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Rosa Alonso Marta Dahlgren

ESP courses and linguistic achievement of engineering students in the Basque Country —

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Abstract

This study compares the performance of a group of 108 students who are proficient in Basque and Spanish and a group of 36 monolingual Spanish students. All of them are learning English for Science and Technology. It aims at analysing whether bilinguals outperform monolinguals on lexical and phonetic production. Similarly, bilinguals whose L1 is Basque are expected to do better then L1 Spanish speakers. Social and individual variables are taken into account. The results showed that bilinguals outperformed monolinguals, although the differences were not statistically significant. They also seemed to indicate that L1 Basque speakers outperformed L1 Spanish speakers and that bilinguals had an advantage on lexical acquisition.

Introduction

Human beings, scholars or not, have always been interested in languages. Greek and Latin gave way to modern languages, and French has been a symbol of cultural prestige since the 18th century. Other modern languages —English, German, Italian, Spanish— also developed an increasing external interest. Due to political and socio-economic reasons during the 20th century, English became a *lingua franca*. The beginning of the 21st century seems to maintain this *status quo*.

In today's almost globalised society, the ability to speak three or more languages is often indispensable and study into the processes of third language acquisition is necessary in order to support these new demands of a modern international community.

International commerce has pushed English definitively into its current status, and although estimates of the total number of different, mutually unintelligible, languages spoken in the world keeps being quite high —from 5,000 to 25,000 depending on the sources and the definition of what counts as a language (Laver & Roukens, 1996)—, it is certain that world-wide linguistic diversity is rapidly diminishing.

Minority languages are dying in many parts of the world, chiefly under the influence of changing patterns of communication, economic or political pressures. Basque is one of those languages that could be considered to be under high pressure although, at present, an apparent feeling of stand-by can be felt. In fact, Basques are surrounded by three 'giants', that is, French and Spanish, as well as English. Another reason for this pressure is the linguistic distance between Basque and Spanish or Basque and English. Basque, unlike other languages spoken in Spain (Catalan, Galician), is a non-Indoeuropean language. Basque morphology and syntax are complex. It is highly inflected, with 15 different noun inflections, and includes a complex ergative case system that distinguishes subjects of transitive and non-transitive verbs. In addition, word order is completely different from Spanish or English. It is not uncommon for non-native speakers of Basque to have incomplete mastery of the grammar even after many years of study or after having been exposed to Basque as the language of instruction at school (Perales & Cenoz, 1996). Another serious challenge facing learners of Basque is that almost all speakers of Basque in the BAC are bilingual and Basque language learners do not need to make the effort to communicate in Basque.

Governments in many countries deliberately present a somewhat skewed picture of monolingualism as normative by the explicit or implicit language policies that they adopt and promulgate (Crystal, 1987). Thus, fewer than 25% (40-50) of the world's countries (150-200) recognise two or more official languages. This attitude represents conservative government policies, since available data indicate that there are many more bilingual, or even multilingual, individuals in the world than there are monolinguals. However, many of the world's languages have yet to be written, codified or elaborated, this representing a potential danger for their existence.

Basque is a minority language (30% of the citizens speak Basque within the Basque Country) but new generations, mainly those living in the Basque Autonomous Community (BAC) are becoming bilingual. Basque was banned from the public domain (BAC and *Nafarroa*) for four decades during the Franco regime (the ban was lifted in 1979), but in 1982 Basque was recognised as an official language by law. Thus, apparently, Basque reached a 'similar' social status as Spanish, an obvious fallacy since this gives a distorted picture of the situation. In France, although laws forbidding regional varieties at school stayed on the books, French remained weak throughout much of the 19th century for the rural masses, and only with *la loi Deixonne* in 1951 was some provision made for Breton, Basque, Catalan and Occitan (Edwards, 1995). The role of the missing language, English, is rather obvious.

When ESP (English for Specific Purposes) lecturers implement new activities, these make use of existing resources to a greater or lesser extent: the extent to which they do so is the extent of the synergy arising from this new activity. Where there is no relation at all between the new and existing activities there will be no synergy, i.e. the return of 'investment' of the institution as a whole will simply be the return on the existing activities plus that of the new activity. I strongly believe that the approach presented in this study will allow the return, for the institution as a whole, for my future students, and for me, to be greater than the simple weighted average of the new and existing activities (two plus two equals five). The questions that immediately come to mind are: Do our bilingual students take advantage, somehow, of their bilingualism? Does acquisition benefit from this potential synergy?

Our world is changing, technology is changing, the needs of industry are changing, and the students coming into engineering are changing. How is engineering education responding to these changes? What kind of paradigm shift is required in the way we educate engineers that goes beyond coping with results in innovation and leadership? These questions also represent, from my viewpoint, the essence of engineering education for the 21st century.

As I am an engineer myself, I strongly believe that engineering has an important role to play in a society with an increased complexity of technical systems. Technology has a deep impact on the life of people throughout the world. This offers the developers and adapters of technology —engineers and their customers— responsibilities and challenges. Some of the crucial questions to the engineering profession are the following: (i) Are we able to take the role of a powerful, but responsible actor or do we accept the role of a reactor?; (ii) Are we willing to interact with 'society' —this term must be understood in a context where physical borders have almost disappeared— or are we looking inwards?

ESP is necessarily a more specialised market than the larger area of English as a Foreign or Second Language. ESP lecturers find themselves in a situation where they are expected to produce a course that exactly matches the needs of a group of learners, but are very often expected to do so with no, or very limited, preparation time. Then, we will have to optimise the scarce resources we usually count on and try to maximise synergies.

The students at the Industrial Technical Engineering College (Industri Ingeniaritza Teknikorako Unibertsitate Eskola—Escuela Universitaria de Ingeniería Técnica Industrial) in Bilbao have the possibility of choosing amongst four different branches: electrical, industrial electronic, mechanical, and industrial chemical engineering. Each of these, in turn, is subdivided into a lot

more specialised sub-branches. The undergraduate students of engineering have needs for English at this stage of their instruction (reading the literature of their subject/field of study) just as they will later on as postgraduate students or professional engineers who will be meeting foreign colleagues or working for foreign firms or institutions.

Although the discipline of third language acquisition represents a young and only infrequently investigated research field in comparison to the more conventional one of second language acquisition, increasingly more researchers are focussing their interests on the complex defining characteristics of third language acquisition. Is it due to the growing necessity for "global citizens"? To learn one foreign language, if not two or three, in order to be marketable in the modern workforce seems to be a current need.

An increasing interest in studying phenomena of multilingualism can be seen in the Basque Country. Language interaction while processing more than two language systems deserves special consideration. The view of bilingualism I adopt coincides with that of (Jessner, 1997). She emphasises the fact that multilingual competence is dynamic rather than static and notes further that language proficiency changes as a result of adjustments to the interacting linguistic subsystems that reflect the user's communicative needs.

Multilingual acquisition and multilingualism involve all the factors and processes associated with second language acquisition and bilingualism as well as unique and potentially more complex factors and effects associated with the interactions that are possible among the multiple languages being learned and in the processes of learning them. Multilingual acquisition and multilingualism can occur simultaneously or successively, formally (through instruction) or naturally (outside school), and in childhood, adolescence, or adulthood. The sociocultural status of each language along with the languages' respective roles and functions in society can contribute additional complexities (Cenoz & Genesse, 1998).

The group of students whose performances in English, either as a second language or as a third language, are going to be analysed within this study belong to the University of the Basque Country and are studying English for Science and Technology (EST). It is well known that in science, a barrier to full access by European citizens is that English has become *de facto* the international language of science (Laver & Roukens, 1996), so there is an obvious pressing need for English at any technical level, and our students are well aware of this situation.

Apart from this, there is a growing need for individual multilingualism (see Cook, 1992, 1993, 1995) as a result of increasing communications between different parts of the world. Therefore, this need to be competent in languages of

wider communication forces, as I mentioned before, not only teachers but also the whole engineering profession to take the role of a powerful but responsible and dynamic actor willing to interact with society.

An important aspect to be considered when dealing with monolinguals and bilinguals is the difference or differences presented when comparing L3 acquisition to L2 acquisition, since the previous experience of acquiring a second language and the results of this experience can influence the process of acquiring an additional language (Cenoz & Genesse, 1998). Thus, when teaching English (ESP to be more precise) to monolingual and bilingual adult university students within a partially or totally bilingual community, and taking into account that older learners have cognitive experience lacking in small children (Edwards, 1995), one should consider questions such as the following ones: Does level of proficiency in the first and second languages play a role in facilitating multilingual acquisition? How does knowing a second language help students acquire subsequent non-native languages, and more specifically ESP-EST?

There is positive transfer from second language learning to learning additional languages, but the *a priori* hypothetical advantage may according to Klein (1995): (1) appear only under specific conditions —for example, the manner in which the L2 was learned—; (2) involve particular areas of acquisition and not others —for example, lexical but not syntactic acquisition—; (3) affect the rate of development but not its course —that is, the stages of development may be relatively consistent, but how fast learners proceed through these stages and whether they reach the final stage may be aided by the richness of their prior linguistic experience—.

Multilingual education: Basque, Spanish and English

Apart from the two official languages, Basque and Spanish, foreign languages have also been part of education in the BAC. Until the 1980s, the most common foreign language studied at school was French. However, there has been an important shift in emphasis from French to English and, at present, English is studied as a foreign language by more than 95% of Basque school children.

Traditionally, students in the BAC have achieved relatively low levels of proficiency in English at school (Cenoz, 1991), so that it was popularly believed that English is better learned during visits to English-speaking countries of from private lessons than in school. The poor English language results obtained in school can be attributed to a number of factors, including large class sizes, the

use of out-dated or traditional instructional approaches, and the lack of welltrained teachers with adequate proficiency in English.

According to (Thomas, 1988), a bilingual person has the potential to develop some awareness that helps him/her approach the process of learning a third language. However, this process is not automatic, and although it is often believed that a bilingual person can easily learn a third language because this person has experienced second language acquisition (a language different from the mother tongue), this may o may not be the case of bilingual engineering students in the Basque Country.

It is commonly believed that learning an additional language is easier for those who already know a second language than for monolinguals (Cenoz & Genesee 1998). These researchers listed in a table a number of studies that had been carried out with different language combinations and in different learning contexts. The studies also differ greatly with respect to research methodologies and testing procedures, but they all have something in common: they all analyse multilingual acquisition in formal contexts. Moreover, in all cases, these studies involve bilingual students who are proficient in at least one minority language (for example, Spanish in the US, Italian in Belgium, Basque in the Basque Country), and this may be either their first or their second language.

	Country	L1 - L2	L3	Tests
Thomas (1988)	US, N = 26	English – Spanish	French	Grammar, vocabulary, writing
Bild & Swain (1989)	Canada, $N = 47$	Italian and non- Romance/English	French	Cloze test, oral story telling
Jaspaert & Lemmens (1990)	Belgium, N = 12/66	French/Italian	Dutch	Grammar, vocabulary, reading, writing
Zobl (1993)	US, N = 33	German, Chinese, Arabic, etc.	English	Grammar
Cenoz & Valencia (1994)	Basque Country, N = 321	Spanish/Basque	English	Grammar, vocabulary, reading, speaking, listening
Klein (1995)	US, N = 32	Hebrew, Italian, Polish, Russian, etc.	English	Lexis, syntax

Overall, the findings from these studies indicate that bilingualism does not hinder the acquisition of an additional language and, to the contrary, in most cases bilingualism favours the acquisition of third languages (Bild & Swain, 1989; Cenoz & Valencia, 1994; Klein, 1995; Thomas, 1988; also cf. Jaspaert & Lemmens ,1990; Zobl, 1993). Not all studies report positive effects of bilingualism on third language acquisition. (Jaspaert & Lemmens, 1990) and (Zobl, 1993) reported no significant differences between second and multilingual language acquisition. Nevertheless, in both studies, the authors regarded multilingual acquisition as an additive process.

L1 versus L2 versus L3 acquisition

The human language faculty consists of a system of innate principles that helps constrain the hypotheses that a child makes in acquiring the syntax of the L1. The learning task in L1 acquisition consists of the child "setting" the parameters of Universal Grammar to the particular values that match the language input received (Klein, 1995). Many researchers have acknowledged the influence of the L1 in L2 learning (e.g. White, 1988). Do bilinguals organise their previous non-native linguistic knowledge to aid in learning a new language? From their broad range of previous experiences, some should carry over to the new language but others would change or would not be applicable. Then, if L2 parameter setting is complex, L3 acquisition will be even more burdensome, in some areas of acquisition at least. But on the other hand, as it was stated before, in most cases bilingualism favours the acquisition of third languages (Thomas, 1988; Valencia & Cenoz, 1992; Zobl, 1993; Klein, 1995; Cenoz, 1998). Intuitively, one expects that the more languages learners acquire, the better they get at it. If the parameter settings of antecedent languages differ from those of the target language, there should be no substantial differences between monolingual and bilingual subjects in the stages of acquisition on the way to the target language setting. But if the situation is the other way round, bilingual subjects would evidence enhanced lexical acquisition because of an improvement in their parameter-setting capabilities that would affect the rate at which they learn (Swain et al., 1990; Valencia & Cenoz, 1992). Then, learners who are already bilingual appear to acquire an L3 relatively more easily and perhaps more proficiently than monolinguals acquire an L2. (Thomas, 1992) suggested that some learners develop an ability to analyse language as an object, a clear structural system, and that bilinguals exhibit this metalinguistic awareness more than monolinguals do. Thus, she concluded that metalinguistic knowledge aids learners in the acquisition of non-native languages and is responsible for the success of L3 over L2 learners.

It has been argued too that early bilingualism helps the child analyse distinctive structural properties of alternative language systems. Bilinguals have enhanced awareness of the arbitrary relationship between words and their referents, bilinguals change labels much more easily than monolinguals do (Ben Zeev, 1977). This finding clearly suggests that bilinguals should have enhanced lexical acquisition talents as compared to monolinguals. But, do these potential

advantages of childhood bilingualism carry over to the acquisition of subsequent languages when these children become adult university students? (Eisenstein, 1980) found that childhood bilingualism has a positive effect on adult aptitude for learning a foreign language, that is, those who learned an L2 as children should have greater success than monolinguals in learning non-native languages as adults. In addition, Eisenstein found a trend for those who had learned a nonnative language in a formal setting, that is, at school, to show greater aptitude for learning subsequent languages than those who had become bilinguals at home. Thomas concluded:

Bilinguals learning a third language seem to have developed a sensitivity to language as a system which helps them perform better on those activities usually associated with formal language learning than monolinguals learning a foreign language for the first time (Thomas, 1988:240).

Research on multilingual acquisition has shown that the magnitude of the transfer between languages can be affected by the linguistic distance among the languages involved (Bild & Swain, 1989). There is evidence for cross-linguistic transfer in multilingual acquisition when the languages involved are similar with respect to phonetic structure, vocabulary and syntax (Möhle, 1989; Singleton, 1987). Moreover, learners are more likely to transfer from their first languages (Ringbom, 1987), and evaluations of the acquisition of English have found that students who have Basque as their medium of instruction (Model D) attain significantly higher grades than students instructed in Spanish (Model A) (Valencia & Cenoz, 1992; Cenoz & Valencia, 1994; Lasagabaster, 1997). In general, results from evaluations of bilingual schools in the BAC corroborate results obtained in Canadian immersion programmes (Genesee, 1987; Swain & Lapkin, 1982) and at the same time extend these results to the case of native speakers of an indigenous minority language. The study we have carried out involves bilingual students who are proficient in a minority language, Basque, plus Spanish, and monolingual students who are proficient only in Spanish.

Methodology

Hypotheses

When comparing the performances of adult university students learning EST (English for Science and Technology) within the same length of time, the following hypotheses could be set out:

• Main hypotheses:

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- 1.1) Bilinguals (Bls) and monolinguals (Mls) will exhibit appreciable differences when tested on specific lexical learning, Bls outperforming Mls.
- 1.2) Bilinguals (Bls) will exhibit a significantly better performance than monolinguals (Mls) when tested on phonetic production.
- Secondary hypotheses:
- 2.1) Bls whose L1 is Basque are expected to outperform Bls whose L1 is Spanish in the EST tests administered.
- 2.2 Bls from Model D —those who used Basque as a means of formal instruction— are expected to obtain better results than Bls from Model B —those who used both Basque and Spanish in formal settings—.
- 2.3) The social and individual variables taken into account in this study will affect the results of both, Mls and Bls, when tested on specific lexical learning and phonetic production from their branch of study.

Main hypothesis 1.1 posits a correlation between metalinguistic knowledge and acquisition of non-native languages. Main hypothesis 1.2 predicts that there will be important differences between the two groups 'aptitude for oral mimicry'. Secondary hypothesis 2.1 considers a positive correlation between having Basque vs. Spanish as L1 and the learners' performances in the EST tests. Secondary hypothesis 2.2 attributes better expected results to Bls from Model D. Secondary hypothesis 2.3 predicts differences in the performances of both Bls and Mls due to social variables such as socio-economic level, attitude towards ESP-EST, motivation (understanding it in terms of communicative needs when using English as a 'lingua franca'), motivational intensity (understanding it in terms of effort made in this subject, ESP-EST course, in comparison with other subjects of the curricula), and individual variables such as PAP ('previous academic performance' when learning English at secondary school) and PCA ('phonetic codification aptitude' or capacity to discriminate, remember, interpret and produce English sounds and phonemes, and relate them to their graphic representations).

Participants

The empirical study was carried out by contrasting the performances of matched groups of 36 Ml (Spanish) versus 108 Bl (Basque/Spanish) students (see appendices 1, 2 & 3). The 144 students ranged in age from 20 to 25 years. The students at the Industrial Technical Engineering College in Bilbao are distributed

amongst the four different engineering branches mentioned before: electrical, industrial electronic, mechanical, and industrial chemical. In this study, the students belonged to the different branches taught at the College and Bls were sub-divided too according to characteristics such as mother tongue and language/s used in formal settings. All attended EST lessons exclusively at the College. At the time they were tested, all of them had attended a similar amount of EST lessons (60 hours) and within the same length of time (two semesters).

The groups were matched as closely as possible. The different branches studied at the College, as well as their distribution, were first taken into account: some 31% studied Mechanical Engineering (M. E.), some 42% studied Industrial Electronic Engineering (I. E. E.), 17% approximately studied Electrical Engineering (E. E.) and 15% studied Industrial Chemical Engineering (I. C. E.). Following these figures the group of Mls was made up of 12 M. E. students, 12 I. E. E. students, 6 E. E. students and 6 I. C. E. students; while the six subgroups of Bls were made up of 18 M. E. students, 18 I. E. E. students, 9 E. E. students and 9 I. C. E. students (see section on Procedure). The total number of students attending EST lessons was 273. The students were distributed as follows: 84 studying M. E., 117 studying I. E. E., 46 studying E. E. and 26 studying I. C. E. Thanks to these figures, it was extremely easy to get the sample of Mls and only slightly more complicated to get the six samples of Bls. There were twenty four men and twelve women within the Mls, while there were eighty one men and twenty seven women within the Bls. Concerning their sexes, the groups were matched to the extent this was possible but, despite a natural trend towards equal figures, there are still differences between the percentages of men and women studying engineering at our College.

A second factor considered was obviously that of their English proficiency. In fact, one semester prior to the study, their levels of proficiency were theoretically equal in terms of written examination. The main purpose of this homogenising process was to see whether degree of prior language experience would have a differential effect on the acquisition process from the time of an earlier test (when their levels of proficiency were equal) to the present.

Method

The tests were administered in June 2002, and were parts of the students' final examinations (obviously, the results obtained were used simultaneously for providing them with marks and for being used as the main source of raw data in this study). The answers of those students previously chosen as being part of the sample were recorded on answer sheets, and later on codified to be statistically

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evaluated. The statistical analyses were carried out by means of the SPSS (Statistical Package for Social Sciences).

Variables

- Independent variables: They were measured via a self-reported questionnaire.
- (1) Social variables. Four variables were measured (see Appendices 4 & 5):
 - (i) Socio-economic level. This refers to the individual's own perception of his/her family's rent level. Five levels were considered: upper class, middle-upper class, middle-middle class, middle-lower class, and lower (or working) class.
 - (ii) Attitude towards ESP-EST. This variable focuses on the way of thinking or behaving towards this subject. Five levels were distinguished: very favourable, favourable, neutral, unfavourable, and very unfavourable.
 - (iii) Motivation. This was understood in terms of communication needs using English as a 'lingua franca' together with the approach given to the ESP-EST course. Four levels were distinguished: very motivated, motivated, low motivation, and no motivation at all.
 - (iv) Motivational intensity. In this case the student's effort made in this subject, compared with other subjects, has been considered and three levels were distinguished: more, equal, and less.
- (2) Individual variables focused on aptitude. Two variables were measured:
 - (i) Previous academic performance. This variable refers to the students' performance when acquiring/learning English for General Purposes in formal settings (secondary school). Four levels were distinguished: very good, fair, bad, and very bad.
 - (ii) Phonetic codification aptitude. This refers to the individual's own perception on this item and five groups were distinguished: very high, high, average, low, and very low.
- Dependent variables: They were measured via two different kinds of tests, to be performed in written form the first kind of test (two gap-filling tests) and orally (reading) the second one.

Procedure

The number of Bl groups that could be organised to be evaluated was quite high if we consider the different possible combinations one can make when taking into account all the educational alternatives. The following chart shows a minimum amount of items that could be combined:

MOTHER TONGUE	Basque	Spanish	Basque / Spanish
FORMAL SETTING LANGUAGE	Basque	Spanish	Basque / Spanish
LEVEL OF FORMAL SETTING	Primary School	Secondary School	University

Variations of all these differentiated elements could lead us to lose our way. Our way out to this intricate state of affairs was to choose those situations happening most frequently and regularly, that is to say:

- A) Being Basque the student's mother tongue and being exposed to it as a medium of formal instruction (Model D) but learning Spanish as a school subject and in an informal setting ('on the street').
- B) Being Basque the student's mother tongue and being instructed in Basque and in Spanish simultaneously in a formal setting (Model B).
- C) Being Spanish the student's mother tongue but learning Basque through formal instruction (Model D).
- D) Being Spanish the student's mother tongue and being instructed in Basque and in Spanish simultaneously in a formal setting (Model B).
- E) Being both Basque and Spanish the student's mother tongue and being exposed to Basque as a medium of formal instruction (Model D) and to Spanish as a school subject and outside school.
- F) Being both Basque and Spanish the student's mother tongue and being instructed in a formal setting in both Basque and Spanish (Model B).

Additionally, and taking into account the different levels of formal setting, we only considered individuals having been instructed in one of the following three possibilities, that is, Basque, Spanish or Basque/Spanish, during both primary and secondary school periods. In other words, the language of instruction used by content lecturers at university was not considered.

The participants were presented two different groups of tests. Within the first group, the first test [1(A)] consisted of a gap-filling test in which 12 words

from a text, originally containing specific lexical items from each branch of study (M. E., I. E. E., E. E., I. C. E.), were deleted. A list of words, per text, was provided to choose amongst its contents the words each student considered most suitable for each blank. These lists contained three times as many words as gaps were included in the texts. Thus, two thirds of the words, although somehow directly connected to the branch of study, could not be used in the context presented. On the other hand, the same technique was used to carry out the second test [1(B)] but deleting one technical word per sentence from a group of eight not-mutually-connected statements instead of from a text —all the students were familiar with this kind of task and they were tested simultaneously if they belonged to the same branch (June 2002). The time span provided for these tests was also controlled (30 minutes à 1.5 minutes per gap) —. (Appendix no. 10 includes specimens of these first tests).

As noted earlier, the reasons why the students were tested on this kind of exercises were, on the one hand, to ensure that learners were able to identify and discriminate the right words from the lists provided and in what percentage, thus, testing their knowledge/acquisition of specific technical vocabulary, from their branch of study, included amongst the deleted words. Moreover, this technique provided us with easy-to-analyse data.

Within the second group, test 2 consisted of a reading exercise. A passage, all the students were familiar with, was chosen amongst the materials used throughout the EST course. Obviously, the texts were specifically selected according to the branch of engineering each student belonged to. All the students were given the chance to see it about five minutes before being their reading turn. Four meetings were programmed for this test. During the first one, all the Mls read their passages (36 students). During the second and third meetings, all the Bls studying M. E. (36) or I. E. E. (36) read their passages. During the fourth meeting, those Bls studying E. E. (18) and those studying I. C. E. (18) did so. I am not a specialist exclusively in the diagnosis of pronunciation errors, but my ear is rather trained in recognising distinctions of speech sounds in this kind of student. However, the main aim of this part of our study is chiefly to recognise the wrong choice of phonemes because they may lead to a different meaning, whereas the wrong use of allophones will only lead to a foreign accent as Finch & Ortiz (1982) state.

Results

Individual results and mean percentages were first tabulated. Appendices 6 & 7 show those individual results —number of gaps correctly filled by each

individual— obtained in the gap-filling tests of both Ml students and Bl students, giving us a first overall view of the specific technical vocabulary acquired. Appendix no. 8 shows data concerning results per branch of study (Mls and Bls), and per Bl subgroups.

Main hypotheses

1.1) Test 1(A/B): Gap-filling tests.

By settling our gaze upon these percentages, the degree to which the two engineering student groups exhibit specific technical lexicon knowledge contrasts slightly (see Figure 1); however, the number of participants within Mls was three times as small as that of Bls; thus, could these figures mean that Bls learning a third language (EST acquired in a formal setting in our study) possess a linguistic competence that is distinct from that of Mls exposed similarly and simultaneously to the second/third language? Further analysis of results in Test number 2 will give us additional information to change this question into a statement. However, a first approach to these results evidences higher rates of right answers for Bls than for Mls within tests number 1(A) and number 1(B). Then, as far as test 1 is concerned, the results obtained seem to confirm hypothesis 1.1 because they show an appreciable better performance of Bls versus Mls.



Figure 1. Mean percentages of correct answers per learner groups [Tests 1(A)&1(B)]

Nevertheless, a closer scrutiny of results reveals important differences when data is less grouped. In other words, Bls outperformed Mls although learners in both groups exhibited distribution differences between them. Mls and Bls, when grouped by branches, obtained the following results in test 1(A) and test 1(B) (see Figure 2 and Appendices 7 & 8):

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The graph indicates the following: I Test 1A Bls outperformed Mls rather clearly within two of the branches considered, that is, I. E. E. and I. C. E., and both learner groups obtained rather similar results within the other two branches considered, that is, M. E. and E. E. Test 1B à Bls from the M. E. and I. E. E. branches outperformed Mls but in the case of the other two branches, E. E. and I. C. E., the results were the opposite. Moreover, Bls studying M. E. and I. E. E. outperformed those studying E. E. and I. C. E. when the results of Test 1 (A) and Test 1 (B) were analysed collectively. As we can observe, only those students from the I. E. E. branch maintain the same trend in terms of Bls outperforming Mls. We cannot forget the existence of studies (Nayak, et al., 1990: 221) concluding that generally Bls showed "no clear evidence that [they] were superior in language learning abilities".



Figure 2. Mean percentages of correct answers per branch and learner group [Tests 1(A)&1(B)]

However, after this basic analysis, a more comprehensive statistical test was carried out to determine whether the differences were significant or not. To this effect, the following tests were carried out for both Mls and Bls:

Monolinguals \rightarrow X₁ = 0.6292; n₁ = 36; S₁ = 0.1948

Bilinguals \rightarrow X₂ = 0.6722; n₂ = 108; S₂ = 0.1262

* Kolmogorov-Smirnov normality test with Lilliefers' correction:

Monolinguals à It is normal. Significance level > 0.2

Bilinguals à It is normal. Significance level = 0.193

* Test on the equality of variances: It is accepted that they are equal.

* Test T on the equality of means: It cannot be refused that the means are equal. Significance level = 0.192

Thus, despite the differences in the gap-filling tests between monolinguals and bilinguals, these are not significant.

1.2) Test 2: Reading test.

The four different tests administered to the four different groups of students, as far as their branches of study were concerned, included at least one word containing each consonant and vowel hereafter mentioned. The figures presented (proportions) are mean values obtained by reaching an agreement between the two different moments that I listened to each chunk, directly from the students and, later on, indirectly from the tape recorder. The basic principle followed when using this scoring system (OPS: Overall Pronunciation Score), in order to give an overall picture of the learner's pronunciation, was: 'the more misuses, the more unintelligible the learner is' or in other words 'the more words a listener is able to identify accurately when said by a particular speaker, the more intelligible that speaker is'.

The main differences between the pronunciation of English and either Spanish or Basque, in terms of the problems learners tend to have, will be described in this section. We will focus on problems with consonants, consonant clusters and sequences, and problems with vowels (Kenworthy, 1990). Other problems learners may have, such as word stress, sentence stress or intonation, are not covered in this study. The results obtained have been divided into two main groups: (a) problems with consonants; (b) problems with vowels (Appendix no. 9).

Problems with consonants

• Single consonants

Confusion between /b/ and /v/ (ban vs. van): Both consonants exist in Spanish but they are similarly pronounced (a kind of combination of /b/ and /v/)

by Spanish speakers within the Basque Country. On the other hand, only 'b' exists in Basque. Some Mls, 33.3%, and some Bls, 30.5%, pronounced /v/ correctly.

Confusion between /d/ and $/\partial/$ (day vs. they vs. modern): Among Mls, 18 students (50%), and among Bls, 48 (44.4%) created a source of unintelligibility (speakers substituted one sound for another, causing difficulties for the listener).

Basque speakers and Spanish speakers tended to substitute /j/ (as in 'yet') by the letter 'y' in Spanish in these proportions: Mls, 66.6%, and Bls, 75%.

The consonant 'h' exists in Basque and in Spanish but it is not pronounced, at least within the Basque Country. Students either deleted the sound /h/ (as in 'hold') where it should be pronounced (i) [Mls 0/36 (0%) and Bls 9/108 (8.3%)] or pronounced it with a great deal of 'hissing' quality (ii) [Mls 24/36 (66.6%) and Bls 69/108 (63.8%)].

The consonant 'r' exists both in Basque and in Spanish, but most students, when pronouncing /r/, adopted a 'too-much-r' style of pronunciation, the proportions being the following: Mls, 83.3%, and Bls, 86.1%.

The sound $/\eta/$ (as in 'sing') does not exist either in standard Basque or Spanish, the main mistakes being (i) to pronounce the /g/ [Mls 18/36 (50%) and Bls 45/108 (41.6%)] or (ii) to substitute $/\eta/$ by /n/ [Mls 6/36 (16.6%) and Bls 6/108 (5.5%)]. Strategy (ii) causes more intelligibility problems than strategy (i).

• Consonant clusters and sequences

When two-element clusters beginning with /s/ (as in 'small') occurred, several Basque speakers and several Spanish speakers inserted a vowel before the /s/ in these proportions: Mls, 66.6%, and Bls, 58.3%.

When final consonant clusters with /s/ (as in 'bets') occurred, these sometimes caused problems to Spanish speakers (they deleted the final /s/): Mls, 33.3, and Bls, 0%.

Final consonant clusters with /t/ and /d/ (as in 'test', 'laughed') resulted more problematic for Spanish speakers [Mls 18/36 (50%)] than for Basque speakers [Bls 15/108 (13.8%)].

Final consonant clusters with /s/ plus consonant plus /s/ (as in 'nests', risks') turned out to be very problematic indeed for Basque speakers and Spanish speakers, the usual escape route being to delete one of the two /s/'s. Mispronunciation proportions: Mls, 100%, and Bls, 88.8%.

Problems with vowels

The sound $/^/$ (as in 'but' —strong form—) does not occur either in Spanish or in Basque. The way out chosen by students was usually to substitute a sound that is similar to $/\infty$ /. Proportions observed: Mls, 83.3%, and Bls, 91.6%.

Confusion between /i:/ and /i/ (as in 'bit-beat'). Spanish speakers and Basque speakers tended to use the latter for both vowels, or to make them equally long. Pronunciation errors: Mls, 83.3%, and Bls, 88.8%.

The sound "schwa" does not occur either in Spanish or in Basque. The most common way out for learners from both groups was to substitute the vowel suggested by the spelling in these proportions: Mls, 83.3%, and Bls, 75%.

The main sources of problems have been pinpointed by comparing the Spanish-speaking adult learners' production as well as Basque-speaking adult learners' production. But before continuing, we should point out the fact that reading aloud is a task that very often makes learners very anxious (Kenworthy, 1990), so learners will make more pronunciation errors when reading aloud than when speaking spontaneously. One of our tasks was to try to reduce this anxiety as much as possible, by trying to give learners a clear purpose for reading. This is a real drawback but studies done in the context of ESP testing, by examining the performance of individuals with different content specialisation on reading tests, indicated that students' performance appeared to be affected as much by their background knowledge as by their language proficiency (Bachman, 1990). In other words, test takers' familiarity with content area and performance on tests of reading provide evidence of an interaction.

Again, this first approach should be statistically checked. To this end, the following tests were carried out for both monolinguals and bilinguals:

Monolinguals à $X_1 = 5.83$; $n_1 = 36$; $S_1 = 1.656$

Bilinguals à $X_2 = 6.35$; $n_2 = 108$; $S_2 = 1.027$

* Kolmogorov-Smirnov normality test with Lilliefers' correction:

Monolinguals à It is normal. Significance level > 0.2

Bilinguals à It is normal: Significance level = 0.02

* In order to compare both populations, mono- and bilinguals, in 'test 2', a non-parametric test was chosen. Differences were not detected. Significance level = 0.418.

Thus, it cannot be concluded that the differences in the reading tests between monolinguals and bilinguals are significant.

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Secondary Hypotheses

Bl student subgroups A and B outperformed Bl student subgroups C and D within test no. 1(A+B) (see Appendix no. 3): subgroup A (70.00%), B (69.16%), C (56.66%), and D (62.50%). On the other hand, the global coefficient of Bl students from subgroups A and B concerning intelligibility (see Appendix no. 9) is 0.37, somewhat higher than that from subgroups C and D (0.30). Moreover, the so called 'Overall Pronunciation Score' reflects better performances of Bl students from subgroups A (64.16%) and B (63.33%) than those from subgroups C (55.83%) and D (58.33%). Then, apparently, results confirm this hypothesis because Bl students having Basque as their mother tongue outperformed those with Spanish as their mother tongue.

This *a priori* conclusion was statistically checked by subdividing bilinguals into 6 groups (see section on Procedure), whereby groups A and B should outperform groups C and D. The following tests were carried out:

AB → X₁ = 0.696; n₁ = 36; S₁ = 1.929

CD \rightarrow X₂ = 0.596; n₂ = 108; S₂ = 2.679

* Kolmogorov-Smirnov normality test with Lilliefers' correction:

Monolinguals à It is normal. Significance level > 0.2

Bilinguals à It is normal. Significance level > 0.193

* Test on the equality of variances: It is accepted that they are equal.

* Test T on the equality of means: It is accepted that AB is superior to CD with significance level equal to 0.05.

Thus, the differences between AB and CD are significant.

2.2) When considering the results obtained by the students within test no. 1(A+B), the following can be stated: Bl student subgroup A outperformed Bl student subgroup B and Bl student subgroup E outperformed Bl student subgroup F. But Bl student sub-group C did not outperform Bl student subgroup D (see Figure 3).

Now, if we consider the results obtained within test no. 2, Bl student subgroup A outperformed Bl student subgroup B, and Bl student subgroup E outperformed Bl student subgroup F. But again, Bl student subgroup C did not outperform Bl student subgroup D (see Appendix no. 9). As far as the 'Overall Pronunciation Score' is concerned, scores reflect exactly the same trend (see Appendices 7 & 8). Then, results only partially support this hypothesis.

However, if the list of psychological variables is taken into account we observe that six Bl individuals from subgroup C show little motivation while only three from subgroup D show this.



The next question was whether the differences between groups ACE and BDF (see section on Procedure) were significant or not.

ACE \rightarrow X₁ = 0.686; n₁ = 54; S₁ = 2.761

BDF \rightarrow X₂ = 0.685; n₂ = 54; S₂ = 2.307

* Kolmogorov-Smirnov normality test with Lilliefers' correction:

Monolinguals à It is normal. Significance level > 0.2

Bilinguals \rightarrow It is normal. Significance level = 0.193

* Test on the equality of variances: It is accepted that they are equal.

* Test T on the equality of means: It cannot be refused that the means are equal. Significance level = 0.517.

Therefore, in spite of the differences observed bilinguals from Model D and bilinguals from Model B, these are not statistically significant.

Although social factors are according to Edwards (1995) virtually always of great importance in accounting for contradictory reports about bilingualism and cognition, we have tried to throw new light on the matters concerning this section. The following charts show a summary of the criteria used to compare social and individual variables:

As we can observe, the socio-economic level of Mls is somewhat higher than that of Bls. Education systems very often transmit middle-middle class culture, so this variable theoretically should affect positively Mls [3.08 à very close from 3.00 (middle-middle class)] and most Bls [3 exceptions: Bl (E) students (2.16) à this could have affected negatively their performance but surprisingly they got the best results in test 1(A+B) and test 2]. The coefficients in this and the following tables have been calculated by means of a 'rule of three' as in the example:

S-E level (Mls)
$$\rightarrow$$
 180 - 5 || 180 \rightarrow max. collective value
111 - x || x = 3.08 5 \rightarrow max. individual value
111 \rightarrow collective value obtained

The chart below shows the coefficients referred to the attitude towards ESP-EST in terms of 'subject' from their curriculum.

Bls show a 'near' favourable attitude towards ESP-EST (0.91), somewhat better than Mls (0.83). There is a relevant aspect too to be considered: Bl (E) students, again, showed the highest coefficient (1.5). However, as we mentioned in the introduction, there is a pressing need for English at any technical level, and our students are aware of this situation.

The chart containing coefficients on motivation shows higher figures when referred to Mls than to Bls. However, the differences are minimal. Some authors (Gardner, 1985) consider that attitude has an influence on motivation, this latter affecting achievement in L2. Bls in this specific context are affected by this dynamic effect too.

When the following item, motivational intensity, was included in the selfreported questionnaire, we only wanted to know the effort made by the students in this subject when compared with others from their curriculum. Mls gave a balanced reply, while Bls as a whole gave a lower coefficient. Nevertheless, they outperformed Mls.

Although the sample of students was taken from the group of students whose marks last year ranged between two narrow limits, as we can see in the following chart most Bl subgroups outperformed Mls (15 out of 18) in their previous academic performance, when being taught General Purpose English.

It is not easy to change the raw phonetic ability of our learners, although it would seem possible to affect their concern for good pronunciation (Kenworthy 1990). However, we needed this information in order to find connections between these figures and results from test 2. Bls considered themselves 'average' with respect to their phonetic codification aptitude, while Mls were somewhat below 'average'. Independent variance analyses were carried out for each factor, the dependent variable being the results obtained within test 1(A+B):

S-E level \rightarrow No differences were observed amongst the groups.

ATT \rightarrow No differences were observed amongst the groups.

MOT \rightarrow No differences were observed amongst the groups.

 $MI \rightarrow No$ differences were observed amongst the groups.

PAP \rightarrow Differences were observed amongst the groups. Significance level = 0.

PCA \rightarrow Differences were observed amongst the groups. Significance level = 0.

Thus, amongst the different social and individual variables taken into account in this study, only the last two (PAP and PCA) affect the results of monolinguals and bilinguals when tested on lexical learning and phonetic production from their branch of study.

Discussion

We still know very little about the conditions in which multilingual acquisition is additive or, alternatively, substractive. That is why we should start by agreeing with Edwards (1995) when he says that strong conclusions about bilingualism are not warranted. Then, let alone when referring to third language acquisition or trilingualism. However, the research reported here supports the claim that Bl adult students attending ESP-EST lessons at university in the Basque Country outperformed their Ml colleagues. It appears from this study that, when learning English (ESP-EST), there is a positive effect of bilingualism on lexical acquisition and phonetic production of specific technical vocabulary from each individual's branch of study. However, once these differences are statistically tested, they are not significant.

Three points are, in my opinion, particularly relevant in this study. Firstly, the formal tests on lexical learning did not yield striking differences between the two groups. Results obtained by Mls (62.50%) and Bls (67.36%) indicate that taking 62.50 as a basis (100%), Bls outperformed Mls in a low percentage (7.77%). The tests on phonetic production yielded more appreciable differences. Appendix No. 9 summarises results obtained in test 2 by Mls (coeff. = 0.30) and Bls (coeff. = 0.37). Again, taking 0.30 as a basis (100%), Bls would have outperformed Mls in a significant percentage (23.33%). However, appendices 6 & 7 include the results of the so called Overall Pronunciation Score (OPS) were Mls (5.8) and Bls (6.3) differed from each other in only 8.62%, which was not

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statistically significant. All this happening after two semesters of ESP-EST lessons.

Secondly, it appears from our results that Bls whose mother tongue was Basque outperformed those Bls whose mother tongue was Spanish (see Figure 3, appendices 7 & 8). This situation seems to be consistent with the findings of Cenoz & Genesee (1998), who emphasise on the success of multilingual education in settings where the students' first language is given every opportunity to develop fully.

Thirdly, the study suggests that Bls might have an advantage in lexical acquisition. Since this might happen particularly among related languages, being bilingual *per se* may not necessarily yield important lexical differences between monolinguals and bilinguals in this study (because Spanish and English morphology exhibit more similarities than Basque and English morphology). However, the simple fact of being bilingual seems to be more beneficial in learning ESP-EST, although the differences are again not significant.

Language competence is a complex phenomenon consisting of several interrelated aspects, where the influence of the different dimensions involved vary according to the English language tests administered to the sample, so comparative research of this kind will still be important in order to understand and predict the effects of bilingualism, with all its constraints, on L3 acquisition. In other words, more complex studies would give us the opportunity to decipher this enigmatic topic in the Basque Country, a place with social and political peculiarities that are not shared by other communities and/or individuals.

Eventually, although perfect balanced bilingual or multilingual individuals are exceptional, since second language learners seldom acquire completely native-like monolingual competence and rarely become balanced bilinguals, we think that the results of our research —including all those aspects I may have misapplied— contribute to literature indicating that bilingual education has an overall positive effect, or at least not negative, on the learning of other languages, and more specifically ESP-EST.

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Appendices

Number 1: Student population

Student popula	ition
M/Eo/Ei/Ch	84/117/46/26 → 273

M: Mechanical Engineering Eo: Electronic Engineering Ei: Electric Engineering Ch: Chemical Engineering

<u>Number 2</u>: Distribution of student population according to their knowledge of Basque and/or Spanish.

	Ml	Bl
M/Eo/Ei/Ch	17/34/18/8 → 77	67/83/28/18 → 196

Ml: monolingual Bl: bilingual

Number 3: Distribution of students for research purposes (samples sizes).

	Ml	Bl
M/Eo/Ei/Ch	12/12/6/6 → 36	36/36/18/18 → 108

<u>Number 4</u>: Independent variables (monolinguals). (For the sake of space and brevity results have been grouped together).

	Socio-structural variables			Psychosocial variables			Individual variables	
	Sex	Age	S-E level	ATT	ATT MOT N		PAP	PCA
Ml / M / 1+2+3	M+W+M	24+22+23	M-M+M-M+M-L	F+N+F	M+LM+M	E+L+M	VG+B+F	A+L+A
Ml / M / 4+5+6	M+M+M	23+24+23	M-M+M-M+M-M	N+F+F	M+M+M	E+L+E	B+F+VG	A+A+A
Ml / M / 7+8+9	M+W+M	22+23+23	M-M+M-M+M-M	F+F+F	M+LM+M	E+M+E	F+F+F	L+A+A
Ml / M / 10+11+12	M+W+M	24+22+23	M-L+M-M+M-L	N+F+F	N+F+F LM+M+M L		B+F+VG	L+A+A
Ml / Eo / 1+2+3	M+W+W	22+21+24	M-M+M-M+M-U	F+F+F	M+M+VM	E+E+E	VB+F+F	A+A+A
M1 / Eo / 4+5+6	M+W+M	20+22+21	M-M+M-M+M-U	F+F+F	M+M+M	E+E+E	F+VB+F	A+A+A
Ml / Eo / 7+8+9	M+W+W	23+22+24	M-M+M-M+M-M	F+F+F	F+F+F M+M+VM E+E+E		VB+F+F	A+A+A
Ml / Eo / 10+11+12	M+W+M	24+21+23	M-U+M-M+M-M	F+F+F M+VM+M E+E+E F-		F+F+F	A+A+A	
Ml / Ei / 1+2+2	M+W+W	23+20+23	M-U+M-M+M-U	F+VF+VF	M+VM+VM	E+E+E	F+F+F	A+A+A
Ml / Ei / 4+5+6	M+W+M	23+23+20	M-U+M-M+M-M	VF+F+F	M+M+VM	E+E+E	F+F+F	A+A+A
Ml / Ch / 1+2+3	M+M+M	22+22+24	M-M+M-M+M-M	F+F+U	M+LM+LM	E+E+E	F+F+VG	A+A+A
Ml / Ch / 4+5+6	M+M+M	24+22+24	M-M+M-M+M-M	U+U+F	M+LM+M	E+E+E	VG+F+VG	A+A+A

Abbreviations used in this appendix and in the following one: S-E level: socio-economic level (U: upper class; M-U: middle-upper class; M-M: middle-middle class; M-L: middle-lower class; L: lower class); ATT: attitude towards ESP-EST (VF: very favourable; F: favourable; N: neutral; U: unfavourable; VU: very unfavourable); MOT: motivation (VM: very motivated; M: motivated; LM: little motivation; NM: no motivation at all); MI: motivational intensity (M: more; E: equal; L: less); PAP: previous academic performance (VG: very good; F: fair; B: bad; VB: very bad); PCA: phonetic codification aptitude (VH: very ligh; H: high; A: average; L: low; VL: very low).

	Socio-structural variables		Psychosocial variables			Individual variables		
	Sex	Age	S-E level	ATT	MOT	MI	PAP	PCA
Bl / M / A /	M+W+M	21+23+21	M-M+M-L+M-	N+F+F	M+M+M	E+M+E	F+VG+VG	A+A+A
Bl / M / A /	M+W+W	23+24+23	M-M+M-L+M	N+N+F	M+M+M	E+M+M	F+VG+F	A+A+A
Bl / M / B / 1+2+3	M+M+M	24+23+23	L+M-L+M-L	F+F+F	M+M+M	E+E+E	F+F+F	A+A+A
Bl / M / B / 4+5+6	M+M+M	20+24+25	L+L+M-L	F+F+F	M+M+M	E+E+E	F+F+F	A+A+A
Bl / M / C / 1+2+3	M+W+W	24+25+23	M-M+M-U+M-	F+F+F	VM+M+M	E+L+L	F+B+B	A+A+A
Bl / M / C / 4+5+6	W+M+M	20+24+25	M-M+M-U+M-	F+F+F	M+VM+VM	E+L+E	F+F+B	A+A+A
Bl / M / D /	M+W+M	23+23+23	M-L+M-M+M-	N+F+F	LM+M+LM	L+E+E	F+F+F	A+A+A
Bl / M / D /	W+M+W	24+23+20	M-L+M-L+M-	F+N+N	LM+M+M	L+L+E	F+F+F	A+A+A
Bl / M / E / 1+2+3	M+M+M	24+22+22	M-M+M-L+M-	VF+F+VF	M+M+M	E+E+E	F+F+F	A+A+A
Bl / M / E / 4+5+6	M+M+M	22+24+21	M-M+M-L+M-	F+VF+N	M+NM+M	E+E+E	F+F+F	A+A+A
Bl / M / F / 1+2+3	M+M+M	22+23+22	M-M+M-U+M-	N+N+N	M+NM+M	E+L+L	F+F+F	A+A+A
Bl / M / F / 4+5+6	M+M+M	23+23+22	M-U+M-M+M-	F+N+N	M+NM+M	L+E+E	F+F+F	A+A+A
Bl / Eo / A /	M+M+M	22+23+24	M-U+M-M+M-	VF+F+F	M+M+M	E+E+E	VG+F+F	H+A+A
Bl / Eo / A /	M+M+M	22+20+23	M-M+M-U+M-	F+VF+VF	VM+M+M	E+M+E	VG+F+F	A+H+A
Bl / Eo / B /	M+W+M	24+23+23	M-M+M-	F+F+F	M+M+VM E+E+E		F+F+F	A+A+A
Bl / Eo / B /	M+W+W	22+24+23	M-U+M-	N+F+F	LM+M+M E+E+E		VG+F+F	A+A+A
Bl / Eo / C /	M+M+M	24+23+20	M-U+M-L+M-	F+N+N	VM+LM+M	M+E+E	VG+F+VG	A+A+A
Bl / Eo / C /	M+M+M	23+24+24	M-M+M-	F+F+F	M+M+LM	M+E+E	F+F+VG	H+A+A
Bl / Eo / D /	M+M+W	22+20+22	M-U+M-M+M-	F+F+F	M+M+M	E+L+E	F+F+F	A+A+A
Bl / Eo / D /	M+M+W	23+24+22	M-M+M-U+M-	VF+F+F	M+M+M	E+L+E	VG+F+F	A+A+A
Bl / Eo / E /	M+W+M	23+22+21	M-M+L+M-U	F+VF+F	M+M+M	E+E+E	VG+F+F	A+A+A
Bl / Eo / E /	M+W+M	20+23+22	M-M+M-M+L	VF+F+F	M+M+M	L+E+E	F+VG+F	A+A+A
Bl / Eo / F / 1+2+3	M+W+M	21+22+22	M-L+M-M+M-	F+F+F	M+M+M	E+E+E	F+F+F	A+A+A
Bl / Eo / F / 4+5+6	M+M+W	22+23+21	M-U+L+M-M	F+F+F	M+M+M	E+E+E	F+F+F	A+A+A
Bl / Ei / A / 1+2+3	M+M+W	23+22+24	M-M+M-	F+F+F	M+M+M	E+E+M	F+VG+F	A+A+A
Bl / Ei / B / 1+2+3	M+M+W	23+22+24	M-U+M-M+M-	N+F+F	M+M+M	E+E+E	F+VG+F	A+A+A
Bl / Ei / C / 1+2+3	W+M+M	22+20+22	M-L+M-L+M-	F+F+N	LM+M+M	E+E+M	F+F+F	A+A+A
Bl / Ei / D / 1+2+3	W+M+W	23+23+23	M-M+M-	F+M+F	M+M+M	E+E+E	F+F+F	A+A+A
Bl / Ei / E / 1+2+3	M+W+M	24+23+20	M-L+M-L+M-L	F+F+F	M+M+LM	M+E+E	VG+F+F	A+A+A
Bl / Ei / F / 1+2+3	M+M+M	22+22+23	M-L+M-L+M-	F+F+F	M+M+LM	E+E+E	F+F+F	A+A+A
Bl / Ch / A /	M+M+M	23+22+23	M-L+M-L+M-	F+F+N	M+M+M	E+E+E	F+VG+F	H+VL+A
Bl / Ch / B /	W+M+M	25+20+23	M-M+M-L+M-	F+M+F	VM+M+M	E+E+E	VG+B+F	A+A+A
Bl / Ch / C /	M+W+M	23+23+25	M-M+M-U+M-	N+VF+F	M+M+M	E+E+E	F+F+F	A+A+A
Bl / Ch / D /	M+M+W	23+22+23	M-M+M-	F+F+F	M+M+VM	E+E+E	B+F+F	VL+A+A
Bl / Ch / E /	M+M+M	20+23+25++	M-L+M-M+M-	VF+F+F	M+M+M	E+E+E	F+F+F	A+VL+H
Bl / Ch / F /	M+M+M	22+20+23	M-U+M-U+M-	F+VF+F	M+M+VM	E+E+E	F+B+VG	A+A+H

<u>Number 5</u>: Independent variables (bilinguals). (For the sake of space and brevity results have been grouped together).

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<u>Number 6</u>: Individual results obtained in the gap-filling tests by Mls // Overall Pronunciation Score (OPS). (For the sake of space and brevity results have been grouped together).

1	FEST NO. 1 (A)	TEST NO. 1 (B)	TESTS NO. 1 (A+B)	OPS (TEST NO. 2)
	('w' / 12 gaps)	('x' / 8 gaps)	('y' / 20 gaps)	('z' out of 10)
Ml/M/1+2+3	10+04+11	04+03+06	14+07+17	6.5+3.5+8.0
Ml / M / 4 +5+6	08+09+07	04+06+05	12+15+12	5.5+4.0+8.5
Ml / M / 7+8+9	06+10+08	07+05+03	13+15+11	4.0+5.5+7.0
Ml / M / 10+11+12	11+07+08	03+03+02	14+10+10	6.0+5.5+6.5
Ml / Eo / 1+2+3	04+11+06	04+07+04	08+18+10	3.5+8.0+4.5
Ml / Eo / 4+5+6	05+05+08	03+06+03	08+11+11	4.0+7.0+3.5
Ml / Eo / 7+8+9	07+04+09	04+07+02	11+11+11	6.0+3.5+6.5
Ml / Eo / 10+11+12	2 09+06+04	05+04+04	14+10+08	9.0+3.0+1.5
Ml / Ei / 1+2+3	07+09+08	08+07+06	15+16+14	6.0+7.5+5.0
Ml / Ei / 4+5+6	06+10+08	08+08+08	14+18+16	6.5+6.5+9.0
Ml / Ch / 1+2+3	08+06+06	08+04+06	16+10+12	7.0+6.0+6.5
Ml / Ch / 4+5+6	10+05+07	05+06+07	15+11+14	7.5+6.0+6.0
Total	264/432	186/288	450/720	5.8 (mean value)
	(61.11%)	(64.58%)	(62.50%)	

<u>Number 7</u>: Individual results obtained in the gap-filling tests by Bls // Overall Pronunciation Score (OPS). (For the sake of brevity results have been grouped together).

Т	TEST NO. 1 (A) ('w' / 12 gaps)	TEST NO. 1 (B) ('x' / 8 gaps)	TESTS NO. 1 (A+B) ('y' / 20 gaps)	OPS (TEST NO. 2) ('z' out of 10)
Bl / M / A / 1+2+3	08+11+07	06+07+06	14+18+13	6.0+7.0+8.0
Bl / M / A / 4+5+6	12+07+10	05+08+07	17+15+17	7.5+6.0+4.5
Bl / M / B / 1+2+3	08+07+06	07+04+04	15+11+10	7.0+5.0+6.0
Bl / M / B / 4+5+6	09+08+07	05+07+06	14+15+13	7.0+5.5+5.5
Bl / M / C / 1+2+3	08+05+07	06+04+05	14+09+12	6.0+6.0+5.0
Bl / M / C / 4+5+6	04+09+06	06+04+05	10+13+11	6.0+5.5+7.5
Bl / M / D / 1+2+3	09+06+08	07+04+07	16+10+15	7.5+6.0+8.0
Bl / M / D / 4+5+6	08+08+06	07+04+04	15+12+10	6.0+4.5+8.5
Bl / M / E / 1+2+3	10+10+12	07+07+08	17+17+20	8.0+8.5+9.0
Bl / M / E / 4+5+6	11+09+08	06+07+07	17 + 16 + 15	7.5+8.0+8.5
Bl / M / F / 1+2+3	09+05+07	05+06+07	14+11+14	7.5+6.0+7.0
Bl / M / F / 4+5+6	08+05+08	04+06+05	12+11+13	6.0+6.5+7.5
Total	288/432	210/288	498/720	6.7 (mean value)
	(66.66%)	(72.91%)	(69.16%)	
Bl / Eo / A / 1+2+3	10+08+07	05+05+04	15+13+11	7.0+7.0+6.5
Bl / Eo / A / 4+5+6	09+09+11	06+06+04	15+15+15	8.0+7.5+6.0
Bl / Eo / B / 1+2+3	09+07+08	04+07+06	13+14+14	6.5+6.0+7.0
Bl / Eo / B / 4+5+6	06+12+06	07+07+02	13+19+08	7.5+5.5+5.0
Bl / Eo / C / 1+2+3	08+05+07	06+05+06	14+11+13	6.0+6.0+7.0
Bl / Eo / C / 4+5+6	06+08+05	07+04+05	13+12+10	7.0+4.5+5.5
Bl / Eo / D / 1+2+3	06+09+07	06+07+07	12+16+14	6.5+6.0+6.0
Bl / Eo / D / 4+5+6	08+09+06	08+06+05	16+15+11	4.5+5.5+9.0
Bl / Eo / E / 1+2+3	11+09+10	06+07+08	17 + 16 + 18	8.0+7.5+7.5
Bl / Eo / E / 4+5+6	12+08+10	08+05+05	20+13+15	8.5+7.0+8.0
Bl / Eo / F / 1+2+3	07+09+06	04+07+06	11+16+12	5.5+7.0+5.5
Bl / Eo / F / 4+5+6	11+08+07	06+06+03	17+14+10	8.0+6.5+5.0
Total	294/432	207/288	501/720	6.6 (mean value)
	(68.05%)	(71.87%)	(69.58%)	

TOTAL	852/1296 (65.74%)	603/864 (69.79%)	1455/2160 (67.36%)	6.3 (mean	n value)
Total	129/216 (59.72%)	87/144 (60.41%)	216/360 (60.00%)	5.3 (mean	n value)
Bl / Ch / F / 1,2,3	21 (58.33%)	18 (75.00%)	39	6.0,	7.5, 4.5
Bl / Ch / E / 1,2,3	24 (66.66%)	12 (50.00%)	36	5.5,	6.5, 4.5
Bl / Ch / D / 1,2,3	15 (41.66%)	09 (37.50%)	24	3.5,	4.0, 3.0
Bl / Ch / C / 1,2,3	15 (41.66%)	18 (75.00%)	33	4.5,	6.0, 3.0
Bl / Ch / B / 1.2.3	30 (83,33%)	18 (75.00%)	48	6.5.	7.0.6.0
Bl / Ch / A / 1.2.3	24 (66.66%)	12 (50.00%)	36	5.5.	6.0. 5.0
	(65.27%)	(68.75%)	(66.66%)		
Total	141/216	99/144	240/360	6.3 (mean	n value)
Bl / Ei / F / 1,2,3	27 (75.00%)	15 (62.50%)	42	7.0,	5.0, 9.0
Bl / Ei / E / 1,2,3	30 (83.33%)	18 (75.00%)	48	7.0,	8.5, 5.5
Bl / Ei / D / 1,2,3	24 (66.66%)	15 (62.50%)	39	5.5,	7.0, 4.0
Bl / Ei / C / 1,2,3	18 (50.00%)	12 (50.00%)	30	5.0,	4.0, 6.0
Bl / Ei / B / 1,2,3	21 (58.33%)	21 (87.50%)	42	1 7.0,	8.0, 6.0
Bl / Ei / A / 1,2,3	21 (58.33%)	15 (62.50%)	36	6.0,	7.0, 5.0

<u>Number 8</u>: Collective results obtained in the gap-filling tests.

	TEST NO. 1 (A) ('x' out of 12 gaps)	TEST NO. 1 (B) ('y' out of 8 gaps)	TESTS NO. 1 (A+B) ('z' out of 20 gaps)	OPS (%)
Ml / M / 1, 2, 3,, 12	99 (68.75%)	51 (53.12%)	150/240 (62.50%)	
Ml / Eo / 1, 2, 3,, 12	78 (54.16%)	54 (56.25%)	132/240 (55.00%)	
Ml / Ei / 1, 2,, 6	48 (66.66%)	45 (93.75%)	93/240 (38.75%)	
Ml / Ch / 1, 2,, 6	42 (48.33%)	36 (75.00%)	78/240 (32.50%)	
Bl / M / A / 1. 2 6	57 (79.16%)	39 (81,25%)	96/120 (80.00%)	
Bl / M / B / 1, 2,, 6	45 (62.50%)	33 (68.75%)	78/120 (65.00%)	
Bl / M / C / 1, 2,, 6	39 (54.16%)	30 (62.50%)	69/120 (57.50%)	
Bl / M / D / 1, 2,, 6	45 (62.50%)	33 (68.75%)	78/120 (65.00%)	
Bl / M / E / 1, 2,, 6	60 (83.33%)	42 (87.50%)	102/120 (85.00%)	
Bl / M / F / 1, 2,, 6	42 (58.33%)	33 (68.75%)	75/120 (62.50%)	
Bl / Eo / A / 1, 2,, 6	54 (75.00%)	30 (62.50%)	84/120 (70.00%)	
Bl / Eo / B / 1, 2,, 6	48 (66.66%)	33 (68.75%)	81/120 (67.50%)	
Bl / Eo / C / 1, 2,, 6	39 (54.16%)	33 (68.75%)	72/120 (60.00%)	
Bl / Eo / D / 1, 2,, 6	45 (62.50%)	39 (81.25%)	84/120 (70.00%)	
Bl / Eo / E / 1, 2,, 6	60 (83.33%)	39 (81.25%)	99/120 (82.50%)	
Bl / Eo / F / 1, 2,, 6	48 (66.66%)	33 (68.75%)	81/120 (67.50%)	
Bl / A (18 students)	156 (72.22%)	96 (66.66%)	252/360 (70.00%)	115.50/180 (64.16)
Bl / B (18 students)	144 (66.66%)	105 (72.91%)	249/360 (69.16%)	114.00/180 (63.33)
Bl / C (18 students)	111 (51.38%)	93 (64.58%)	204/360 (56.66%)	100.50/180 (55.83)
Bl / D (18 students)	129 (59.72%)	96 (66.66%)	225/360 (62.50%)	105.00/180 (58.33)
Bl / E (18 students)	174 (80.55%)	111 (77.08%)	285/360 (79.16%)	133.50/180 (74.16)
Bl / F (18 students)	138 (63.88%)	99 (68.75%)	237/360 (65.83%)	117.00/180 (65.00)

<u>Number 9</u>: List of phonetic items checked within test 2: absolute figures and percentages of correct pronunciations.

CONSONANTS Single consonants	Mls	Bls	Bl (A)	Bl (B)	Bl (C)	Bl (D)	Bl (E)	Bl (F)
/v/	12/36 (33.3%)	33/108 (30.5%)	6	5	3	3	10	6
/d/ and /ð/	18/36 (50%)	60/108 (55.6%)	12	9	2	9	15	13
/j/	12/36 (33.3%)	27/108 (25%)	6	0	3	3	9	6
/h/	12/36 (33.3%)	30/108 (27.7%)	6	4	0	3	8	9
/ r /	6/36 (16.6%)	15/108 (13.9%)	3	0	0	3	6	3
/ŋ/	12/36 (33.3%)	57/108 (52.7%)	15	6	7	9	12	8
Subtotal	72/216	222/648	48/108	24/108	15/108	30/108	60/108	45/108
Coefficients	0.33	0.34	0.44	0.22	0.13	0.27	0.55	0.41

Consonant clusters (CCs)	Mls	Bls	Bl (A)	Bl (B)	Bl (C)	Bl (D)	Bl (E)	Bl (F)
two-element CCs beginning with /s/	12/36 (33.3%)	45/108 (41.6%)	8	3	7	9	12	6
final CCs with /s/	24/36 (66.6%)	108/108 (100%)	19	18	17	18	18	18
final CCs with /t/ and /d/	18/36 (50%)	93/108 (86.1%)	18	15	15	15	17	13
final CCs with /s/ + consonant + /s/	0/36 (0%)	12/108 (11.1%)	3	3	0	0	4	4
Subtotal	54/144	258/432	48/72	39/72	39/72	42/72	51/72	39/72
Coefficients	0.37	0.59	0.66	0.54	0.54	0.58	0.70	0.54

VOWELS	Mls	Bls	Bl (A)	Bl (B)	Bl (C)	Bl (D)	Bl (E)	Bl (F)
///	6/36 (16.6%)	9/108 (8.3%)	4	0	0	2	3	0
/I/ and /i:/	6/36 (16.6%)	12/108 (11.1%)	3	3	0	3	3	0
/ə/	6/36 (16.6%)	27/108 (25%)	5	3	3	7	6	3
Subtotal	18/108	48/324	12/54	6/54	3/54	12/54	12/54	3/54
Coefficients	0.16	0.14	0.22	0.11	0.05	0.22	0.22	0.05

TOTAL	144/468	528/1404	108/234	69/234	57/234	84/234	123/234	87/234
COEFFICIENTS	0.30	0.37	0.46	0.29	0.24	0.35	0.52	0.37

Number 10: Tests administered (1A, 1B).

Test 1(A) [Industrial Electronic Engineering & Electrical Engineering]

Fill in the gaps using those words you consider most appropriate from the list provided:							
avalanche	bit	cellular	circuit	coded	CPU		
cut-out	data	design	draughtsmen	dual-in-line	etched		
field-effect	files	forward-biased	gauge	grid	grinding		
groove	interface	lay-outs	mobile	off-the-shelf	parts		
peripherals	pnp	PROMs	punched	push-button	random		
schedule	transceivers	treble	via	wafer	workstation		

Over the past few years television viewers have been able to see history unfold before their eyes. Nor could the provision of [...1...] telephone services have advanced so far if they were reliant on the heavy duty antennas that were prevalent only a decade ago.

A technique called surface mounting technology, SMT, enables components such as transistors to be mounted on the printed [...2...] boards. By opting for components that are literally mounted onto the boards, rather than using the traditional method with [...3...] holes manufacturers reduce considerably the size of their products.

German firm K-W, a long established manufacturer of satellite [...4...] with a product line that covers reception and installation applications from antennas for [...5...] reception to stations for communication [...6...] satellite, has made full use of SMT for its products. K-W began to use commercially available computer aided [...7...] tools in an attempt to shorten the production schedule. A particular problem they faced was that many of its [...8...] were not used to working with computers. [...9...] prepared by hand were then handed over in order to create, also by hand, accurate production drawings.

In 1987 K-W started to draw up a fully automated design to simplify PCB development. It took a year to put together a [...10...]-based system that could handle design. For its [...11...] package, K-W chose Boardstation from Menthor Graphics.

In the customisation carried out to help engineers, the menus themselves are tailored, and the list of components are confined only to those that the company maintains in its inventory –that way designers cannot specify [...12...] that are out of the stock.

Key: $1 \rightarrow$ cellular; $2 \rightarrow$ circuit; $3 \rightarrow$ punched; $4 \rightarrow$ transceivers; $5 \rightarrow$ mobile; $6 \rightarrow$ via; $7 \rightarrow$ design; $8 \rightarrow$ draughtsmen; $9 \rightarrow$ lay-outs; $10 \rightarrow$ workstation; $11 \rightarrow$ off-the-shelf; $12 \rightarrow$ parts.

Test 1(A) [Mechanical Engineering]

Fill in the gaps using those words you consider most appropriate from the list provided:

aligned	boring	bulkier	cam	casting	chasing
chuck	collet	cross-section	cutting	die	framework
gears	gripping	jawed	knurling	mechanically	mills
offsetting	operated	parts	ram	reamers	revolutions
right	rotated	rugged	saddle	slid	slide
spindle	stock	swivelling	tailstock	tapered	turret

LATHES

A lathe is a machine tool which is used to produce work, which is circular in [...1...], by rotating the work against a cutting tool. In other words, it generates a surface of revolution. The finished work may be cylindrical or [...2...]. In addition to generating cylindrical surfaces, lathes can generate plane surfaces by facing. The lathe may also be used for boring and cutting screw threads.

One type of lathe is known as a centre lathe, and it is made up of a number of basic parts which are accurately [...3...] one to another so that accurate components can be produced.

The bed acts as a support for the other parts and, therefore, consists of a strong, rigid [...4...] usually made of cast iron. The top is machined to form the slideways, which carry the saddle, the headstock and the tailstock. The saddle controls the movement of the [...5...] tool. It is free to slide backwards and forwards along the slideways, thus enabling the tool to move parallel to the spindle axis. On the upper surface of the saddle

it is the cross-slide, which enables the tool to move at [...6...] angles to the axis of the spindle, and is, therefore, used in facing operations.

The compound slide is mounted on the upper surface of the cross slide. This can be rotated in such a way that the tool is able to move at an angle to the [...7...] axis when cutting a taper. The tool post is mounted on the compound [...8...], and carries the cutting tool.

The other principal parts on the lathe are the headstock and the tailstock. The headstock contains the [...9...], the controls and the spindle to which the workpiece is attached. It is the spindle, which causes the workpiece to rotate. The [...10...] does not rotate and is used only to support the other end of the workpiece.

The gears in the headstock enable the operator to change the speed at which the workpiece is [...11...]. The speed chosen for a given material depends on the size of the diameter of the workpiece and the material from which it is made. The cutting speed is constant for a given material, with a given cutting tool for a given job.

The cutting speed is the surface speed of the workpiece and is measured in metres per minute and is determined by the spindle speed, i.e., the number of revolutions per minute, and the diameter of the workpiece. Thus at constant [...12...] surface speed is directly proportional to the diameter. It follows, therefore, that the spindle speed is inversely proportional to the diameter for a constant surface speed. The cutting speed varies according to the metal being machined.

Key: $1 \rightarrow$ cross-section; $2 \rightarrow$ tapered; $3 \rightarrow$ aligned; $4 \rightarrow$ framework; $5 \rightarrow$ cutting; $6 \rightarrow$ right; $7 \rightarrow$ spindle; $8 \rightarrow$ slide; $9 \rightarrow$ gears; $10 \rightarrow$ tailstock; $11 \rightarrow$ rotated; $12 \rightarrow$ revolutions.

Fill in the gaps using those words you consider most appropriate from the list provided:							
acidify	barium	beverages	blast	bonds	bromine		
cast	dilute	dropwise	due	e.m.f.	firebrick		
grade	hazard	impelled	impervious	lead	leak		
limestone	lungs	lye	molten	nullify	pitchblende		
Pyrex	quicklime	shell	slag	spectacles	splitting		
staggering	tritium	undergo	unlike	well	yet		

Test 1(A) [Industrial Chemical Engineering]

Text 1

Aim: The purpose of this experiment is to show that observable reactions occur between [...1...] sodium hydroxide and aqueous solutions of bromine and iodine and, furthermore, that these reactions are reversible.

Introduction: You add the above mentioned sodium hydroxide [...2...] to bromine water and iodine solution in turn. A significant change in colour in either halogen solution indicates that a reaction has occurred. If you suspect that the change in colour is only [...3...] to a dilution effect, you should set up a control experiment, where you add the same number of drops of distilled water to the halogen solution.

To determine whether the reaction is reversible, you [...4...] the alkaline halogen solution and see if the original halogen colour reappears.

Requirements: safety [...5...] ; 5 test-tubes; 1 test-tube rack; 4 teat-pipettes; bromine water, Br_2 ; iodine solution, 0.01 M I_2 (in KI); sulphuric acid, 1 M H_2SO_4 ; sodium hydroxide solution, 2 M NaOH; distilled water.

[...6...] warning: Bromine water is poisonous and corrosive. The vapour is extremely irritant to the eyes, [...7...] and skin. Therefore you must **avoid** contact with skin; avoid inhaling the vapour.

<u>Text 2</u>

The field of organic chemistry is so vast that, despite the fact that thousands of organic compounds are in daily use, only a tiny fraction of the possible compounds are being utilised. [...8...] organic, chemicals play a vital role in the life of every person in his food and [...9...], in drugs and medicines, in textiles and dyes, in plastics and roads, as fuels or refrigerants, as explosives or adhesives.

The key element present in all organic chemicals is carbon. It has a valence of 4, for it has 4 electrons in its outermost [...10...] which are used in forming covalent [...11...] with atoms of hydrogen, oxygen, the halogens, nitrogen, sulphur, and other carbon atoms. [...12...] the situation in inorganic chemistry, where electrovalent, ionic compounds predominate, the properties and chemistry of carbon compounds are intimately related to the non-ionic bonds present in these compounds.

Key: $1 \rightarrow \text{dilute}; 2 \rightarrow \text{dropwise}; 3 \rightarrow \text{due}; 4 \rightarrow \text{acidify}; 5 \rightarrow \text{spectacles}; 6 \rightarrow \text{Hazard}; 7 \rightarrow \text{lungs}; 8 \rightarrow \text{Yet}; 9 \rightarrow \text{beverages}; 10 \rightarrow \text{shell}; 11 \rightarrow \text{bonds}; 12 \rightarrow \text{unlike}.$

Test 1(B) [Industrial Electronic Engineering & Electrical Engineering]

Fill in the gaps	using those we	ords you conside	r most appropi	riate from the list j	provided:
actuated	biasing	breaker	brushgear	commutator	connections
cut-out	erased	flashlight	frame	gauge	path
processing	push-button	quote	resistance	rinsing	soft
spinning	stationary	trace	transformer	vacuum	windings

1.- "A consists of a primary coil to which the input is applied, and a secondary coil from which the output is obtained."

2.- "The coils have a core of iron on which the former is mounted."

3.- "A simple circuit consists of a solenoid and a switch with contacts."

4.- "Materials exhibit superconductivity when they have almost no to an electric current at very low temperatures."

6.- "The great expansion of data technology as known today began with the discovery of the transistor in 1948."

7.- "A characteristic feature of a microcomputer system is its 'bus' form of

8.- "The metal of the oscilloscope is part of its transmission system."

Key: 1 \rightarrow transformer; 2 \rightarrow soft; 3 \rightarrow breaker; 4 \rightarrow resistance; 5 \rightarrow windings; 6 \rightarrow processing; 7 \rightarrow connections; 8 \rightarrow frame.

Test 1(B) [Mechanical Engineering]

Fill in the gap	s using those [•]	words you co	nsider most appr	opriate from th	e list provided:
apparatus	bearing	bolts	canister	concrete	firebrick
gear	grid	groove	hose	ironclad	leverage
maintenance	mesh	shearing	sine	slag	specimen
spindle	thawed	tubing	verdigris	vice	wear

2.- "Nuts and can be turned by means of a spanner."

3.- "When using gas welding equipment, remember to keep lines out of gangways."

4.- "A blast furnace contains a lining inside a steel shell."

5.- "Roads are often reinforced with steel"

6.- "In a tensile test to destruction, increasing loads are applied to a of the metal until it breaks."

7.- "..... preparations are often necessary for successful welding of various corner, T-, and butt joint applications."

8.- "Isometric drawing paper is a paper with an isometric printed on one side."

Key: $1 \rightarrow$ maintenance; $2 \rightarrow$ bolts; $3 \rightarrow$ hose; $4 \rightarrow$ firebrick; $5 \rightarrow$ mesh; $6 \rightarrow$ specimen; $7 \rightarrow$ groove; $8 \rightarrow$ grid.

Test 1(B) [Industrial Chemical Engineering]

Fill in the gaps	using those wo	ords you conside	r most appropi	riate from the list j	provided:
boxwood	chart	cling	congeners	contingent	embers
engine	fire-damp	granted	greenhouses	haze	leisure
linoleum	methanol	negligible	presto	prevailing	rate
rusting	speck	steelwork	stream	wax	zip

1.- "The true boiling-point for the pressure must be ascertained."

2.- "The stem is divided into 100 equal parts by means of a special dividing"

5.- "An inflammable gas called methane oris often found in coal mines."

7.- "The of a landing-stage at the seaside tends to become badly corroded due to the regular immersion in sea-water with the rise and fall of the tide."

8.- "It must not be taken for that a catalyst which catalysis one reaction will catalyse another."

Key: $1 \rightarrow$ prevailing; $2 \rightarrow$ engine; $3 \rightarrow$ leisure; $4 \rightarrow$ greenhouses; $5 \rightarrow$ fire-damp; $6 \rightarrow$ haze; $7 \rightarrow$ steelwork; $8 \rightarrow$ granted.

Number 11: Tests administered (2).

Test 2 (part of) [Industrial Electronic Engineering & Electrical Engineering]

A signal from a transmitter may be propagated in three ways: by ground waves, by space waves and by sky waves. Ground waves travel round the surface of the earth for short distances. As they travel, they lose energy. This loss of power, or attenuation, depends on the nature of the surface. Attenuation also varies with the frequency of the signal: the higher the frequency, the greater the ground wave attenuation. At frequencies above 20 MHz the range is reduced to line of sight.

Propagation by space waves applies mainly to very high frequencies. Part of the transmitted signal travels in a direct line from transmitting antenna to receiving antenna. Partly the signal is reflected from the ground. The higher the frequency, the greater the possible ground wave reflection. The range of space wave propagation is restricted to approximately twice the direct optical path.

The range covered by ground waves and space waves is limited. Greater distances can be achieved using sky waves. Sky wave propagation depends on the ionosphere.

A signal transmitted from point A would not be received at B because of the curvature of the earth if it were not for the ionosphere. This consists of a number of layers of ionised gas in the upper atmosphere. If a transmission is directed towards these layers, it will be reflected back to earth.

Test 2 (part of) [Mechanical Engineering]

The cylinder head is cast as one piece. It is the upper sealing surface of the combustion chamber. It may serve one, two, three, four or six cylinders. The valve guides, which guide the valve stem during the opening and closing of the valve, are pressed into the cylinder head. All cylinder heads are made of a special iron alloy casting containing carbon, silicon, and copper. This alloy mixture provides elasticity and good thermal conductivity, and has a low thermal expansion rate. The size of the cylinder head is not determined by the number of cylinders but rather by such factors as the overall cost of the engine, the cylinder block design, the number of main bearings, the expected thermal stress, and the anticipated cooling and sealing difficulties (of the cylinder head).

Whether an individual cylinder head is used for each cylinder or whether the cylinder head covers two, three, four or six cylinders, it must nevertheless have adequate strength and stiffness. It must act as a sealing surface between the cylinder sleeve, cylinder-block top deck, and oil and cooling passages, without distorting the sleeve or valves. The cylinder head must be sufficiently strong so that it does not crack between the cylinder-head bolts (studs), between the intake and exhaust valve, or between the valves and injector (sleeve or bore).

Test 2 (part of) [Industrial Chemical Engineering]

One end of a short length of capillary tubing is heated in a source of heat, e.g. a bunsen flame, until the glass softens and seals the other end of the tube. Then, the tube

APPENDIX 4: TEACHING JOBS

Teaching jobs found in http://careers.shef.ac.uk/vacancy

Description: Opportunity to participate in 3-6 month projects in Brazil with Native English. This British organisation has 2 functions: teaching English to Brazilian students and placing British trainees on conservation projects. It is a school in the city of Cuiaba in the state of Mato Grosso, central west Brazil. Cost to the volunteer: £200 deposit, return airfare, travel insurance, vaccinations, £150 per month food and accommodation. **Skills:** None stated

Description Many opportunities in 13 countries (Nepal, China, Ecuador and Mongolia being this year's addition) in teaching, conservation and work intership projects. All placements are available year-round. Length of stay can be from 2 weeks to 1 year. Full in-country support and pre-departure support included. TEFL certificates included free **Skills** None stated

Description Travel Teach programmes offering working holiday opportunities, teaching conversational and comprehensive English in 2 former republics of the Soviet Union, Lithuania and Moldova. English is taught in schools and organisations to school children and adults. Opportunities available throughout the year, including during the academic summer vacation, with flexible periods of teaching from 2 weeks to 12 months. Charges are from £445 and includes return flight travel, visas, meals, accommodation, language learning and excursions **Skills:** None stated

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3.References should be given in the following format: Blakemore, D. 1987 Semantic constraints on Relevance. Oxford: Blackwell Richards, C. 1985 "Inferential pragmatics and the literary text" Journal of Pragmatics 9:261-285

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