

International Conference on Education and Educational Psychology (ICEEPSY 2011)

Factors Underlying the Reading Performance of Algerian Microbiology Students

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Abstract

This study aims at identifying some of the factors that have a bearing on the reading achievement of ESP students. The research questions were: (1) What are the factors which underlie the students' reading performance? and (2) What test tasks influence their reading achievement? The findings of the first question indicate that there are three factors which underlie adequate understanding of texts: (i) lexical knowledge, (ii) coherency, and (iii) comprehension. The findings of the second question indicate that the students performed moderately on the 'local' reading skills as well as on 'global' reading skills and strategies.

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Selection and/or peer-review under responsibility of Dr Zafer Bekirogullari.

Keywords: *Reading comprehension; reading proficiency; reading skills and strategies; ; Assessing reading; ESP*

1. Introduction

Courses whose specific objective is the reading of scientific and technical texts are becoming more and more common in universities and technical colleges throughout the world, and Algeria is no exception. The microbiology institute at Ferhat Abbas University, like the other institutes, receives students that have been trained in Arabic and have a low competence in the English language. This linguistic handicap in English has brought with it some problems of reading comprehension in the students' own speciality. Given this situation and based on a reading comprehension test, the present work has as a main objective the scrutiny of the factors which underlie the students' reading performance together with the test tasks have a bearing on their reading achievement.

2. The nature of reading:

Reading is a complex process which has been extensively studied across a wide range of different disciplines. This is manifestly reflected in the vast literature on reading and on the teaching and testing of reading in both mother tongue and foreign language classroom contexts. Reading can be viewed as decoding process of reconstructing the author's intended meaning via recognizing the printed letters and words, and building up a meaning from the text.

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2.1. Reading as discrete skills or one single skill

The reading skill can be defined as "a cognitive ability which a person is able to use when interacting with a text" (Urquhart and Weir, 1998: 88). For Paris et al. (1991: 611), reading "skills refer to information-processing techniques that are automatic, whether at the level of recognizing grapheme-phoneme correspondence or summarizing a story". Debate has gone over the years on whether reading is made up of a set of discrete skills that are separately identifiable or whether these skills relate to common underlying abilities, and thus they are indivisible. As a result, two viewpoints emerged; the first views reading as a single holistic process; whereas the second considers reading to be a multi-divisible skill.

The view that reading is a set of discrete skills is based on the assumption that if reading is a skill, then it must be possible to break it down into underlying components skills for the purpose of teaching and testing. Advocates of this view also hypothesize that students may exhibit differences in levels of proficiency across these skills. William and Moran (1989: 224) give an account on the current consensus among writers on teaching materials as follows: "While material writers might disagree on the emphasis to be devoted to any particular skill, there seems to be substantial agreement on such skills as guessing the meaning of unknown words, identifying anaphoric reference, identifying the main idea and inference". Likewise, Grabe (1991) may also be seen to represent this view. He emphasizes the importance of automaticity in reading, particularly in word identification, and identifies as components of the reading skill: syntactic knowledge, knowledge of formal discourse structure (formal schemata), content and background knowledge (content schemata), and metacognitive knowledge and skill. In opposition to the skills approach of reading, many researchers have cast doubt on the multi-divisible nature of reading and argued that it is not possible to differentiate between the reading skill components, either through empirical investigation or through expert judgements. Lunzer et al.'s (1979) empirical study is often cited as evidence that reading is a single undifferentiated ability. Here we can quote their conclusion: "One must reject the hypothesis that several tasks used in reading tests of reading comprehension call on distinct subskills which can differentially be assessed and taught" (p.59). This conclusion gained further support from Alderson and Lukmani (1989) and Alderson (1990).

However, the results of both hypotheses have been criticised on three grounds. Firstly, both groups of researchers proceeded by giving their subjects tests on their understanding of passages, yet doing a comprehension test and actually reading are not the same thing. In other words the link between the results of a comprehension test and the process of reading is indirect (Williams and Moran, 1989; Alderson, 1984). Secondly, advocates of the unitary view of reading conducted their studies on native speakers of English; however it may be that these subjects are free of the specific linguistic problems experienced by the non-native speakers. Thirdly, the levels of understanding that the learners have achieved and which advocates of the skills approach are trying to establish do not relate to the process of understanding but to the product. The latter, however, may vary according to readers and readers' purposes and motivation for reading (Alderson, 1984). Finally, despite the inconsistency of the evidence for the discreteness of the skills, the latter figures prominently in English as a Foreign Language (EFL) reading material. Nuttall's view is representative: "That is possible to promote reading skills and strategies ... is still largely a matter of faith, but the number of materials produced show that it is a faith widely held" (1985: 199). While sympathetic to the view of reading as a unified process, Brown and Hirst (1983) point out that the discrete skills approach is highly productive in that it provides many ideas for exercises. Furthermore, some specialists propose addressing the skills more directly rather than try to develop them indirectly through exercises. Thus Carrell, Pharis and Liberto (1989) have suggested that students receive explicit strategy training in order to improve their skills.

2.1. Reading strategies

Most definitions of strategy see it as a conscious response to local problems in a text. Urquhart and Weir (1998: 95) define strategies as "ways of getting round difficulties encountered while reading". For Carrell (1998), reading strategies include any of a wide array of tactics that readers use to engage and comprehend texts. With respect to the distinction between "skill" and "strategy", there is a fair amount of confusion and a considerable terminological inconsistency both in the in the reading literature and teaching material. Much of the research frequently fails to distinguish between strategies and skills. For example, "inferencing" is a skill for Davis (1968), but a strategy for Olshavsky (1977); skimming and scanning are referred to as strategies by Sarig (1987), while for Munby (1978), they are skills. On the other hand, some writers (Nuttall 1996; Grabe 1999) use skills/strategies as if the two were interchangeable, whereas for others (Paris, Wasik and Turner, 1991; Uquhart and Weir, 1998).

Skills are distinguished from strategies on three aspects: (i) Strategies are reader-oriented, skills are text-oriented; (ii) Strategies represent conscious decisions taken by the reader. They are selected deliberately to achieve particular goals. Skills are regarded as an acquired ability which has been automatised and applied to text largely subconsciously. Examples of such automaticity are lexical recognition and syntactic parsing; (iii) Strategies, unlike skills, are carried out in order to solve a problem, e.g. failure to understand a word or the significance of a proposition, failure to find the information one was looking for. Nevertheless, a reader's behaviour can change from involving a "skill" to a "strategy" and vice versa. In other words, when an emerging skill is used intentionally, it can become a strategy; whereas a strategy can go underground and become a skill. For example, for beginner readers, phonological encoding may be a strategy used in recognizing written words. However, a fluent reader who may possess the skill of rapid automatic word recognition may still resort to the strategy of phonological encoding when faced with an unfamiliar word (Williams and Moran, 1989). Indeed, according to Paris, et al. (1991: 611), strategies are more efficient and developmentally advanced when they are applied automatically as skills. Furthermore, the conscious and deliberate character of strategies makes them open to inspection and evaluation for their utility, effort and appropriateness.

3. Assessing reading

An assessment or test can be defined as a measurement to sample behaviour in that a teacher tests a limited sample and then generalizes from the results; however, an assessment of linguistic competence should not be regarded as a precise instrument like a ruler or scale that measures weight or length, because it is very difficult to measure competence accurately (Kilfoil and Van der Walt, 1997). Below, we will provide a description of the major aspects pertaining to the assessment of reading comprehension such as the setting of objectives, choosing the adequate content in terms of text type and familiarity with the content, the difficulty level of the text and skills and strategies to test.

3.1. Objectives: what skills and what strategies

The current consensus is that reading is an interactive process that is the product of complex information processing system involving both bottom-up and top-down processes. Within this view, reading can be broken down into underlying skills and strategies such as using context to guess meaning of unfamiliar word, identifying main ideas, locating specific information and understanding relations between parts of the text.

3.2. Content of the test: types of texts

In selecting texts, various factors have to be taken into account to determine their suitability for testing the targeted skills and strategies. These factors involve topic familiarity, language difficulty, channel of presentation and the skills and strategies we want to test. The *familiarity* of the text can be established through survey, and texts at the extremes of a familiarity continuum should be avoided (Khalifa, 1997). In general, a text should not be so unfamiliar that it cannot be mapped onto the reader's existing schemata. Rather, it should be "sufficiently familiar to candidates so that candidates of a requisite level of ability have sufficient existing schemata to enable them to deploy appropriate skills and strategies to understand the text" (Khalifa, *ibid*: 143). The *difficulty level of the text* is largely determined by its linguistic, organizational, propositional and discoursal features. It is also determined by such individual variation as background knowledge and purpose of reading (Urquhart and Weir, 1998). The best guide to the types of texts that might be selected and that could be based on *a priori* needs analysis is perhaps texts that test-takers will have to process in the target situation. Concerning the *channel of presentation*, test developers need to decide on the nature and amount of non-verbal information such as charts, tables and diagrams which most science texts consist of. The *skills and strategies* we want to test will also influence text selection. For example, if we aim at testing reading carefully for main ideas comprehension, problem/solution, causative or comparison texts from journals or textbook would be more appropriate than more descriptive texts with detailed information. On the other hand, in careful reading, the text may not necessarily have explicit main ideas comprehension for selection in which case the reader might have to construct them through propositional inferencing, whereas in skimming and search reading the main ideas should be clearly stated (Urquhart and Weir, 1998).

3.3. Form of the test

It is noteworthy that there is no one "best method" for testing reading. Because of the varied purposes a test might have, no single method can fulfill all of them. Certain methods are more widely used than others merely for reasons of convenience and efficiency. However, no approach to the measurement of the construct of reading is without its advantages and disadvantages (Johnston, 1983). The most common technique for assessing reading which dominated textbooks for teaching reading include multiple-choice items, matching, gap filling, information transfer, and the summary test.

4. Methodology

4.1. Purpose of the study

The current study seeks to answer the following questions:

1. What are the factors which underlie the students' reading performance? and
2. What test tasks have a bearing on their reading achievement?

4.2. Materials

A reading comprehension test, developed by the researcher, was administered to students.

4.3. Participants

The test was administered to a hundred and twenty one Algerian university students majoring in Microbiology, but due to a large number of absentees (23) during the second sitting of the test which took place a week later (the test was scheduled in the students' regular English class), the results of 88 out 121 students were appropriate for analysis.

4.4. Description of the test:

The Reading passages

Given the variety of activities and test items, the test was divided into two parts with one reading passage for each part. Both texts were taken from specialized books. They are authentic in the sense that they are destined to a specialist readership. Thus, they exhibit as many salient features of the target situation texts for the population as possible; hence their form (syntactic and lexical features) has been kept intact. The texts fall within the expository type and involve definitions, descriptions, and classification. In addition, we have been careful to give self-contained texts which do not necessitate knowledge of the previous and subsequent parts in the book.

Skills and strategies

A number of skills and strategies on which there appears to be some consensus concerning their importance in academic reading are involved in the test; they include the ability to: locate specific details, identify main ideas, understand relationship between stated ideas, and understand academic vocabulary. Based on Urquhart and Weir (1998) matrix of reading types which distinguishes between 'local' reading and 'global' reading, we grouped the vocabulary subtests under the 'local' reading section and the comprehension subtests under 'global' reading section obtaining the following layout:

- Local-reading skills and strategies: They operate at the word level and involve understanding lexis and deducing meaning of lexical items as follows: Guessing words from text, determining word function, finding opposites, and finding synonyms. For the purpose of analysis, and because they are all related to vocabulary understanding, we will label the four above four tasks V1, V2, V3, and V4, respectively.
- Global-reading skills and strategies: They involve processing the text in order to establish an accurate comprehension as follows: Reading for main ideas, reading for details, information transfer (table completion, and figure completion), a multiple-choice exercise, a matching sentence halves exercise, and a gap-filling exercise. Similarly, for the purpose of analysis, and because they are all related to text comprehension, we will label the above seven tasks as C1, C2, C3, C4, C5, C6, and C7, respectively.

Test administration

Before administering the tests, the students were given several instructions as regards the sitting of the tests. They were reminded to work independently. The students were also briefed on how to answer the questions.

Approximately ten minutes were given to the students to go through the test paper and to raise any question pertaining to the tests.

Scoring

Although the test contains two parts, the scores were calculated globally (minimum 0/maximum 60) and for each individual question: 1 point for the correct response; 0 points for an incorrect response. The vocabulary items received 22 points (36.66%) out of the total score; whereas, the comprehension items received 38 points (63.34%) out of the total score. Each activity is allocated a mark according to the number of item that it contains. For example, activity one was attributed four marks because it contains four items, and activity three was attributed seven marks because it contained seven items.

5. Analysis of the results

Statistical analyses were conducted using the LISREL 88S Statistical Package (Karl G. Jöreskog and Dag Sörbom, 2006). The test results were analysed using both a descriptive and a multivariate statistical procedure. Descriptive statistics includes frequencies, percentages, means, standard error, coefficient of variation, and correlation between the test items. Multivariate statistics, on the other hand comprises a principal component analysis, and factor analysis.

5.1. Descriptive statistics

The table below shows the mean, standard deviation and coefficient of variation of the test main sections, namely 'local-reading' and 'global-reading' sections as follows:

Table 1: Mean Scores and SE, CV for 'Local' and 'Global' reading Strategies (N=88)

| Measure | M | SE | CV (%) |
|---------------------------|----------|-----------|---------------|
| Global Score /60 | 25.65 | 9.97 | 38.86 |
| Local Reading /22 | 8.55 | 4.79 | 56.02 |
| Global Reading /38 | 17.08 | 5.77 | 33.78 |

By comparing the mean scores of the two test section, we can see that the test-takers performed rather moderately both on global and local reading tasks. However, the coefficient of variation is higher for local reading which indicates that there was a higher variability in the distribution of scores (CV: 56.02%) with the vocabulary tasks than that of tasks related to comprehension (33.78%). A more detailed statistical analysis about the mean scores, standard error and coefficient of variation of all the subtests for the whole group will be reported in the following table.

Table 2: Mean (M) Scores, Standard Error (SE), and Coefficient of Variation (CV) for Test and Subtests of the whole Group (N=88)

| Measure | Global score /60 | V1 /04 | V2 /07 | V3 /04 | V4 /07 | C1 /04 | C2 /05 | C3 /05 | C4 /04 | C5 /08 | C6 /06 | C7 /06 |
|-----------|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| M | 25.65 | 01.88 | 02.93 | 02.28 | 01.48 | 02.62 | 02.02 | 03.19 | 01.42 | 04.14 | 01.97 | 01.69 |
| SE | 09.97 | 01.36 | 01.84 | 01.40 | 01.46 | 01.29 | 01.32 | 01.10 | 01.28 | 01.41 | 01.30 | 01.58 |
| CV | 38.8 | 72.3 | 62.7 | 61.4 | 98.6 | 49.4 | 65.3 | 34.4 | 90.1 | 34 | 65.9 | 93.4 |

To start with, we can notice that the total group mean score is 25 which indicates that the test-takers' comprehension level is low. This low level is reflected in the mean scores of the individual tasks where we have weak mean scores for seven out eleven tasks. On the other hand, there is a large dispersion in the scores with the coefficient of variation values scattering widely especially with V4 (finding synonyms), 98.6%; C7 (gap-filling), 93.4%, and C4 (figure completion), 90%. However, the variables that are tightly clustered involve C5 (multiple-choice questions), 34%, and C3 (finding opposites), 34.4%.

5.2. Multivariate statistics

A Principal Component Analysis was conducted in order to examine the factor structure and internal consistency of the reading test. Overall, the indicators clustered highly on each factor with 11 indicators corresponding to 11 underlying factors in the test. As a criterion for retention, we selected the components whose eigenvalue is greater than 1.0. This criterion allows us to be fairly sure that the factor will account for the variance of at least one of the variables used in the analysis and that every one of them reasonably contributes to the measurement of the whole test. Since the first 3 factors were the only ones with eigenvalues ≥ 1 , the final solution will represent 65.90% of the variance in the data. Thus, we can say that this solution will explain 65.90% of the variance in these 11 variables. The last eight factors, having a weak contribution in the interpretation of the data have not been tackled. The tables below display the above information.

Table 3: Factors with Eigen values larger than 1

| Component | Eigenvalue | % of Variance | Cumulative % |
|-----------|------------|---------------|--------------|
| 1 | 5.08 | 46.21 | 46.21 |
| 2 | 1.13 | 10.23 | 56.44 |
| 3 | 1.04 | 9.46 | 65.90 |

The loadings of each subtest on the 4 factors are shown in Table.

Table 4: Factors loadings for each variable

| Variables | V1 | V2 | V3 | V4 | C1 | C2 | C3 | C4 | C5 | C6 | C7 |
|-----------|-------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|
| 1 | 0.351 | 0.285 | 0.311 | 0.388 | | | | 0.328 | | | 0.354 |
| 2 | | | | | | | | | | 0.738 | |
| 3 | | | | | 0.540 | 0.339 | -0.359 | | 0.381 | | |

Extraction Method: Principal Component Analysis.

The *factor loadings*, listed above" represent the correlations between factors (what the set of variables represent) and the variables themselves. These values range from -1.0 to +1.0 (like Pearson's *r*). The first factor extracted accounts for 46.21% of variance and receives its highest loading from V4 (lambda 0.388), the second highest from C7 (lambda 0.354), and V1 (lambda 0.351), followed by V3 (lambda 0.311) C4 (lambda 0.328). Of the five strongest loaders on this factor, three (V1, V3, and V4) are vocabulary skills, and two (C4, and C7) are comprehension skills. Figure completion (C4) and gap-filling (C7) although they test the understanding of the overall meaning of the text, they are word-based. Hence they can be said to overlap with 'local' reading section of the test in the sense that they load heavily on lexical knowledge on the part of the test-takers. The commonalities between them and vocabulary (V1, V2, V3, and V4) subtests help to explain that they are testing more or less the same trait; that is '*lexical knowledge*'. Meanwhile, the second factor account for 10.23% of variance. The strongest loader on factor 2: C6 (lambda 0.738) appears to represent what we will call '*coherency*'; that is the logical, orderly and consistent relation of parts. The third factor accounts for 9% of the variance and appears to represent '*comprehension*' dimension. The following items loaded highly (lambda>.30), C1 (lambda.540), C5 (lambda. .381), C3 (lambda .359), and C2 (lambda .339).

In summary, the factors for the test in order of variance were: (1) lexical knowledge (eigenvalue = 5.08, variance explained = 46%), (2) coherency (eigenvalue = 1.13, variance explained = 10%), and (3) comprehension (eigenvalue = 1.04, variance explained = 9%). The table below indicates the correlations between the three factors.

Table 5: Factor Correlations

| | Lexical Knowledge | Coherency | Comprehension |
|-------------------|-------------------|-----------|---------------|
| Lexical Knowledge | 1.000 | | |
| Coherency | 0.594 | 1.000 | |
| Comprehension | 0.674 | 0.549 | 1.000 |

All the factors are significantly intercorrelated: 'lexical knowledge' and 'coherency', 'lexical knowledge' and 'comprehension', 'coherency' and comprehension. Foremost in these pairwise relationships are 'lexical knowledge' and 'comprehension', which indicates a strong association between vocabulary and comprehension.

6. Discussion of the results of the test

(1) What are the factors which underlie the readers' reading performance?

The findings indicate that there are three factors which underlie adequate understanding of texts: (i) lexical knowledge, (ii) coherency, and (iii) comprehension. It also revealed a significant correlation between the different factors, especially between 'lexical knowledge' and 'comprehension'. They are the main determinants of reading ability. Factor analysis revealed that 46.21% of the variance is accounted for by the lexical knowledge dimension. Lexical knowledge, then, appears to be a prerequisite for comprehending text. Laufer (1989) found that the lexical

“threshold level” is 95%; that is if the student understands less than 95% of the text lexis, his/her comprehension of the text will be unsatisfactory. The other key part of this ongoing reading comprehension as shown by the results of factor analysis, that is the coherency dimension, which loaded heavily on the ‘matching sentence halves’ activity requires a variety of skills in order to maintain a consistent standard of coherence. These skills involves skimming through the sentence halves to have a general idea; then reading carefully before sequencing segments of text, thinking about which sentence half might come where and predicting next events. In addition, the development of ideas can be seen in different lexical and grammatical relations inside and between sentences. Therefore, careful attention should also be paid to both lexical words and phrases, and grammatical structures that may indicate such relations in the paragraph. The third factor accounted for in this analysis which is the comprehension dimension requires the reader to apply higher-level comprehension skills and strategies that are strategic; for example, using background knowledge, monitoring comprehension, questioning, and making inferences. Thus the three factors appear to complete each other.

(2) What test tasks have a bearing on the reading achievement of the test-takers?

A comparison of the mean scores of the test’s main sections revealed that the test-takers performed moderately on the ‘global’ reading as well as on ‘local’ reading skills and strategies, but performance is even lower with local reading skills. This suggests that the lexical knowledge is tightly related with comprehension skills and strategies. Interest in the connection between vocabulary knowledge and successful reading has a long history in the research of foreign language reading. If we accept comprehension as the goal of reading, vocabulary knowledge is the foundation of reading proficiency and fluent reading (Daneman 1991; Stanovich 1991). In order for reading to be successful, then, the learners must have a solid lexical knowledge in place, must process word rapidly and automatically and approach new words strategically to learn content matter. Furthermore, a comparison between the coefficients of variation of the two test sections indicated a higher variability in the distribution of scores with the vocabulary activities than that related to comprehension subtests. The difference between the coefficients of variation for the above sections (56.02% and 33.78%, respectively) shows the fact that the subjects have performed rather more homogeneously in the latter than in the former.

7. Some pedagogical implications

To meet the requirements dictated by the specific instructional setting of our subjects, namely an ESP situation, and taking into account the problem stated in the introduction, that is the graduates’ low-level reading proficiency in English that fails to meet the requirement of their academic needs, an adapted instructional approach should be developed in order to help the learners, especially the less-competent ones, improve their reading performance. The results of the study enable us to suggest some operational guidelines; they involve two major suggestions: the importance of strategic reading instruction and the importance of vocabulary teaching.

7.1. Strategic reading instruction

Research on strategy training revealed that reading strategies can be explicitly taught. Such training should be integrated into courses in order to help students monitor their reading processes and improve their reading comprehension. Strategic reading programme should be based on the examination of a number of variables including: (i) existing use of strategies prior to instruction, (ii) levels of English proficiency, (iii) age of learners, (iv) L1 background, (v) quality of pre-test post-test measures, and (vi) the length instruction (total hours per treatment and total time of overall instruction). Phakiti (2006). Several models of strategic reading instruction which have been developed to meet the learners’ specific pedagogical needs exist in the literature. The most widely used models include: Reciprocal Teaching Approach (RTA) (Palincsar and Brown 1984), Experience-Text Relationship (ETR) (Au 1979), Transactional Strategy Instruction (TSI) (Pressley and Wharton Mc Donald 1997), and Cognitive Academic Language Learning Approach (CALLA) (Chamot and O’Malley1994). In order to create variety in their class, enhance students’ motivation and promote successful comprehension of texts, we recommend that such models be introduced in classrooms.

7.2. Vocabulary instruction

The results of the study enable us to suggest the need for multiple ways both for acquiring new vocabulary and handling unfamiliar words in the text to achieve comprehension. Research on vocabulary instruction found that there is no one best method for vocabulary instruction (The National Reading Panel, 2000). In other word, no one

single instructional method is sufficient for optimal vocabulary learning. Vocabulary instruction experts all recommend a multi-component approach and a variety of methods to help students acquire new words and increase the depth of their word knowledge over time. Effective instruction includes opportunities for both incidental (indirect) word learning and intentional (direct) word teaching. McNeil (1987:123) emphasizes on the 'active processing of new vocabulary so that vocabulary development enhances reading comprehension not just word knowledge. Furthermore, classroom approaches for developing word recognition skills and coping with the vocabulary load of the texts may involve the utilization of a number of strategies such as using a dictionary, guessing the meaning of the unknown word, or choosing to disregard the unknown words if they do not cause breakdown in text comprehension. This kind of explicit vocabulary instruction can help students learn enough words to become better readers. Last but not least, vocabulary instruction should be accommodated to the variety of learning styles among second language learners (Anderson, 1994). According to him, 'all students do not learn vocabulary in the same way, nor do all vocabulary words lend themselves to one method of acquisition...Methods should be varied and combined according to the learner's individual needs and preferences' (p.181).

8. Conclusion

Learning/teaching English for Specific Purposes, and particularly developing the reading skill is likely to be a long and an ongoing process; one in which the teacher, aware of the multiplicity of learner identities, makes the necessary changes to suit the students' interests and needs, even when the course is in progress.

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