design. It requires identifying the language requirements that students have in relation to their specific fields of study or job and designing the course to satisfy those requirements. Teachers may create a course that is relevant, beneficial, and helpful for students by doing a needs analysis, ensuring that they learn the language skills and knowledge they need to succeed in school or in their employment.

The current study aimed to investigate the language needs, learning hurdles, and challenges faced by chemistry and biology students in ESP classes, as well as the difficulties faced by ESP teachers and the successful outcome of the teaching method. The university curricula for non-linguistic specialisations and professionally oriented foreign language for the specialties of chemistry and biology were compared in order to achieve this. Moreover, the study involved 13 General English, ESP and subject instructors, as well as 44 first-year chemistry/biology students at Suleyman Demirel University in Almaty, Kazakhstan.

A working curriculum in the field of "Foreign Language" for universities of non-linguistic specialties and a working curriculum POIYa 3207 Professionally-oriented Foreign

Language for the chemistry-biology specialty, developed in accordance with the state compulsory education standard of the Republic of Kazakhstan, were observed and analysed by researchers through the use of document analysis, a type of qualitative research. In accordance with the Working Curriculum Programme of Kazakh Universities, General English is taught in the first and second semesters for 3 credits each, while Professionally-Oriented English is taught in the sixth semester—the third year of studying these subjects as compulsory disciplines—for only 2 credits.

As a result, the Working Curriculum Programme's analysis, as was previously indicated, has a flaw that relates to the time that the English language is taught, with a gap in the third, fourth, and fifth semesters when there are no English language lessons. However, it is odd how Kazakh higher education institutions provide their students a high-quality variety of languages with 8 credits of English in four years in compliance with the government papers indicated above (Trilingual Education Road Map from 2015). When the majority of the coursework is delivered in Kazakh or Russian, it will be fascinating to examine how well the students' future professional demands are met by the General English requirement of 6 credits and the Professionally-Oriented English requirement of 2 credits.

We examined the 6B015002 Educational Programme for Chemistry/Biology bachelor students registered at Suleyman Demirel University for the future 4 years in addition to the regular Working Curriculum of Kazakh Universities. The Suleyman Demirel University's dual major programme in "Chemistry and Biology" is a relatively new course that gives students the chance to study two essential scientific disciplines at once while preparing them for the difficulties of English-language instruction. The program's objectives are to prepare qualified chemistry and biology teachers, equip them with the skills necessary to design learning environments using instructional technologies, employ a variety of unique teaching methods and techniques in their instruction, and stay current with advancements in their field. In contrast, students pick up the abilities needed to thrive in their chosen careers.

Students in the four-year chemistry/biology programme take a 3-credit optional ESP course in the second term in addition to the 6-credit General English course that is required in the first term. A 2-credit ESP course is further offered in the sixth semester. The fact that all other key topics are taught in English offers these pupils a significant edge over others who are schooled in either Kazakh or Russian, which is another important consideration. Since English is used as the major medium of instruction in this degree at Suleyman Demirel University, graduates will be qualified to teach biology and chemistry in English.

The majority of General English and ESP instructors acknowledged the significance of addressing students' needs and adapting teaching strategies in order to do so. The survey also stated that needs analysis was crucial for ESP course design. The academic independence, variety of teaching methods and resources, and increased incentive for students to acquire and practise subject-specific information were all deemed advantages of ESP courses. There were problems, too, including a lack of resources and networking with scientific instructors, holes in the curriculum, and inadequate English proficiency.

The study emphasises how crucial it is for language and science teachers to work together to fulfil the unique requirements of chemistry and biology students in ESP courses. The English language needs of the scientific students were recognised by the content professors, who also proposed themes for an ESP syllabus while highlighting the value of speaking and writing abilities. Overall, the present study underscores the need for ESP courses that are designed to meet the specific needs of learners in their fields of study or

work, and for collaboration between language and content teachers to ensure the success of such courses.

Table 1 shows students' attitude towards the statement that ESP course meets their needs, which is also evident in their answers to the second question where 52% of respondents answered strongly agree, and 32% answered agree while 57% of respondents understood the relevance of ESP classes to their needs.

Table 1 Questionnaire results from chemistry-biology students (N=44)

#	Respondents	Number of respondents	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Total (%)
1	English is significant for your academic studies	44	64%	32%	5%	0%	0%	100%
2	ESP course meets your study expectations	44	52%	32%	9%	7%	0%	100%
3	ESP course is helpful in understanding your major subjects (chem-bio) in English	44	61%	20%	14%	0%	5%	100%
4	ESP classes are relevant to your needs	44	57%	32%	9%	0%	2%	100%
5	Materials should be more focused on Chemistry – Biology	44	30%	39%	23%	7%	2%	100%
6	Materials should be more focused on Academic English	44	23%	32%	25%	14%	7%	100%
7	Teaching methods used by teacher are useful	44	75%	18%	5%	2%	0%	100%
8	The teaching methodologies used by teacher are appropriate	44	75%	16%	9%	0%	0%	100%
9	During ESP classes you have opportunities to work in groups and pairs	44	68%	27%	5%	0%	0%	100%
10	Do you enjoy your ESP classes?	44	66%	32%	2%	0%	0%	100%
11	The evaluation procedures in the course are carried out appropriately	44	44%	37%	12%	5%	2%	100%
12	English is necessary in your future career	44	93%	7%	0%	0%	0%	100%

The bar graph below demonstrates how students feel about how well the ESP course prepares them for the various English disciplines. Only 5% of individuals said "strongly disagree," compared to 61% who overall said they "strongly agree". Students who graduated from NIS and BIL schools (N=24) and had prior experience with chemistry and biology in English are those who responded "strongly disagree" or "neutral." However, students from public schools (N=20), where chemistry or biology classes were taught in Kazakh or Russian, respectively, provided the bulk of the favourable comments.

The results show that students are aware of the significance of the English language in their specific professional sectors because 93% of students stated that English is essential for their future jobs. According to the statistics on students' aims, 25% of participants

claimed that improving their understanding of academic English was their top priority, while 75% responded that using English outside of the classroom was their top priority.

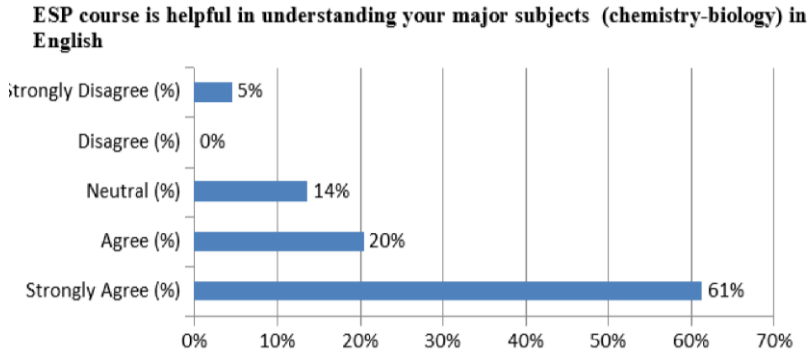

Fig. 1 Question #3: The ESP course is useful for comprehending your primary courses (chemistry and biology) in English

Both fifth and sixth questions in Figure 2 show almost the same significance with 69% participants who strongly agree and agree with a mean value M= 2.1364 and a SD value = 1.00211 to the fifth and 55% of strongly agree and agree answers with M=3.0000 with SD=1.29399 results to the sixth question respectively. Therefore, after consulting with the head of the chemistry and biology department, it was decided to divide the elective English course into ESP and EAP where ESP course was intended for those who graduated from public schools with either Kazakh or Russian as the medium of instruction and EAP was for graduates who came from schools with English as the medium of instruction. This way some students have the opportunity to improve language competencies relevant to their respective area of studies while some have the opportunity to work more on EAP since their knowledge of ESP is already high.

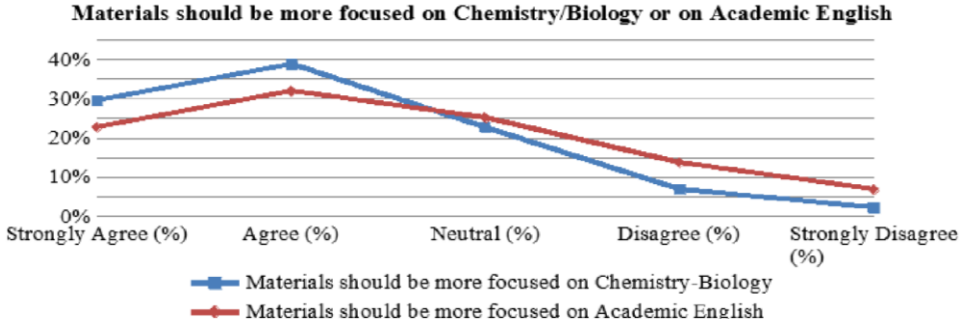

Fig. 2 Questions #5 & 6 Materials should be more focused on Chemistry – Biology or Academic English

The present study aimed to investigate the attitudes of chemistry-biology students towards English for Specific Purposes (ESP) courses and the extent to which these courses meet their academic and professional needs. A survey was given to 44 first-year chemistry-biology students at Suleyman Demirel University in Almaty, Kazakhstan, in order to achieve this.

Twelve Likert-type questions were included in the survey to gauge how important students thought English was for their academic work and future careers, how well-suited ESP courses were to their needs, how effective the teaching methods were, and how satisfied they were with the courses overall. When the survey questions' reliability was evaluated using Cronbach's alpha, it was discovered that both the original and the standardised items had an alpha value of 0.728, suggesting moderate internal consistency. This implies that the survey questions provided accurate representations of the opinions of chemistry-biology students regarding ESP courses. Tables 2 and 3 below show the actual value for Cronbach's alpha.

Table 2 Cronbach's Alpha

Case Processing Summary			
		N	%
Cases	Valid	44	100.0
	Excluded	0	.0
	Total	44	100.0

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	N of Items
.728	.728	12

Table 3 Item-Total Statistics

Item-Total Statistics						
		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
1	English is important in your academic studies	18.4091	25.038	-.130	.342	.755
2	ESP course meets your study expectations	18.1136	18.801	.637	.658	.669
3	The ESP course is useful for comprehending your primary courses (chemistry and biology) in English	18.1591	17.858	.652	.731	.661
4	ESP classes are relevant to your needs	18.2273	18.552	.736	.812	.657
5	Materials should be more focused on Chemistry – Biology	17.6818	19.710	.439	.424	.699
6	Materials should be more focused on Academic English	16.8182	22.850	.008	.179	.786
7	The teaching methodologies used by teacher are useful	18.4773	20.534	.587	.676	.686
8	Teachers employ proper instructional strategies	18.4773	22.813	.225	.470	.725
9	You can work in partners and groups when taking ESP lessons	18.4545	23.370	.165	.291	.730
10	You enjoy your ESP classes	18.4091	20.294	.656	.670	.680
11	The evaluation procedures in the course are carried out appropriately	18.0227	20.162	.430	.420	.700
12	English is necessary in your future career	18.7500	24.378	.069	.139	.734

The adjusted item-total correlation coefficients for the 12 survey questions varied from -0.13 to 0.74, with an average of 0.43, according to the item-total statistics. This implies that respondents' opinions of ESP courses in general were generally positively correlated with a significant portion of survey topics. Additionally, the squared multiple correlations had an average value of 0.54 and varied from 0.14 to 0.81. This shows that the survey's questions explained, taken as a whole, a fair proportion of the variation in respondents' perceptions of ESP courses.

Additionally, Cronbach's alpha values for eliminated items varied from 0.66 to 0.79, indicating that each survey question was significant and added to the survey's overall dependability. This suggests that all the survey questions were measuring different aspects of chemistry-biology students' attitudes towards ESP courses.

Overall, these statistics indicate that the survey questions are reliable and valid measures of chemistry-biology students' attitudes towards ESP courses. The results of the study suggest that chemistry-biology students value the importance of English in their academic studies and future careers. The survey questions related to the relevance of ESP courses to their needs, the usefulness of the teaching methodologies used, and their overall satisfaction with the courses were also found to be moderately correlated with the students' overall attitude towards ESP courses. These findings suggest that ESP courses are meeting the needs of chemistry-biology students to some extent, but there is room for improvement in course design and delivery.

As previously mentioned, needs analysis should be designed to demonstrate students' language needs and obstacles in language learning, problems that teachers face in teaching ESP and teaching outcomes. Thus, Figure 3 below is a good illustration of the needs, lacks, wants and targets of instruction in ESP for the chemistry/biology students and the needs of the labour market in Kazakhstan.

The study supports the idea that obtaining data on students' current language requirements and target language usage is the first step in developing an English for Specific Purposes programme. By utilising real resources, course components should show students' enthusiasm in the intended subject(s) and current language. The purpose of the current study is to develop a needs analysis (NA) to look at the language requirements of scientific (chemistry/biology) students. According to the findings of the study, it is recommended that ESP courses be divided into two groups: one for students with poor English proficiency who attended public schools, and another for students with high English proficiency who attended institutions where science was taught in English.

4. CONCLUSION

This study aimed to evaluate the academic and professional needs of students in the Chemistry and Biology combined major program at Suleyman Demirel University in Almaty, with regards to the English for Specific Purposes (ESP) course offered at the post-secondary level. Chemistry and biology students need a variety of general academic language skills, including listening comprehension, speaking abilities with both general and subject-specific vocabulary, and reading and writing abilities to comprehend and produce academic and scientific literature. This was revealed by the present situation analysis, target situation analysis, and learning situation analysis. Higher-level English-speaking pupils, however, did not demonstrate appreciable language development in ESP lessons. This is perhaps because they attended specialised institutions where science classes were delivered in English.

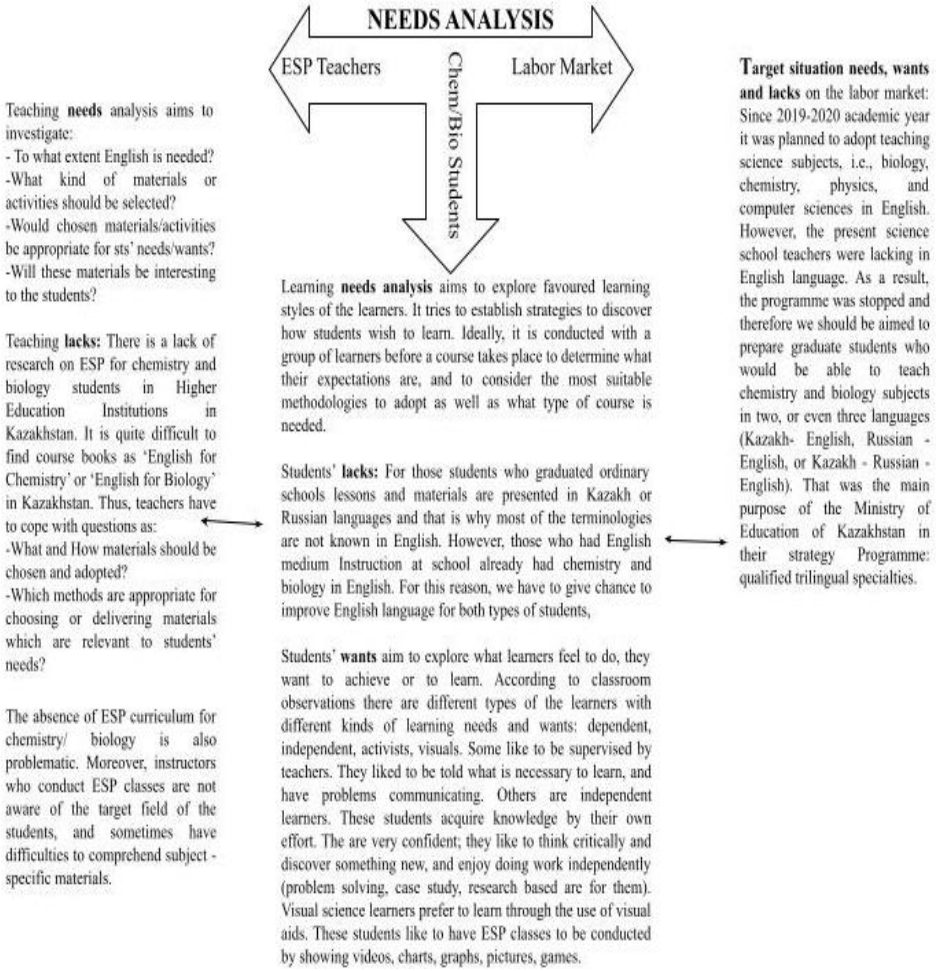

Fig. 3 ESP Needs Analysis Results for chemistry and biology students

Despite the analysis conducted to ascertain the requirements of the students and to identify the context and objectives of the course, the research has certain restrictions. Future studies should do a more thorough needs analysis and incorporate additional instructor views.

This would make it possible to create ESP courses that are specifically catered to the needs of students at various levels. In comparison to General English classes, a study indicated that ESP courses had benefits including academic independence, a variety of teaching approaches and resources, and higher incentive for students to learn and practise things relating to their speciality. However, there are several negatives, including a lack of resources and networking with scientific instructors, a lack of English proficiency, and curricular gaps. In order to provide courses that give all students an equal chance to increase their English proficiency at the post-secondary level, ESP teachers must be cognizant of their students' demands. In the future, class observations and teacher and student interviews using ESP might offer further information on this crucial subject.

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