CHAPTER V

MATERIALS AND METHODOLOGY

The present chapter proposes to investigate the types of materials and methodology relevant to the learning needs of first year biology students identified in the previous chapter. Hence, needs analysis as well as specification of English language skills and linguistic knowledge required for learning English are important prerequisites to determine appropriate and adequate English language teaching materials and methodology.

We examine these under three heads. In part one on ‘Evaluation of the Prescribed Course’, we include an analysis of the prescribed English language course from the point of view of its relevance to the needs of biology students. We also look at the students’ response to the present text, that is, the interest it is able to hold, its adequacy in terms of students’ English language learning needs and its level of difficulty. We also suggest the time to be devoted to teaching ES in the Department of biology, while in part two on the ‘Selection of English Language Reading Texts’ required by biology students we consider appropriate texts for reading in their subject area. We have classified reading texts into modified, unmodified, and specially written texts. In part three on ‘Methodological Implications’, we recommend materials and techniques. In this part we have discussed some of the techniques which can help the ES teacher to make the lesson more interesting. We have also tried to see
whether or not there is something specific about ES methodology and the relation between the teaching process and students needs. The types of rhetoric exercises and functions have also been discussed and analysed. Examples of these functions are: rephrasing and equivalence, contextual reference and avoiding repetition, checking facts and ideas, connecting facts and ideas, transfer of information. (see section 5.3.2 - Rhetoric of the register and the exercises).

It is necessary at this point to define and explain what is meant by the "authenticity of the text" and the importance of needs analysis as a determining factor in materials production.

"An authentic text is a stretch of real language, produced by a real speaker or writer for a real audience and designed to convey a real message of some sort". (Morrow: 1977: in Skehan: 1980: 32). An authentic text, therefore, "aims to convey information and ideas rather than the use of language". (Kennedy: 1984: 48). It is written with a specific readership in mind. Authenticity means "the development of personal learning strategies to approach the particular task of interpretation and further application of texts to real life situations". (Escoricia: 1985: 232).

Students' need is a determining factor in course design and overrides other considerations. An ES course ought to be purposeful and "based on a rigorous analysis of students' needs and 'tailor-made' to that end". (Robinson: 1980: 13).
Palmer says that "there are many logical principles, and we must strive to incorporate all of them into whatever programme we design". (Palmer: 1964: 28). Once the syllabus has been specified, the ES course director has to begin the task of materials production. The topics and situation that the language is linked to will relate to the students' subject of specialisation. The ES teacher should be materials writer as well. Course materials ought to be based on passages taken from the specific subject text books of biology and the topics covered linked to those studied by students. Subject specific materials look relevant. If learners have got used to working with a particular kind of text in the ES classroom they will be less apprehensive about tackling it in the target situation. ES materials (in the form of texts) should be more closely linked to the skills required by the students and by a functional rather than strictly structural approach.

Good materials encourage learners to learn. They contain interesting texts, enjoyable activities which engage the learners' thinking capacity, and opportunities for learners to use their existing knowledge and skills and content which both learner and teacher can cope with. They encourage in the learner a sense of progress and achievement. Materials embody a view of the nature of language and learning. They reflect what we think and feel about the learning process. In the following section we evaluate the prescribed ES course from the point of view of its relevance to students needs and appropriateness to methodology.
5.1 **Evaluation of the Prescribed Course**

In the introduction to the present ES course under review the authors say that the basic language of scientific English is made up of sentence patterns, structural words and non-structural vocabulary. This content has also been determined by extensive research, a scrutiny of more than three million words of modern scientific English. In other words, the content is derived from a register analysis. Now the ES course book i.e. "A Course in Basic Scientific English", by Ewer and Latorre, 1969, is among those books which are shown to be deficient with reference to the new unit of analysis, the micro-act. Thus, the register analysis previously conducted (see chapter 2) proves to be an inadequate device for determining content. The explanations, exercises, and examples which are provided in this text book, and which one supposes are to be applied in the teaching of micro-acts too, are designed to implant items of knowledge in the learner's mind and not to develop a capacity for using this knowledge. The text book leaves considerations of appropriate methodology entirely out of account.

The course consists of 12 units covering topics such as 'the scientific attitude', 'numbers and mathematics', 'scientific method and the methods of science', 'pure and applied science', 'science and the future', the scientist and government'. Each unit consists of sections such as comprehension questions on the passage; word study such as word building; exercises on synonyms and opposites, nouns and their associated verbs, compound nouns, noun phrases, and
phrasal verbs. Another section is structure study which consists of tenses, negative, interrogative, passive and active voice, the -ing form, and the infinitive. Each unit also has a discussion and a criticism section. Most of the units are supplemented by a bibliography for further reading. The book is also provided with supplement of extracts from current scientific literature; four appendices on prefixes and suffixes, irregular verbs, abbreviations and symbols, weights and measures; a basic dictionary and an index of structures.

Ewer and Latorre (1969) say that the focus of their book is oral, which seems surprising since it is a collection of long texts with numerous grammar and vocabulary exercises and explanations. By 'oral' the authors mean that the exercise material should be drilled. Although the exercises are varied, they are nonetheless uncontextualized and obviously constituted in text book language. However, the book is a useful fund of information about English for scientists. It provides a good practice in reading.

5.1.1 Students' Response to the Present Text

An ES textbook has to suit the needs of teachers, students and sponsors. So, it is important that the subjective factors which will admittedly play a part, should not be allowed to obscure objectivity in the early stages of analysis. The evaluation process can be divided into four major steps:
1. Defining criteria
2. Subjective analysis
3. Objective analysis
4. Matching

"We should use the materials evaluation process as a means of questioning and developing our own ideas as to what is required" (Hutchinson: 1987: 97). The scientific language learnt by students should arise from their science course material and the experimental work they perform. It should not be divorced from the curriculum (Harrison: 1979: 67). Moreover, the course should be adequate in terms of the needs of biology graduates. In response to Q. 25, appendix 2, p.227 39% of the students state that the course material is not interesting, while 16% of them say that it is boring. However, 39% of the students find the course interesting. Our observation is that some students are not interested in the text because the passages are not taken from biology subject area. Besides, the exercises and examples in this book do not develop students capacity to express biology scientific knowledge in English. However, the book can be a useful text of English for general science (see section 5.1, Evaluation of the Prescribed Course).

Table 27, Q. 26, p.152, shows that 59% of biology students state that they consider the present course not very adequate in terms of the needs of biology students. Only 18% of them consider it as being adequate.
However, Q.27, Table 27, Appendix 2, shows that 37% of the students think that the present course is not so difficult. 22% of them consider it as being difficult and 24% did not give any reply.

Table 27 Adequacy of the Present Course in Terms of the Needs of Biology Students, Difficulty of the Present Text

<table>
<thead>
<tr>
<th>Q. 26 Do you consider the present course adequate, not very adequate, or inadequate in terms of the needs of biology students?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. adequate</td>
</tr>
<tr>
<td>b. not very adequate</td>
</tr>
<tr>
<td>c. inadequate</td>
</tr>
<tr>
<td>d. no reply</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q. 27 Do you think that the present text is difficult?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. difficult</td>
</tr>
<tr>
<td>b. not so difficult</td>
</tr>
<tr>
<td>c. easy</td>
</tr>
<tr>
<td>d. no reply</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q. 28 Which part of the text do you find difficult?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. the passages</td>
</tr>
<tr>
<td>b. vocabulary exercises</td>
</tr>
<tr>
<td>c. grammar exercises</td>
</tr>
<tr>
<td>d. no reply</td>
</tr>
</tbody>
</table>

Q. 28, Table 27 shows that 41% of the students state that they find vocabulary exercises the most difficult,
followed by passages (31%) and grammar exercises (22%).

It is important to organize and spread the course appropriately. The teacher should have a weekly and a yearly plan. If he is ahead of the plan he should move more slowly, if he is behind the plan he should then move more quickly. The teacher should distribute the course material according to the weeks and months of the year. He needs to consider the possibility of unexpected interruptions. The day in which examinations and holidays occur should be taken into consideration. Each activity should be given its due share of time. (Al-Hammash: 1985: 18 ff).

The following table shows the suggested time to be devoted to teaching ES in the Department of Biology. It is clear from the table that 40% of the biology teachers and 70% of the ES teachers are of the opinion that English should be taught for two hours per week in the first year of study, while 80% of the M.Sc. students feel that an ES course should be taught for two hours for the first year biology students. 24% of the B.Sc. students also consider two hours teaching time enough for them. 24% of these students emphasize the importance of English and say that it should be taught for two hours in all stages of study. We thus find that the teaching of English in the Department of Biology is insufficient. We need to devote at least four hours a week for teaching English at all stages of study, that is, from first year to fourth year B.Sc. classes.
TABLE 28  **The Time Suggested for Teaching ES in the Department of Biology**

Q.29 Suggest the time you would like to devote to teaching ES in the Department of Biology.

<table>
<thead>
<tr>
<th>Years per week</th>
<th>Biology Teachers</th>
<th>ES Teachers</th>
<th>B.Sc. Students</th>
<th>M.Sc. Students</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>9</td>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1+2</td>
<td>2</td>
<td></td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>1+2+3</td>
<td>2</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>1+2+3+4</td>
<td>2</td>
<td></td>
<td>12</td>
<td>40</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>1+2</td>
<td>3</td>
<td></td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>1+2+3</td>
<td>3</td>
<td></td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>1+2+3+4</td>
<td>3</td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1+2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1+2+3</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1+2+3+4</td>
<td>4</td>
<td></td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>any other alternative?</td>
<td>2+4</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

"Reading texts chosen for use in the English language class must represent the kind of text which the students are required to read for information in the course of their studies". (Mackay et.al.: 1979: 121). Texts should provide motivation by sustaining students' interest. Also the information they contain must be relevant to the students'
specialist studies programme. The text should, therefore, be taken from the specific area in which the students are engaged because we have a homogeneous group of biology students. "The only justification for having highly specialised texts is to achieve face validity. Learners may be more motivated by them, because they make the language seem more relevant". (Hutchinson: 1987: 161). However, if the use of such texts makes work in the class difficult, it is the teacher who has to make the text more interesting.

Specialised texts exhibit various characteristic lexical features. These can be isolated, analysed and used as subjects for useful exercises for students.

5.2 **Selection of Reading Texts**

Reading texts can be classified as follows:

1. Unmodified texts selected from appropriate sources without alteration.
2. Modified versions of such texts.
3. Especially written texts.

Unmodified Texts are selected from appropriate sources without alteration. This procedure is the one most ES teachers follow, and besides it is the simplest and least time-consuming. The text should be taken from the specific area of biology because we have a homogeneous group. The sentence structure and vocabulary should resemble that of the textbooks on students' reading list. The reading texts chosen for use in the English language class must represent
the kind of text which the students are required to read for information in the course of their studies. (Mackay and Jordan: 1979: 121). These texts provide motivation to students because the information they contain are relevant to their specialist studies.

**Modified Texts** are ones written with the objective of reducing reading difficulty by simplifying certain structures. Compound and complex sentences can be divided up, logical connectors, discourse markers, and anaphoric expressions can be introduced and the students' attention drawn to these devices of textual cohesion. (Mackay et.al: 1979: 123). The main problem with the use of simplified texts is that they present the learner with something artificially constructed that is different from the real text he will be faced with in his subject area. (Kennedy: 1984: 48). They also lose some meaning with simplification, and often lack genuineness.

**Preparing Specially Written Texts** is time-consuming and assumes a knowledge of the subject on the part of the teacher. The texts are written either by or on the instructions of the author to provide contextualized illustrations of what are regarded as important teaching points (Mackay: 1979: 123).

In the following part of the chapter some methodological implications and techniques have been presented. Besides, some teaching materials and rhetorical exercises have also been recommended.
5.3 **Methodological Implications, Recommended Materials and Techniques**

5.3.1 **Methodological Implications and Techniques**

In order to provide learners with general communicative competence, the ES teacher must be able to make use of an information gap between himself and his students. He may, therefore, pretend that he does not know certain concepts and ask his students to explain them to him. The students may need some specific terminology, and may feel motivated in asking their teacher for the right English term. The teacher might make use of the students' knowledge of the subject when he introduces a new reading text to the class. He might ask the students to observe the title and try to predict what the text might contain, or say what they already know about the subject.

The ES teacher with his methodological preparation and teaching experience can usefully turn the situation into a problem solving activity to be successfully completed by the students with the help of the text and himself. Moreover, methodology should engage the learner in activities which he would normally take part in, when putting language to use for particular purposes. Interest is the simplest of all the ways of engaging the learner's mind, involving him in the lesson, creating an atmosphere of learning and encouraging his creativity. As an example of how the lesson can be made interesting we give below the figure which illustrates how the human body's blood system works.
Hello! I'm a blood cell and I'm going to take you on a tour round this body's blood system.

We're in one of the veins at the moment on our way to the heart. We've given up all our oxygen, so we're feeling rather tired now.

We're going into the heart through a valve and into the right atrium. This is like a 'collecting chamber' and then we'll be sucked into the right ventricle.

Here we are now in the ventricle. The heart muscles are starting to contract, so the pressure in here is quite high now. We're about to be pumped into one of the arteries to take us to the lungs. Here we go!

We've just arrived in the lungs. We're getting nice and clean and picking up the fresh oxygen. Mmmm, that feels good. All that lovely oxygen.

We've got our oxygen now, but before we go off round the body we have to go back to the heart. You see, after going through the lungs we're not at a high enough pressure to take us all round the body. So the heart has to boost the pressure.

Here we are in the heart again, but this time in the left side, all ready to be pumped into the arteries. You will have guessed by now that the heart is really two pumps side by side.

This is where we leave the heart. We're just coming through the outlet from the left ventricle. We're at a very high pressure now. But we've got a long way to go, giving our oxygen to the tissue. Bye!

A positive feature of an ES methodology derives from its association with communicative and functional approaches to language teaching. "The communicative language movement has influenced syllabus design in so far as it has moved the focus away from grammatical or structural specifications towards semantic (functional and/or notional) or situational specifications". (Bloor: 1984: 17). However, as Robinson (1980: 39) states methodology must at some stage involve stimulation, role rehearsal, approximation of real-life language usage and a concern with authentic information. The competent teacher knows how to make learning successful, and can help his students to learn faster, better and more enjoyably. Methodology has to be experienced in the classroom. However, there are some techniques which can help the teacher to make the ES classroom a livelier, more enjoyable and thus more effective environment for both learner and teacher. It is quite probable that some of the exercise types associated with ES are in fact entirely appropriate to general ELT, but have arisen with ES because of its greater attention to relevant language practice, to students' motivation and needs, and to efficiency of teaching and learning (see Robinson: 1980: 39).

The teaching of English for science is now established as an important area in ELT, and one which demands the creation of continuous links between those who teach English and those who teach science. However, three stages can be distinguished in the teaching of English for science. The
first stage is the common elementary course in the language with no scientific reference. The second encompasses a superstructure that could serve scientific purposes, while the third includes a subsequent scientific purposes, while the third includes a subsequent superstructure serving a specialized scientific purpose. (Harrison: 1979: 61). The activities in the classroom should provide feedback to all the stages in the teaching of language. The act could be designed to communicate and share knowledge between students. A variety of topics, skills and exercises can be used for the purpose.

However, ES is so diverse that no methodology can be considered as a norm for all classes. The choice of a particular method depends upon the professional background, training and preference of those in charge of devising the course. (Strevens: 1980). Thus there is nothing specific about ES/ESP methodology. The principles which underlie good ES methodology are the same as those that underlie sound ELT methodology in general. General English teaching can be usefully employed in ES. However, matching the teaching to the learners' needs extends freedom to innovate in methodological terms. This is perhaps one of the major attractions which ESP offers to the experienced teacher. (Strevens: 1980: 121). The concern of methodology is to stimulate problem solving activities of the kind congruent with the students' specialist preoccupations. Thus, methodology is to be placed at the very heart of the operation, with course design directed at serving its
requirements and not the reverse. (Widdowson: 1984: 107). The teacher can devote the whole of his teaching time to activities that are relevant to the eventual aims of the learner.

We also need to repeat things in order to learn them, but frequent repetition creates boredom. Variety of skills, therefore, is a vital element in keeping the learners' minds alert. It is one of the ways of achieving reinforcement while still maintaining concentration. Variety, as we have stated earlier, includes variety of texts, exercises, skills and topics. Using a range of skills greatly increases the range of activities possible in the classroom. The lesson, therefore, should be interesting. Interest is the simplest way of engaging the learner's mind. Learners, therefore, need to be involved both cognitively and emotionally in the lesson. Moreover, lesson preparation is interpreted as the teacher planning the stages of the lesson.

In a learning-centred approach the methodology must be considered right from the start. To achieve this, the syllabus must be used in a more dynamic way in order to enable methodological considerations, such as interest, enjoyment and learner involvement to influence the content of the entire course design.

5.3.2 Rhetoric of the Register and Exercises
In this section we look at exercises developed to:
1. reinforce the reader's perception of certain discourse functions,
2. direct the students’ attention to the way anaphoric devices work,

3. make the biology students aware of the communicative functions of sentences and the way written discourse develops,

4. get the students to recognize how the language and subject matter are interrelated in acts of communication.

These exercises include: (a) rephrasing and equivalence, (b) contextual reference and avoiding repetition, (c) checking facts and ideas, (d) relation between statements: connecting facts and ideas, (e) transfer of information: completing a passage by referring to a diagram, (f) reordering jumbled sentences, (g) guided writing, (j) definitions in scientific discourse. We include here a passage from Pearson (1978: 69) together with exercises followed by a discussion.

The exercises devised should take into account the needs of the students and the nature of the abilities which must be developed to meet them, and be related therefore to the kind of rhetorical considerations within the context of which we have placed the exercises presented here. The purpose is to draw the reader’s attention to the process by which a piece of language is interpreted as a discourse. The following exercises are drawn from Pearson (1978), Mackay et.al. (1979), and Brumfit (1980). These exercises are usefully used in ES because of their greater attention to
relevant language practice, to students' motivation and needs, and to efficiency of teaching and learning. (See Robinson: 1980: 39). We include here a passage from Pearson (1980: 69) on the Species and their Adaptations.

Species and their Adaptations

A species can be thought of as a group of morphologically similar organisms which can interbreed to produce fertile offspring. Dogs and cats, for example, are two groups of animals which we easily recognize as two distinct species. The members of each group resemble one another in certain obvious ways, and individuals can mate to produce offspring which are also able to interbreed.

The need to specify that individual members of a species must not only be similar morphologically but must also be able to interbreed is well illustrated by six species of mosquitoes in the genus Anopheles. These species all occur in Europe and cannot be distinguished one from another on the basis of morphology only. It is known, however, that these mosquitoes are divided into six separate interbreeding groups, with any individual able to reproduce successfully only if it mates with an individual from its own group. In other words, we have here one 'morphological species' which is divided into six 'interbreeding species'.

The need to specify that the offspring of two parents from the same species must be fertile is due to the fact that we find cases where different species can interbreed. For example, the horse and the ass can mate and produce living offspring which we call mules. We can then notice two characteristics of these offspring: first, they are morphologically distinct, being different in some ways from both horses and asses, and secondly, they are infertile. Thus we recognize that horses and asses are morphologically similar species.

Another kind of difficulty with the concept of 'species' is illustrated by the butterfly Papilio dardanus, which does not consist of morphologically similar individuals. In this species the males are similar but the females sometimes resemble the males and sometimes resemble butterflies belonging to various other species. Here, then, we have one 'interbreeding species' which consists of several 'morphological species'. Clearly, it is not possible to find a simple definition of what we mean by a 'species'. The concept is very useful, but we must always remember that the facts are extremely complicated.
EXERCISE A  Finding out about the meaning of words

Find in the passage the words and phrases below and answer the questions about them. The numbers in brackets refer to the paragraphs in which the words occur.

1. interbreed (1) here means:
   (a) reproduce by means of an asexual process
   (b) reproduce with a member of the same species
   (c) reproduce with a member of another species

2. fertile offspring (1) are offspring which are:
   (a) capable of developing into adults
   (b) able to survive as adults
   (c) able to produce living young

3. specify (2) could be replaced here by:
   (a) make clear
   (b) make certain
   (c) decide

4. well illustrated (2) is here similar in meaning to:
   (a) clearly shown
   (b) easily understood
   (c) well explained

5. Which word in the third paragraph means unable to produce living young?

6. concept (4) could be replaced here by the word:
   (a) definition
   (b) view
   (c) idea

EXERCISE B  Avoiding repetition

The sentences below are based on the passage. Change or add to the words printed in italics so that each sentence could begin a paragraph. Write in your notebook. The numbers in brackets refer to the paragraphs which contain the original sentences.

1. These species all occur in Europe and we cannot distinguish between them in terms of morphology. (2)

2. These mosquitoes are divided into six interbreeding groups. (2)

3. They are infertile. (3)
4. In *this species* the females are not all morphologically similar. (4)
5. *The concept* is very useful. (4)

**EXERCISE C  Checking facts and ideas**

Read the statements below and decide whether they are true (T) or false (F). The numbers in brackets refer to the paragraphs in which the information can be found.

1. The genus *Anopheles* contains more than six species. (2)
2. Horses and asses are regarded as members of the same species. (3)
3. Mules are unable to reproduce sexually. (3)
4. The females of *Papilio dardanus* never resemble the males of the species. (4)

**EXERCISE D  Connecting facts and ideas**

The paragraph below needs certain words added to it in order to make clear the relationships between the sentences or between the parts of a simple sentence. Decide which of the words below must go in each space in the paragraph and then write the paragraph. Use each word once only, and do not use *although* in the first sentence.

- although
- however
- secondly
- thus
- first
- moreover
- therefore
- whereas

... the members of some groups of morphologically similar organisms can all interbreed, in other cases they cannot. ..., some interbreeding groups contain morphologically different individuals. ..., it seems that no simple definition of 'species' is possible on the basis of morphology and an ability to interbreed. ..., there are two further complications. ..., certain similar but morphologically distinct groups can interbreed, ... the offspring are infertile. ..., there are some groups of organisms which never reproduce sexually at all and ... cannot be covered by a definition based on the ability or the inability to interbreed.
Ex. A - Rephrasing and Equivalence

Lexical equivalence is used to establish textual cohesion. It is a matter of lexical patterning. In most texts there are words, phrases, and even entire sentences which have essentially the same meaning or are used by the author with the same meaning in a particular text. (Mackay et. al.: 1979). In this exercise, the learner is made aware of how two different expressions may refer to the same thing. For example, fertile offspring is synonymous with the phrase able to produce living young, and a substance which can not be seen is synonymous with the phrase an invisible substance. The purpose of this exercise is to make the learner realize that writers commonly express the same idea in different ways and that there is no one-to-one correspondence between one linguistic form and one meaning. It is important that the student should realize this because two phrases may mean the same thing only within the context of a particular passage and it is therefore only by studying the context that the equivalence can be established. (See Allen: 1978). It is a copying exercise, the purpose of which is to reinforce the reader’s perception of certain discourse functions.

Ex. B - Contextual Reference and Avoiding Repetition

In order to understand a text, it is essential to know what words like ‘this’, ‘that’, ‘these’, ‘it’, and ‘them’ refer to. The selection of the wrong reference for one of these items may lead to a misunderstanding of what the writer
refer back to a word, phrase, clause, sentence or longer stretch of text which appeared earlier. Foreign learners need to be taught these points which can be dealt with by using either a multiple choice format or asking students to identify the reference (see Mackay, et.al: 1979: 125).

The exercise draws the learner’s attention to the way pronouns and demonstratives are used to refer to something already mentioned and so serve to relate one statement to another. The exercise directs the learner’s attention to the way anaphoric devices work and so prepare him for those cases where identification of the reference is not so easy. (Allen: 1989: XV). We can draw student’s attention to features of anaphora in the passage by means of an exercise of the following kind:

1. In paragraph 2, line 3, these refers to --------------
2. In paragraph 3, line 5, they refers to --------------
3. In paragraph 4, line 3, this refers to --------------

This exercise can also be designed in a way that it involves no writing at all, e.g.,

In paragraph 4, line 3, this refers to:
(a) anaphelets (b) papiliodardanus (c) Horses and assess
We can also give the students an exercise like the following:

Each sentence in the paragraph below is good English but the paragraph itself is not well structured. Can you see why?

*Heteronema* and *Rhabdomonas* are found in fresh water. *Heteronema* and *Rhabdomonas* are flagellate protozoans and *Heteronema* and *Rhabdomonas* both lack chloroplasts. In *Heteronema* there are two flagella, but one simply trails back beside the body. The other flagellum is used for swimming and the other flagellum is held straight out in front of the body. In *Rhabdomonas* only one flagellum is present and the flagellum is held out at right angles to the body.

The problem in this paragraph is that there is too much repetition. We can improve it by using *they* twice and *it* twice and by leaving out the word *flagellum* at one point.

(Pearson: 1978: 10).

**Ex. C - Checking Facts and Ideas**

Comprehension checks require the learner to indicate whether a given statement is True or False according to the passage. But it is important that he should know why a statement is True or False and be able to recognize what it is in the passage that leads him to decide one way or the other.

**Ex. D - Relation between Statements: Connecting Facts and Ideas**

Intersentential relationships have to do with the way in which sentence and groups of sentences combine to form units of discourse. We have to direct our attention, therefore, to an examination of markers which have been well described in Greenbaum: 1969 and Winter: 1971, and which can provide us with a framework upon which to base teaching materials.
Expressions like 'therefore', consequently, however, etc. indicate what function a particular sentence is meant to fulfil. A sentence which contains "for example", indicates that the sentence is used to make a statement which illustrates a point made previously. Such expressions are explicit indicators of the communicative function of sentences. (Allen: 1978: XVI) (see chapter two on linking devices). The purpose of this exercise is to make the learner aware of such communicative functions and of the way written discourse develops. This type of exercise focuses on the way sentences themselves function as communicative acts within the discourse. We want to get the learner to see that understanding a passage of English involves the recognition of what illocutionary acts are performed in it. Students can be asked to insert expressions into the sentences of the passage which make explicit what their illocutionary function is.

This exercise requires the reader to use his knowledge of the language productively: he has to insert the given expressions in the correct places and to make structural alterations where necessary in the sentences concerned. This grading is intended to effect a gradual transfer from receptive awareness to productivity ability. In this exercise our purpose is to get the learner to make explicit acts like defining and illustrating.
Ex. E - Transfer of Information: Completing a Passage by Referring to a Diagram

This exercise reflects the importance we attach to the presentation of language as an essential aspect of the scientific subject which the learner is studying. The purpose of the approach we are illustrating here is to get the learner recognize how the language and subject matter are interrelated in acts of communication. Again, we could get the student to draw a simple diagram of an organism and provide a verbal description.

Information transfer involves the use of written English to express facts and ideas presented in the form of diagrams. Science students are familiar with the use of non-verbal means of communication like formulae, graphs, diagrams, and line drawings, and this activity of transferring information from a non-verbal to a verbal medium is intended to link the students' learning with their main area of study. For an illustration see the following diagram.
The flower of the Buttercup (Ranunculus)

Copy the diagram into your notebook. Label it but do not put in the notes. Now write out the following description of the flower, finding the information you need in the notes in the diagram.

The flower of... consists of... whorls of... The outermost whorl (or...) is made up of five green..., and internal to it is the..., made up of five larger, yellow-coloured... Together, the calyx and the... constitute the perianth. Inside the perianth, there are numerous spirally-arranged..., which make up the... The final whorl, in the centre, consists of numerous spirally-arranged..., which constitute the... All four whorls are borne on the..., which is the tip of the flower-stalk (or...).

(Pearson: 1978: 63)

We can also ask the students to make a simple statement about a process. To do this, we may present an equation and derive an appropriate statement from it both in L1 and L2 in the following manner:
The equation provides a basis for making a factual statement to the effect that a certain reaction takes place. The statement in English has been associated with a statement in L1 and with the non-verbal representations. This exercise is used both as a translation and information transfer exercise. (See also Ex. G.).

Ex. F - Reordering Jumbled Sentences

The student is required to reorder the sentences correctly using his knowledge of connectives and clues provided by other cohesive ties, e.g.,

Now reorder the sentences below to form a well-structured paragraph:

1. In addition, a variety of spore-dispersing structures have effectively exploited air currents and the activities of other organisms.
2. As a result, the mycelia have few adaptations for survival under truly dry conditions.
3. Most of the mycelial growth occurs in local zones of moist substrata.
4. The fungi have managed to survive under terrestrial conditions without structural complexity.
5. Development of ascocarps and besidiocarps was probably favoured by natural selection because these structures are efficient at dispersing spores (Kirk: 1977: 136).

**Ex. G - Guided Writing**

Students are also given a set of very brief notes which they are asked to build into a paragraph, or they are asked to write a passage of description interpreting a labelled diagram or a series of diagrams of a process or experiment. Students also can be asked to write a passage of interpretation of a graph or table, perhaps answering specific questions on the trends involved. Figure 4., p.174, shows the structure of the heart of the dogfish in a median longitudinal plane section.

**Ex. H - Translation Exercises**

Many teachers find translation to be an excellent way of testing reading comprehension provided that this testing techniques will not lead to heavy classroom use of translation exercises and thus encourage the students to speak their native language more than the foreign language. Translation exercises are more appropriate in reading courses and less valid in courses stressing the audio-lingual skills. We have to select a passage unfamiliar to the students that is written by the same author whose work they have been reading. Students are allowed to use the dictionary but they should be advised not to spend their time checking the meaning of every single word. Attention should be paid to fluency and sentence connection.
Now write two paragraphs about the structure and working of the dogfish heart.

STAGE ONE
The first paragraph should describe the form and internal structure. Include the following information:

The heart is S-shaped when seen from the side.
There are four chambers connected in series.
There are three sets of valves.
You must also describe the relative size of the chambers and the relative thickness of the walls. and of course say what the parts are called.

STAGE TWO
The second paragraph should describe the way the heart works as a pump. Include information about:

contraction (which forces blood forward)
the prevention of back-flow
the direction of blood-flow

When you write out your paragraphs, give them the title The structure and functioning of the dogfish heart and draw the diagram between the two paragraphs. Label it but do not give any of the other information.
Students are also given biological terms in English and asked to translate them into Arabic, e.g.,

<table>
<thead>
<tr>
<th>L2</th>
<th>L1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell membrane</td>
<td></td>
</tr>
<tr>
<td>Hereditary material</td>
<td></td>
</tr>
<tr>
<td>Cell wall</td>
<td></td>
</tr>
<tr>
<td>Granules</td>
<td></td>
</tr>
<tr>
<td>Meiosis</td>
<td></td>
</tr>
<tr>
<td>Bud</td>
<td></td>
</tr>
<tr>
<td>Contractile fiber</td>
<td></td>
</tr>
</tbody>
</table>

These terms and expressions can be given to biology students in Arabic, asking them to give their meanings in English. However, we have to go beyond the vocabulary level to sentences and paragraphs, e.g.,

**Sentence in English**
Chloroplasts are highly organized and specialised membranous organelles that are the sites of all photosynthetic reactions in eukaryotic cells
(See Ex. E. Transfer of information).

**Sentence in Arabic**

**Ex. I - Note Taking**
Note-taking practice aims to practise four types of skills: transferring the spoken word to written text; listening for key words and phrases; selecting out relevant details, and recognising topics and main ideas. Note-taking,
therefore, can aid the learning process. It is related to recall, and reviewing one’s notes is a useful procedure.

Now read the passage on page 163 again very carefully, then make a note of which paragraph each of the following statements relates to:

1. Different species can interbreed.
2. We can have one interbreeding species which consists of several morphological species.
3. Individuals can make to produce offsprings which are also able to interbreed.
4. Species cannot be distinguished one from another on the basis of morphology only.
5. It is not possible to find a simple definition of what we mean by species.

Now make notes on all the important points in the passage.

Look at the following passage, and as quickly as you can, find the answer to this question: what are the seven characteristics of living organisms? Write the answer in your notebook.

The answers should be written under the following headings:

1. The difference between plant and animal nutrition.
2. The importance of movement in animals and plants.
3. The relationship between energy and the seven characteristics of living organisms.
THE CHARACTERISTICS OF LIVING THINGS

All organisms have seven important characteristics in common. It is these seven special properties of living organisms that enable us to distinguish between living and non-living things.

First, only living organisms can move under their own power. For example, animals move in search of food and water, and many simple plants live and even swim in water. In addition, many plants have reproductive cells that swim, and many plants can move their leaves or other parts of their bodies.

The second characteristic is that all organisms grow until they reach a certain size or age. Then they reproduce, giving rise to new organisms. The fourth characteristic shared by plants and animals is that they are all sensitive, so that they respond to external stimuli. Plants, for example, may react to changes in light intensity by opening and closing their flowers, and animals may respond to heat by seeking a cool place.

However, movement, growth, reproduction and sensitivity are activities or processes which use a lot of energy. The need for energy explains why organisms are also characterized by the three processes of nutrition, respiration and excretion. Plant nutrition starts when carbon dioxide, water, and various inorganic substances are taken in. From these materials the plant makes, or synthesizes, substances like sugars, starches and proteins. Sunlight is the source of energy for this synthesis. Animal nutrition is different, because animals cannot synthesize complex organic substances. Instead, they must take in these substances as their food.

Although nutrition is very different in plants and animals, the results of the process are similar: the organism acquires energy-rich substances such as sugars. During respiration these substances are 'burnt', so that energy is released and becomes available for all the chemical activities that need energy. The waste materials that are formed as a result of the organism's chemical activities are removed from the body in the process of excretion. Energy is also required for this process.

The answer to the question that we started with is easy to find when you notice that some words are printed in bold type. So, if we want to make a note of the seven characteristics of living organisms, we need only give a heading plus a numbered list:

A The 7 characteristics of living organisms:

1. movement 5. nutrition
2. growth 6. respiration
3. reproduction 7. excretion
4. sensitivity
Ex. J - Definitions in Scientific Discourse

This exercise shows how we attempted to provide grammar practice in a meaningful way, and without losing sight of the natural communicative use of language, e.g.

Expand the following into full definitions. Write each sentence twice, using any of the following patterns:

\[
\text{is/are.}
\]

\[
a. \quad \text{A} \quad \text{may be defined as} \quad \text{B which} \quad \text{C is/are called}
\]

\[
b. \quad \text{B which} \quad \text{C is/are known as}
\]

1. metamorphosis/the physical transformation/ is undergone by various animals during development after the embryonic state.

2. metals/the class of chemical elements/are characterized by ductility, malleability, lustre and conductivity.

Now look at the following diagram which describes the circulatory system of the fish.

Figure 5

![Diagram of the circulatory system of a fish]

The circulatory system of a fish
We can also define each feature of the Blood Vascular system in terms of other parts of the system: The blood is the transport medium of the BVS. Now write definitions referring to the figure above.

1. The heart ............
2. The veins and arteries ............
3. The capillaries .................

5.4 In this chapter we have analysed the present English language course studied by first year biology students and it has been found that the passages, exercises and examples are designed to implant items of scientific knowledge rather than to develop a capacity for using this knowledge. The course is a collection of long texts with numerous grammar and vocabulary exercises. The exercises are uncontextualized and the context of the book is not related to students subject of specialization. It is on general science.

The selection of reading texts has also been discussed and it has been suggested that English language reading texts should represent the kind of text which students are required to read for information in their subject of specialization, i.e., they should be relevant to the students specialist studies. However, texts apparently must have new words and expressions because the purpose here is to enhance the learning process. The material should also be more closely linked to the skills required by the students. The material should be interesting and engage the learner's thinking capacity.
Our questionnaire shows that the present course is not very adequate in terms of the needs of biology students (see Appendix 2, p.227). However, the text is not so difficult. Some of the students see that the difficulty lies in the passages and vocabulary exercises. The time factor has also been emphasized and it has been stated that the course material should be distributed according to the time available. The English language course can be taught for two hours a week for first, second, third and fourth years of study. However, others suggested that teaching English for two hours a week to first year is insufficient.

Methodology has to be experienced in the classroom. However, some techniques which can help the teacher to make the ES classroom livelier and more interesting have also been discussed. A link should be created between those who teach English and those who teach science. Yet, there is nothing specific about ES/ESP methodology. However, teacher can innovate in methodology by matching the teaching to the learners' needs. The teacher should start with presentation, provide practice exercises and finally make students perform creativity activities.

We have also emphasized the variety of exercises, skills, and topics to involve the students in the lesson. Then, we have discussed in detail the types of discoursal exercises which take into account the needs of the students and the abilities which must be developed to meet them, like rephrasing and equivalence, contextual reference and avoiding
repetition, checking facts and ideas, connecting facts and ideas, transfer of information, translation exercises and note-taking.