



Concordia Working Papers
in Applied Linguistics

Proceedings of the International Symposium on the Acquisition of Second Language Speech
Concordia Working Papers in Applied Linguistics, 5, 2014 © 2014 COPAL

Stress in English: Prosodic and Rhythmic Complexity for Arab Learners

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Abstract

This paper investigates the problems native speakers of Arabic, particularly Egyptian Arabic (EA henceforth), face in learning two-to-five syllable words, regarding stress assignment, with special focus on compound words in English. The study identifies a continuum or a hierarchy of the difficulties that Egyptian Arab learners face in deciding the place of stress, with the aim of suggesting some corrective steps for avoiding these difficulties in the future and hence help the improvement of students' performance in this field and enhance the process of learning. The study is based on four tests. The first two tests, one written test and one audio-recorded, are initial tests at the beginning of the academic term. The second two tests are at the end of the term. The students are divided into three groups in order to allow the researcher to see the differences between students with different degrees of instruction. The findings indicate, among other points, that word-length is associated with low performance of students. While, in compound words which consist only of two syllables, the phonological structures of stressed syllables which are different from that of EA are among the main reasons for incorrect stress placement on the part of the students.

Arab Learners of English as a second Language face various difficulties that hinder their acquisition of English. They are unable to perceive L2 differences that are not made in their L1 and consequently are "unable to produce them" (Major, 2008, p. 75). Among these difficulties is the prosodic and rhythmic complexity of English language, particularly stress assignment in English words. Much attention has been given to segmental contrasts in recent L2 literature (Eckman et al., 2003; Strange, 1995). While, little is said about L2 English stress.

Similarity and contrast in the supersegmentals of Arabic and English are highlighted in the literature (Aziz, 1980; Fledge & Port 1981; Heleil, 1972, 1976; Moray & Snider, 1969; Mitchell, 1960; Sheik Ibrahim, 1986), all these studies, including many others not cited; here assert the predictability of the occurrence of errors in the performance of Arab students as a foreign or second language. However, the concentration on these studies is on the predictability of errors by Arab students rather than the types of errors produced by Arab students, reasons of occurrences, level of significance and hierarchy of difficulty. It is argued that "[e]mpirical studies in this realm are scanty and sketchy" (Ghaith, 1993, p. 382). From, here emerge the importance of this study that shows the actual occurrence of errors in the English supersegmentals on word-level stress, their types (types of errors produced by EA students), level of significance and hierarchy of difficulty, with the aim of suggesting some corrective steps for avoiding the occurrence of those errors in the future. The study is specifically concerned with the assignment of primary stress at the word level by Egyptian Arabic students.

DEFINITION OF STRESS, ITS CORRELATES, AND ITS NATURE IN ENGLISH

The definition of stress is "rather difficult" (Hogg & McCully, 1987, p. 1) Although for the speaker stress has one distinct physical correlate, that is a stressed syllable occurs when the speaker pushes more air out from his/her lungs, of course in comparison with the amount of air pushed out for the pronunciation of the unstressed adjacent syllable, for the hearer this process can have any one of the three results, or some combination of the three. The hearer can hear any one or all of the following: (1) an increase in the pitch, (2) an increase in loudness, (3) an increase in vowel length. This means that stress is associated with only one process that is an increase in the respiratory activity on the part of the speaker which causes an increase in any one or all of the above mentioned parameters. The correlation between these parameters is quite patent in the sense that

they are dependent on each other; consequently, stress cannot be attributed to one single parameter (Roach, 2000; Flege & Bohn, 1989). Furthermore, cross-linguistically, these parameters are not equally important. Whereas, loudness and duration serve subsidiary function relative to pitch prominence in English, they may not be less important in Arabic. In addition, each one of these can be affected by other factors which have nonlinguistic nature; therefore, the position of defining stress is complex. Despite all these problems associated with the definition of stress, there is no real difficulty in the claim that "stress is an isolable phonological phenomenon", because the hearers are able to, relatively simply, pick out the patterns of stress, in addition to, the existence of definable physical and acoustic correlates of stress. Stress is "a suprasegmental phenomenon", a property of a string of segments not of an individual segment (Hogg & McCully, 1987, p. 2).

In English, every word has a definite place for the stress, and there is no simple way of knowing which syllable must be stressed. This nature of English language was emphasized by Gimson (1980, p. 221):

[T]he accentual pattern of English words is *fixed*, in the sense that the main accent always falls on a particular syllable of any given word, but free in the sense that the main accent is not tied to any particular situation in the chain of syllables constituting a word.

English is a stress-timed language which has a "variable word stress" (Ladefoged, 1982, p. 224). The placing of stress in English is unpredictable¹. Therefore, all good dictionaries indicate the place of stress in each word.

INCORRECT STRESS PLACEMENT: STATEMENT OF THE PROBLEM

It is easy for Arab learners to predict the placement of stress within Arabic words, that is due to the fact that word stress in Arabic is "predictable and therefore non-phonemic" (Mitchell, 1960; Larudee, 1973; among others). The fact that word stress is predictable leads to the negligence of the notion of teaching stress altogether in the Arabic language classes, consequently, native speakers of Arabic do not know the meaning of the

¹ The placement of stress in English is not entirely unpredictable – see Davenport & Hannahs (2010, pp. 78-84). However, the predictors of stress are complex, so for the L2 learners, English stress is practically unpredictable.

term. In addition, no attention is given to the topic of stress in Arabic languages studies. Mitchell (1960, p. 368) was "understandably puzzled by the failure of the Arab grammarians to mention the subject of accentuation [stress]". Additionally, the (1) unpredictable nature of stress in English and (2) the phonemic value that English word stress has hinder the acquisition of English stress patterns as they reflect distinguish differences between the two languages."[A]lthough English and Arabic are both strongly-stressed languages, they show marked differences with regard to the place and function of stress" (Aziz, 1980, p. 104-5).

ASSIGNING STRESS TO COMPOUND WORDS: SOURCES OF DIFFICULTY

English has some inconsistencies in the way it treats compounds, in terms of writing them and in terms of pronunciation and particularly stress placement. This represents a great source of difficulty for Arabic-speaking learners. The confusion is increased by the way so-called compound words are written and pronounced. "Sometimes with a hyphen, sometimes without, sometimes as one word, sometimes as two, for example, 'no one' or 'no-one', 'teapot' or 'tea-pot', 'trademark' or 'trade mark'" (Taylor, 1991, p. 68). What is more, we may find words that are written in all three possible ways, for example: *egg cup*, *eggcup*, or *egg-cup*, likewise *audio visual*, *audio-visual*, *audiovisual*. The problem is the fact that the pronunciation is not reflected in the spelling. What is reflected is the variability of writing which in turn increases the confusion for the learners. All these different ways of writing is reflected in pronunciation particularly the place of stress within the compound words. The variability of writing represents the variability of pronunciation.

Some compound words have a single stress while others have so-called double stress; there are also more elaborate compounds which may have several stresses. Therefore, the variability both in writing and in pronunciation is the primary cause of severe problems for the Arab learner or for the non-native speaker of English generally. In addition to this, the learner is not able to distinguish between two words which happen to occur together and a compound word because there is no clear dividing line between them, "there is no clear dividing line between two-word compounds and pairs of words that simply happen to occur together quite frequently" (Roach, 2000, p. 83). Even if the learner is able to distinguish a compound word from two words in sequence, there is no indication of how a compound word should be stressed. "It is notoriously

difficult to know how to stress English compound words" because it is not easy to define "what a compound word is" (Taylor, 1991, p. 67).

The confusion between phrases versus compounds can be resolved by the use of metrical phonology. It is one single parameter which is responsible for stress in both phrases and compounds. The difference between the phrase *time flies* and the compound word *time-flies* is that in *time flies* the initial metrical structure of each component word only consists of one baseline asterisk and the application of End Stress to the collocation in its right-most setting leads to the projection of the last baseline asterisks directly above *flies*, as Roca & Johnson (1999, p. 322) argued, "the resulting grid appropriately expresses the fact that *flies* has greater prominence than *time*". Therefore, phrasal stress can be assigned to the collocation by applying End Stress in its right-most setting as follows:

- (1)
- | | | | | | |
|-------------------------|---|---|---|---|---------------|
| | | | | X | Stress line 1 |
| X | X | X | X | X | Baseline |
| Time flies → Time flies | | | | | |
| End Stress [Right] | | | | | |

On the contrary, the stress in the compound *time-flies* is on *time*. So, the word *time* has greater prominence than *flies*. How this output is reached at? The same procedure for phrases will be applied to compound. This procedure is consistent with the right-most setting of End Stress. But the main point is the application of extrametricality. The general statement of extrametricality as Roca & Johnson (1999, p. 323) presented it to the learners:

Make the right –most /left-most asterisk extrametrical
(notationally: * → <*>).

To obtain the correct placement of stress in compound words, extrametricality should be applied before End Stress as in (2):

- (2)
- | | | | | |
|-------------------------|---|---|-----|----------|
| X | X | X | <X> | Baseline |
| Time-flies → Time-flies | | | | |
| Extrametricality | | | | |

- (3)
- | | | | | |
|--------------------|-----|------------|---|---------------|
| | | X | | Stress line 1 |
| X | <X> | | X | <X> Baseline |
| Time-flies | → | Time-flies | | |
| End Stress [Right] | | | | |

Extrametricality "is only relevant to compound structures", phrases and sentences do not allow it in English (Roca & Johnson, 1999, p. 324). To conclude, it is with metrical phonology that we are able to distinguish between phrases and compounds in terms of stress. As explained, it is the parameter "right" for End Stress which is responsible for the allotment of stress in both phrases and compounds. In compounds, we need to apply extrametricality before end stress. Applying extrametricality allows us to retain the setting "right" for End stress throughout English.

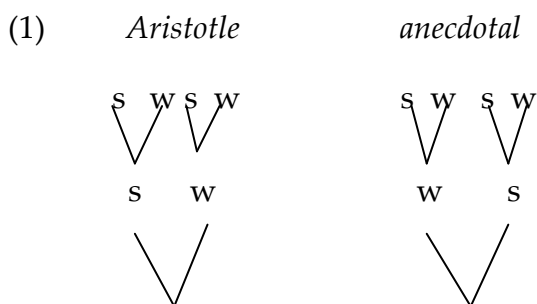
METRICAL PHONOLOGY

Metrical phonology deals with stress in the word and in the phrase. Lieberman (1975) first proposed the theory in his doctoral dissertation, then it was further developed by Liberman and Prince (1977), Halle & Vergnaud (1978), and Hayes (1981, 1984, 1995), among others. Metrical phonology is a non-linear approach to stress in which the properties of stress reflect a hierarchical rhythmic structuring that organizes the syllables, words, and syntactic phrases of a sentence. So, stress is viewed as "the linguistic manifestation of rhythmic structure, and that the special phonological properties of stress can be explained on this basis" (Hayes, 1995, p. 1). The secondary stress of a language (if it has one) can moreover be determined "by a rhythmic principle which creates an alternation of stressed and unstressed syllables" (Watson, 2002, p. 84). Metrical trees and metrical grids are the formal representation of meter. The following six points summaries the main features of the metrical stress theory (Hayes, 1995, p. 1-2):

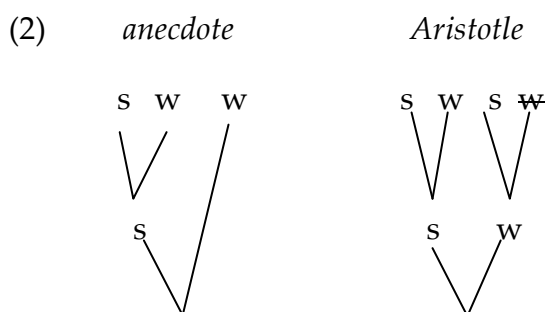
- 1) A bracketed grid is the formal representation of metrical structure.
- 2) The foot is the smallest metrical unit.
- 3) The Iambic/Trochaic Law is a principle which represents the basis of the foot inventory.
- 4) Metrical structure creation is non-exhaustive.
- 5) Many stress languages impose a ban on 'degenerate' feet.
- 6) Syllable weight is not a unitary phenomenon; instead, languages distinguish between syllable quantity and syllable prominence.

EXTRAMETRICALITY

Extrametrality is regarded as a notion of metrical theory. It was introduced by Liberman and Prince's 1977 article "as a means of handling the deviant stress patterns of words like 'allegory, 'alligator, and 'Aristotle' " (Hayes, 1982, p. 227). These words are exceptional because they have branching constituents on the right that are labeled weak. The word *anecdotal* has a regular pattern in comparison with the exceptional word Aristotle:



Liberman and Prince (1977) suggested that "if certain cases of word-final -y, -r, and -l are extrametrical, then word trees in which they appear can be labeled by the normal rule for nouns, which makes final nonbranching constituents weak" (Hayes, 1982, p. 227). In this case, Aristotle would be labeled in the same way as anecdote:



While the idea of general rules of extrametricality was first proposed by Hayes (1979), extrametricality is regarded as a principle in metrical phonology which "allows certain ELEMENTS in a given string not to count when assigning metrical structure" (Crystal, 2008, p. 182). It must be noted, here, that the rules of extrametricality are not applied blindly to all forms, but there are some restrictions which govern the process of extrametricality. These, (Hayes, 1995, p. 57), are constituency,

peripherality, edge markedness, and nonexhaustivity. So, extrametricality, which is restricted to peripheral elements, enables the analysis to avoid foot types which are rare or unknown at word edges, to mark exceptions to stress rules and to deal with the stresslessness of peripheral syllables. The extrametrical rule ignores a particular prosodic constituent as if it were not there. Explaining the function of the extrametrical rule, Hayes (1995, p. 57) stated that it "designates a particular prosodic constituent as invisible for purpose of rule application: the rules analyze the form as if the extrametrical entity were not there". For example, the syllable is called "extrametrical" if it is ignored by the stress rules of metrical theory of stress; that is, "treated as if it were not there" (Hayes, 1982, p. 227).

PARAMETRIC METRICAL THEORY

A notion which has been crucial to metrical studies of word-level stress is "the idea of parametrizing the theory" (Hayes, 1995, p. 54). In a parametric theory, a rule system is considered as "a particular choice from a limited list of option or parameters" (Hayes, 1995, p. 54). The term Parameter-setting is used in determining the parametric values for a given language. The overall approach is referred to as Principles and parameters theory (PPT) of universal grammar. Principles and parameters (P&P) as a theory was largely formulated by the linguist Noam Chomsky. Hayes (1995, p. 55) stated that there is a problem within parametric metrical theory, that is "to what extent the parameters characterize rules versus grammar". Hayes conservatively assumed that "parameters characterize rules" (1995, p. 55). However, he agreed with Halle and Vergnaud (1987) who argued that parameters have more general scope than rules. Hayes (1995, p. 55) gave an example in support of the position that parameters have more general scope than rules, and states that "when more than one rule creates feet, the feet created should be the same. This in general appears to be true".

There are some criteria which govern the success of the parametric theory. These are: (1) to what extent it is well defined (2) it is maximally restrictive, and (3) it is capable of describing all the stress systems of the world's languages. The latter criterion is regarded, by Hayes (1995, p. 55), "the most difficult [one], as the stress systems of many languages are remarkably complex"; therefore, a theory which reduces such complexity to a small set of general principles is a substantial result". In addition, it may help "account for the ease with which children acquire complex stress

systems, in that a system can be learned by setting the parameters one by one" (Hayes, 1995, p. 55).

Dresher and Kaye (1990) (DK, henceforth) mainly relied on metrical theory as the basis for their study which aimed at parametrizing metrical theory for the sake of learning. DK (1990, p. 139) stated the reason for selecting metrical stress theory; "[it has] characteristics that make it a possible candidate for a theory of UG". Following this logic, Parameterized metrical stress theory can serve as the basis of an explicit learning theory. It is a model which deals with a complex system of stress and can help in showing how learners can acquire stress of a language by setting the parameters one by one.

Metrical Parameters

Metrical parameters are intended to capture the hierarchical nature of stress. They are a group of settings that characterize a particular part of the phonological system which is mainly related to stress. DK (1990) outlined a number of universal parameters for metrical construction in labelled trees where various possibilities are expressed in terms of a series of binary parameters. Those parameters are unmarked or open but they are set for each language according to its specific characteristics.

Table 1 below shows the metrical parameters settings, as given by Youssef & Mazurkewich (1998, p. 308), for EA and English.

Table 1. Metrical Parameters Settings for EA and English

	EA	English
P1: The word-tree is strong on the	[Right]	[Right]
P2: Feet are	[Binary]	[Binary]
P3: Feet are built from the	[Left]	[Right]
P4: Feet are strong on the	[Left]	[Left]
P5: Feet are quantity sensitive (QS)	[Yes]	[Yes]
P6: Feet are QS to the	[Rime]	[Rime]
P8A: There is an extrametrical syllable	[No]	[Yes]
P8B: There is an extrametrical segment	[Yes]	[No]
P8: The extrametrical element on the	[Right]	[Right]

There are three differences between EA and English. In parameter 3 the default setting for the direction of the foot is from left to right as in EA. While it is from right to left in English so English has the marked setting for this parameter. Therefore, the expectation is that EA students will have difficulty in resetting this parameter to its marked value in English. As for

parameters 8A and 8B, the difference between the two languages is that in EA, the extrametrical element is a segment while in English it is a whole syllable. If extrametricality of syllables is taken into consideration alone, one finds that EA "has the default setting in contrast to English, which has a marked setting for this value" (Youssef & Mazurkewich, 1998, p. 308). Therefore, the prediction is that EA students will have a difficulty in resetting this parameter to its marked value in L2.

STRESS PLACEMENT

Stress Placement Rules in Egyptian Arabic (EA)

Word-stress patterns in EA have received a great deal of attention in recent years because of the central role they have played in the development of metrical phonology. Mitchell (1960) discovered the basic word stress pattern, while the description of EA stress rules was first formulated by McCarthy (1979) and then reported in Halle & Vergnaud (1987), Hayes (1995) and also Watson (2002). The basic facts are as follows:

- 1) Stress falls on the last syllable, if it is superheavy (CVCC or CVVC).
 darabt (CVCC) (I/you beat)
 sakakiin (CVVC) (knives)
- 2) Otherwise, stress falls on the penult, if it is heavy:
 be:tak (your (m.sg) house)
- 3) Otherwise, stress is on the antepenult or the penult, whichever is separated by an even number of syllables from the immediately preceding heavy syllable if there is one, or from the beginning of the word if there is no preceding heavy syllable, where zero is counted as even (Hall & Vergnaud, 1987, p. 61):
 katabitu (she wrote it)
 muxtalifa (different) (adj. fem. Sg.)

To conclude, stress placement in EA is a function of the internal structure of the syllable, its weight, and the position of that syllable relative to other syllables in the word.

Factors Which Govern the Position of Stress in English

- 1) The grammatical category of the word (whether the word is noun, verb, adjective, adverb, etc)

- 2) The morphological structure of the word (whether it is complex, compound or simple word. i.e., whether it is suffixed or not)
- 3) The phonological structure of the syllables of the word.
- 4) The number of the syllables in the word.

There are a number of proposals in literature which account for stress assignment in English. Roach (2000), Davenport & Hannahs (2010) stated these rules in a simple way which is suitable for the foreign learners. Goldsmith (1990) explained that in the English verb, we assign stress to (a) final syllable with long vowels, (b) a final cluster of two consonants, or (c) penultimate syllables otherwise (Chomsky & Halle 1968, p. 69 cited in Youssef & Mazurkewich, 1998, p. 309) as explained below: Stress placement in English interacts with different kinds of information.

A	B	C
engine <u>er</u>	coll <u>ap</u> se	ast <u>on</u> ish
Volun <u>teer</u>	torm <u>en</u> t	<u>ed</u> it

The final syllable is stressed in categories A and B because "the long nuclear vowels or consonant clusters in the final syllable attract main stress" Chomsky & Halle (1968) (as cited in Youssef & Mazurkewich 1998, p. 309). As for verbs in (c) the stress falls on the penultimate because the final syllable does not attract main stress (Youssef & Mazurkewich 1998, p. 309). It must be noted here that verbs and unsuffixed adjectives follow the same stress rules. As for nouns, stress depends on the nature of the rhyme of the penultimate syllable. For the majority of English nouns of more than two syllables, if the penultimate syllable is heavy it takes stress, while if it is light, stress is placed on the antpenult syllable even if that syllable is light for example, e.le.phant. Heavy syllables are syllables in which the rhyme consists of long vowels, diphthongs or coda, while syllables with rhyme consisting only of short vowel are known as light (Davenport & Hannahs 2010, p. 82). In two syllable nouns, the penultimate syllable typically takes stress even if it is light. As for adjectives, stress depends, to some extent, on whether they are suffixed or not. The suffix in adjectives is divided into three types: stress taking suffixes, stress shifting suffixes, or suffixes which do not affect the place of stress (neutral).

METHODOLOGY

The Tests

The study relies on four tests. The first two tests, one written test and one audio-recorded, are initial tests at the beginning of the academic term. They are referred to as pre-tests. There are two pre-tests: one written and one audio-recorded. The second two tests are at the end of the term. Those tests are referred to as the post-tests as the students took them after they receive some explicit teaching on English stress rules on word level. In the study, there are two post tests: one written and one audio-recorded. For the written tests, the students are given a sheet of paper with polysyllabic words which are given as a word list with blank space after each word, in order to allow the students to transcribe the words and allocate stress appropriately using the IPA system. The students are informed that the tests are part of their term exam. These tests are part of a course entitled English Phonetics and Phonology. They are asked to follow the instructions and transcribe the test-items, including allocating primary stress where applicable. For the audio-recorded test, the students are given a sheet of paper on which the words are written and they are asked to look at the words and pronounce them with especial focus on pronouncing the syllables carrying primary stress.

The Students

The students involved in the study are the top 15 senior students in the English department of the Faculty of Education, Zagazig University, Egypt. The criteria used in selecting the students depend mainly on their marks in all courses and particularly on courses of phonetics and phonology during the previous years of their study. Their native language is Egyptian Arabic. They are divided into three groups to allow the researcher to see the differences between students receiving different degrees of instruction. So, there are three groups in the study. Each group consists of five students. The transcriptions provided by the students follow the IPA system. This is the system generally followed by British dictionaries. The IPA system of transcription is the system in which the students receive their education in courses of phonetics at the University, in which all of the subjects have participated; therefore, they are acquainted with this system and its phonetic symbols and diacritics. The 15 students provide 89 transcriptions each. This gives 1335 transcriptions

for the pre and post tests as well as the same for the audio-recorded test. So this gives a total corpus of 2670 for both of the pre and the post tests. The same words are used in the pre and post tests in order to allow the researcher to measure the performance of the students in specific words and to see whether the students are able to acquire the stress parameters of English or not.

Metrical Stress Pattern of Test Items

The words used in the testing represent either a match or a mismatch of the metrical parameters settings and stress placement rules for EA and English. Words which represent a match with EA stress placement rules can be divided into three kinds of matches incorporated into groups entitled: 1 match, 2 match, and 3 match. Also, words which represent a mismatch with EA stress placement rules can be divided into three kinds of mismatches which are also incorporated into three groups entitled: 1 mismatch, 2 mismatch, and 3 mismatch.² What distinguish each group or category from the other are the stress pattern of the words as well as the phonological structure of the syllables of the words. The focus is on the phonological structure of the last three syllables, these are the final syllable of the word, the penultimate, and the antepenultimate syllable. The reason for the concentration on the last three syllables is that in EA the stress falls on one of the three last syllables within the word ultimate, penultimate, and antepenultimate (Langendoen, 1968, p. 102).

The compound words used in test represent a mismatch of the metrical parameter settings and stress placement rules in EA. Each word consists of two syllables, in which stress falls on the first element due to extrametricality of the last syllable. Recall that in English nouns the last syllable is invisible to stress rules, therefore stress falls on the first element even if the last syllable is heavy. All compound words used in the test, however, take penultimate stress in English. In EA, on the other hand, the final syllable in most of these words would have either a long vowel (*soundproof, blackboard, broadcast*), or diphthong (*armchair, suitcase, handout, greenhouse*) and would therefore receive final stress as words of EA, because they would correspond to stress placement rules in EA which places stress on the final superheavy syllable.

² The representation of metrical stress patterns of words used in the tests, whether the word represents a match or mismatch with the metrical parameter settings and stress placement rules in EA, is provided beside each word in the hierarchies of difficulties, see appendix A for details.

Expectation of Students' Performance in Pre-tests

The performance of students is expected to be low in all polysyllabic words which represent mismatch in all types of pre-tests whether written or audio-recorded. As there is no extrametricality of final syllable in EA, so the expectation of the performance of students, in compound words, is that they will ignore this feature of English, i.e. extrametricality of the last syllable. Instead, their performance is expected to correspond to the unmarked value for the extrametricality parameter which states that the nonexistence of an extrametrical syllable is the default value for the universal metrical parameters. All of the words are compound words which consist of two syllables in which in English stress falls on the first element. In all of them, the stress goes on the penultimate syllable irrespective of its weight.

The crucial question here is this: is there any significant improvement between the pre –test and the post test? If the answer is yes, and there is some kind of improvement in the performance of the students in the post tests, whether written or audio-recorded, this means that the students are able to acquire the metrical parameter settings and the stress placement rules for English compound words. In other words, the students are able to re-set the stress parameter of UG appropriately for L2. They are able to acquire L2 stress parameters.

RESULTS AND DATA ANALYSIS

Overall Performance

Polysyllabic Words

The polysyllabic words in both of the written and the audio-recorded tests are classified into groups in descending order of difficulty.³ This gives nine groups in written test, and sixteen groups in the audio-recorded test. Figure 1 shows the performance of the students in the nine groups of words, while Figure 2 shows the performance of the students in the sixteen groups of words.

³ See appendix A for details related to hierarchy of difficulty in written tests and that related to the audio-recorded tests.

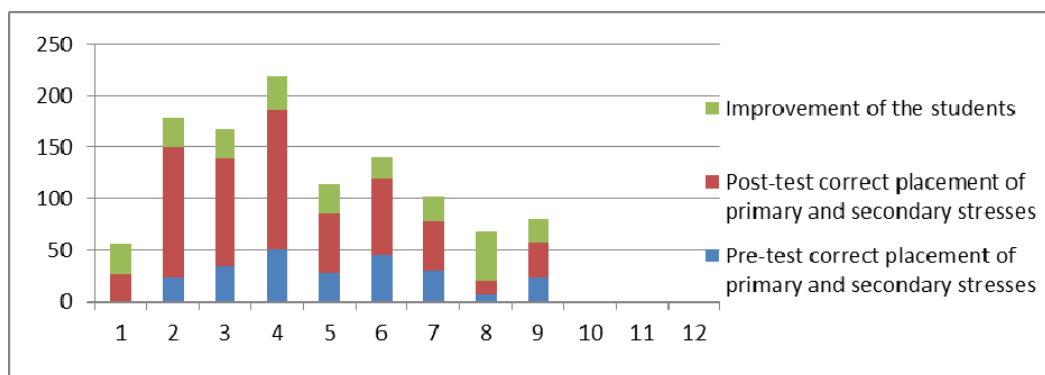


Figure 1. Performance of the students in stress placement in the written tests.

The overall performance of the students in stress placement in the pre-test is low. The students provided 243 correct transcriptions, i.e. 18.2022% of the total. In the post-test, however, there is a better performance: 622 correct transcriptions, i.e. 46.592% of the total. The average performance of the two tests is 32.3971%.

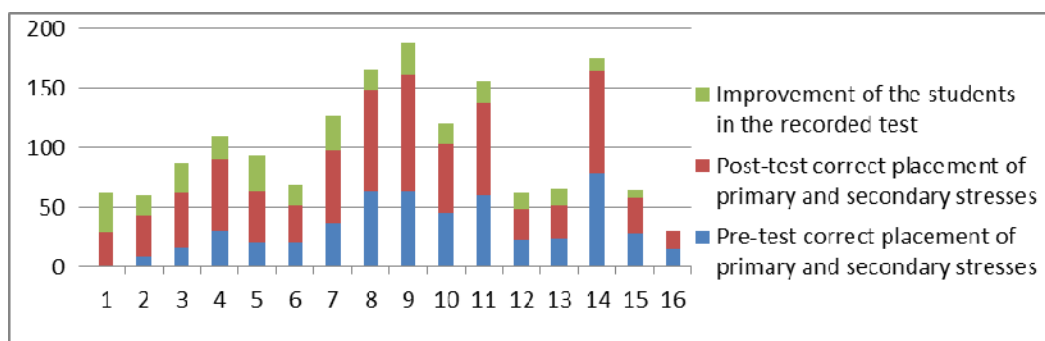


Figure 2. Performance of the students in stress placement in the audio-recorded tests.

The overall performance of the students in stress placement in the pre-test is low. The students provided 530 correct transcriptions, i.e. 39.7% of the total. In the post-test, however, there is a better performance: 808 correct transcriptions, i.e. 60.524% of the total. The average performance of the two tests is 50.112%.

In Figure 3, the comparison between the written and the audio-recorded tests shows that the degree of the improvement of the students in the written test is higher than that of the audio-recorded test. In both tests, the performance of students is low. This reflects the difficulty of

deciding the correct placement of stress for Arab learners. Word length⁴ is associated with low performance; consequently, more practice is required in this area.

The following table gives the performance of the three groups in compound words in both pre and post written tests. The table indicates the number of correct placement of stress for each word out of five in the three groups.

Table 2. Correct Placement of Stress in Compound Words in Pre and Post Written Tests

Word	Pre test						Post test							
	Group 1		Group 2		Group 3		Total	Group 1		Group 2		Group 3		Total
	F	%	F	%	F	%		F	%	F	%	F	%	
broadcast ²	0	-	0	-	0	-	0	3	60	0	-	0	-	3
background ²	2	40	0	-	1	20	3	2	40	2	40	2	40	6
greenhouse ²	0	-	0	-	0	-	0	3	60	1	20	4	80	8
blackboard ²	1	20	0	-	2	40	3	4	80	2	40	1	20	7
handout ²	1	20	0	-	2	40	3	5	100	2	40	5	100	12
suitcase ²	1	20	0	-	0	-	1	2	40	1	20	0	-	3
heartfelt ²	1	20	1	20	0	-	2	3	60	1	20	1	20	5
soundproof ²	2	40	0	-	0	-	2	4	80	1	20	2	40	7
armchair ²	0	-	1	20	0	-	1	4	80	1	20	0	-	5
TOTAL	8	17.7 78	2	4.44	5	11. 11		30	66.66 7	11	24. 44	15	33.33	

⁴ In appendix B, see Table 6 which shows the performance of students vs. word-length in written tests, and Table 7 for the audio-recorded tests. The combined average length of polysyllabic words in both tables indicates that word-length is associated with low performance on the part of students as far as stress is concerned.

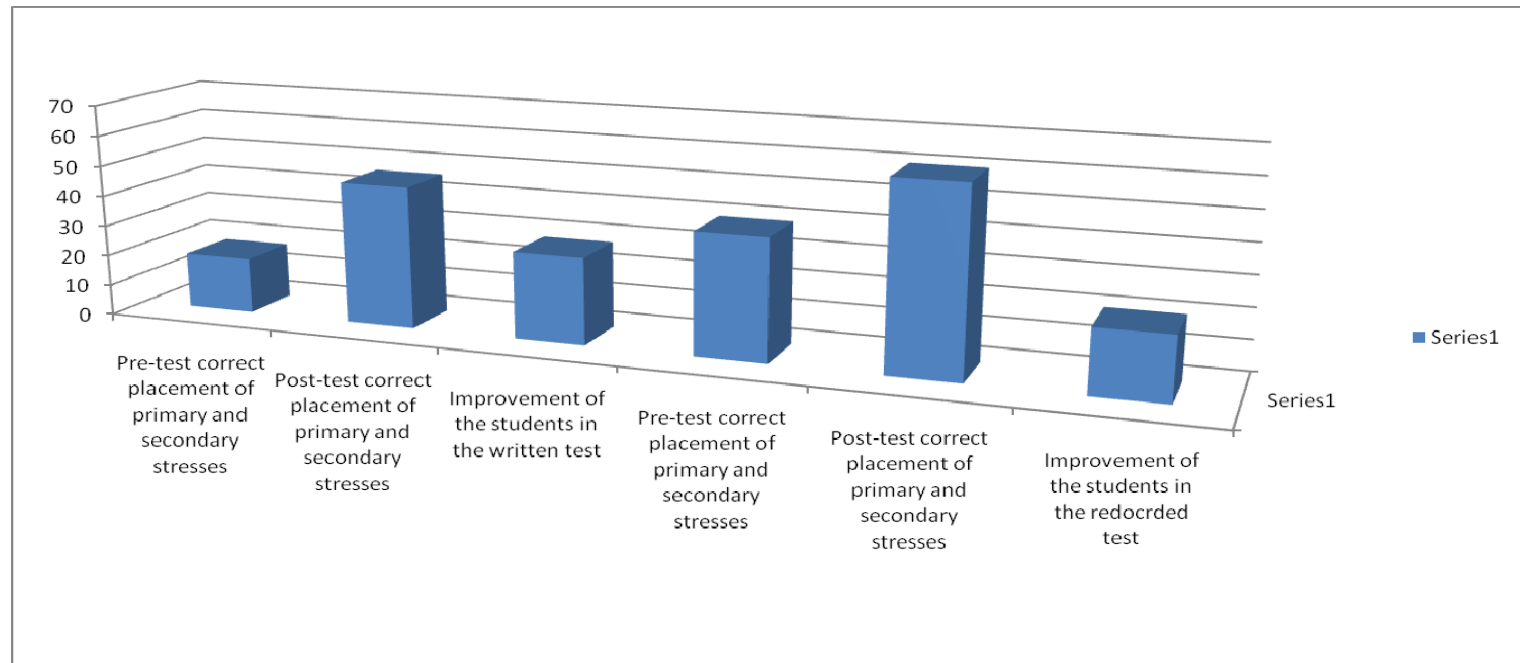


Figure 3. Comparison between the performance of the students in the written and the audio-recorded tests.

From the table, one finds that the performance of the students, i.e. the performance of all three groups is low in the written pre-test. The first group proportion is 17.778; the second is 4.44; while the third is 11.1. These proportions indicate the difficulty of assigning correct placement of stress to compound words due to (1) The phonological structure of the syllable that tempts Egyptian students to put stress on wrong syllable and (2) The metrical stress parameters of these words which represent a mismatch to Universal Metrical parameters. The performance of each group doesn't reach to 18 % of the total 100 % .i.e. the students do not know at this early stage where stress should be. For example, in the words *broadcast* and *greenhouse*, no student in each of the three groups is able to provide correct placement of stress as the frequency of occurrence (f) of correct placement of stress is zero. Transcriptions provided by students are: /,gri:n'haus/, /gri:n'haus/, /grɪn'haus/, /gri:'naʊs/, /brɒd'kɑ:st/, /broad'kæst/, /bru:d'kæst/.⁵ While, in the written post-test, there is improvement for each group. The improvement of the first group is $(66.667-17.778) = 48.889 \%$, the improvement of the second group is $(24.44-4.44) = 20 \%$, and the improvement of the third group is $(33.33- 11.11) = 22.22 \%$. The improvement of the three groups of students in the post-written test in compound words can be shown in Figure 4 below.

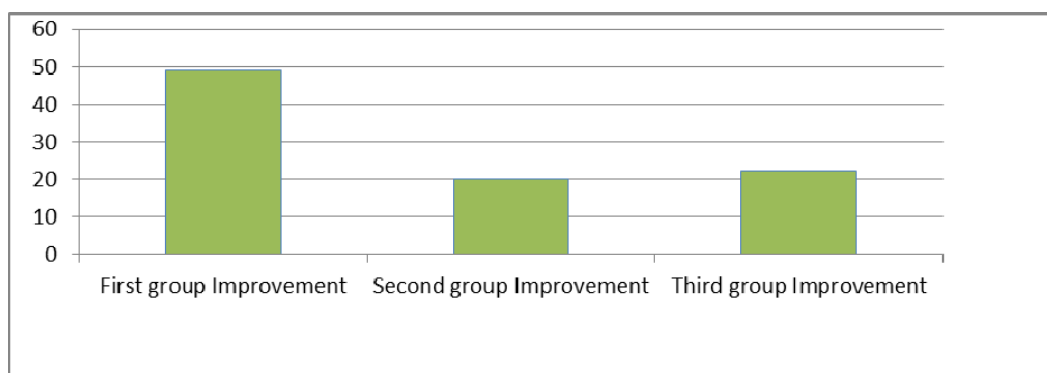


Figure 4. Comparison of the improvement of the three groups in post-written test.

The assignment of stress to compound words represents great difficulty for all groups in the pre-test. In the post test, after the three groups receive instruction on the topic, the performance improved. As for performance of groups in written post-test: group one (first group) which received the highest number of lectures, as well as extra metalinguistic instruction and

⁵ Repeated transcriptions are omitted.

audio materials on English stress patterns achieved the highest proportion of correct assignment of stress to compound words in comparison to the other two groups. The improvement of the third group (which gets only the usual English sessions and exercises in two lectures) is approximately equal to the improvement of the second group which gets sessions, exercises, and metalinguistic instruction in four lectures. It must be noted here that both group two and three did not receive audio material on English stress pattern, therefore, the improvement of their performance tends to be approximately equal as well as not high, i.e. does not exceed 23 %. What is important here is that, depending on statistics which highlight the improvement of each group, audio materials on English stress patterns can be regarded as an effective factor which is responsible for the high improvement of group one. On the contrary, the lack of audio materials on the topic, although of existence of different degrees of instructions in lectures, leads to the approximately equal improvement of group two and three. The improvement in the performance of the three groups indicates that the students are able to acquire the stress parameter of English and hence they are able to reset stress parameter of UG to that of English.

The following table gives the performance of the three groups in compound words in the audio-recorded tests in both the pre-test and post test.

Table 3. Correct Placement of Stress in Compound Words in Pre and Post Audio-Recorded Tests

Word	Pre test						Total	Post test						Total
	Group 1 F %		Group 2 F %		Group 3 F %			Group 1 F %		Group 2 F %		Group 3 F %		
broadcast ²	0	-	0	-	0	-	0	4	80	0	-	0	-	4
background ²	3	60	3	60	2	40	8	5	100	4	80	4	80	13
Greenhouse ²	4	80	2	40	3	60	9	5	100	3	60	4	80	12
blackboard ²	3	60	2	40	3	60	8	5	100	4	80	4	80	13
Handout ²	4	80	2	40	4	80	10	5	100	3	60	4	80	12
suitcase ²	5	100	0	-	2	40	7	5	100	3	60	1	20	9
heartfelt ²	2	40	3	60	2	40	7	4	80	3	60	1	20	8
soundproof ²	3	60	1	20	2	40	6	4	80	3	60	3	60	10
Armchair ²	1	20	2	40	0	-	3	4	80	4	80	2	40	10
TOTAL	25	55.55	15	33.33	18	40		41	91.1	27	60	23	51	

In the audio-recorded test, which is also a production test, the students' performance is not high in the pre-test, but it improved in the post test after the students received instruction on the topic. The improvement of the first group is $(91.1-55.55) = 35.55 \%$, the improvement of the second group is $(60-33.33) = 26.67\%$, and the improvement of the third group is $(51-40) = 11\%$. The improvement in the performance of the students who are divided into three groups indicates that they are able to re-set stress parameters of UG to that of English compound words; in other words, they are able to acquire English.

Some of the errors are related to the perception of the students of compound words as two words which are of equal importance, i.e. they treat the two words as two separate words; hence, they assign two stresses to one word. This error only occurs in group two in the pre-test. Two words are assigned two primary stresses with the proportion 4.444. The transcriptions provided by students are */ˈbrɒdˈkɪst/* and */ˈhætˈfel/*. The assignment of two stresses to one compound word reflects that the students are transferring their knowledge of Arabic language to English. They give the two words *heart* and *felt* equal prominence. "Arabs tend to give equal prominence (and equal rhythmic weight) to both words in the compound" which is in conformity with the usual pronunciation of words as: "?ad'daaru Ibay'Daa? the white house" (El- Hassan, 1994 , p. 210). This pattern of stress is alien to Arabic Language. So, the well established habit of Arabic pronunciation interferes in their pronunciation of English compound words.

DATA ANALYSIS OF METRICAL STRESS PATTERNS

All the compound words used in the test take penultimate stress in English. Since all of them consist of two syllable, so stress falls on the first element. In EA on the other hand, the final syllable in most of these words have either a long vowel (*soundproof, blackboard, broadcast*), or diphthong (*armchair, suitcase, handout, greenhouse*); therefore, the students, in all pre tests whether written or audio-recorded, correspond to stress placement rules in EA which let stress fall on the final superheavy syllable. So, this means that, the phonological structure of the syllable which has either a long vowel or a diphthong in those compound words is a main factor which affects the students' performance. They respond to the weight of the syllable, ignoring the stress rules of English language. Therefore, they transfer the stress pattern of their language L1 to target language L2 and

this transfer leads to wrongly putting stress on the second element instead of the first one.

Another factor, which has played a major role in the low performance of students in the pre tests, is the lack of extrametricality of whole syllable in EA. EA has the concept of extrametricality itself, but the extrametrical element in EA is a segment on the contrary to English which has the process of extrametricality in a whole syllable. So, this indicates that there is a difference between the two languages regarding the extrametrical element. It is a segment in EA, while a whole syllable in English. Yousef & Mazurkewich (1998, p. 308) stated that "the difference between the two languages is that the extrametrical element in CA is a segment, whereas it is a whole syllable in English" (CA stands for Cairene Arabic which is Egyptian Arabic in this study). If we take into consideration the default setting of the universal metrical parameters outlined by Dresher & Kaye (1990), we find that EA has the default setting because it allows the extrametricality of segments not of syllable and the extrametricality of syllable is the default value for Universal Grammar. So, EA has the unmarked value for that parameter. While, English has the marked value for that parameter since it allows the extrametricality of whole syllable. Since all compound words used in the tests contain extrametricality of a whole syllable, the students have not adopted this parameter setting. In other words they ignore the extrametricality of a whole syllable and correspond to their own language which does not include this parameter. Ignoring this process of extrametricality of a whole syllable renders wrong the place of stress, putting it on the second part of the compound noun instead of the first part which should receive stress.

To conclude, the low performance of the students in pre tests whether written or audio-recorded is mainly related to two factors. These are: the phonological structure of the second syllable which is regarded by students as a superheavy syllable that should receive stress instead of the first syllable, and the lack of extrametricality of a whole syllable in EA which is responsible for wrong placement of stress on second element instead of the first one as the students ignore the extrametricality of the last syllable and behave as if it were visible to metrical stress rule, hence, they incorrectly stressed the second element. In the post tests, whether written or audio-recorded, there is improvement in the performance of the students. This improvement indicates that the students are able to acquire the stress rules as well as the metrical parameters of English. As for the improvement of the groups: the first group which had received extra instruction as well as extra audio materials on English stress rules

recorded the highest improvement in both of the post-written and the post audio-recorded tests in comparison to the other two groups. This indicates that instruction and lectures are not sufficient for high performance. The need for audio materials on the topic after lectures, in which stress rules of English is provided, is an important factor that leads to the improvement of the performance of the students.

PEDAGOGY

The students should have some knowledge on the phonology of EA, as well as the phonology of English, presented in a simple way, in the light of metrical phonology. This phonological knowledge of two languages will play an important role in the development of the performance of the students since they will be aware of their mistakes. In compound words which consist of two nouns that function as a single linguistic unit and that are written without a space between them, the students should know that the stress will fall on the first element. They should be able to distinguish between the sequence of two nouns which is a phrase and the sequence of two nouns which should be regarded as a compound noun. In phrases, stress falls on the second noun because of the application of End stress [right] directly to the nouns, while in compound words, extrametricality of last syllable should be applied first before end stress.

Each compound word is a noun which consists of two syllables in which the stress falls on the first syllable. As Davenport and Hannahs (2010, p. 82) stated, "in two syllable words, the penultimate typically bear the stress irrespective of its weight". This rule is explained in metrical phonology by the application of the metrical stress rules. Also, the students should have some knowledge on metrical phonology, as it explains where stress should be, than to memorize a stress rule and trying to apply it without understanding why stress should be on particular syllable rather than the other one.

From the performance of the groups which gives the highest percent of correct placement of stress to group one that received extra exercises and extra metalinguistic instruction as well as audio materials on English stress patterns, one finds that there is a relationship between the production of sounds and correct placement of stress and the auditory understanding of those sounds that receive stress. Group one understands where to put stress in English words. This understanding is enhanced with audio materials on the topic. Therefore, they achieved the highest percent of correct placement of stress in comparison to the other two

groups which do not receive auditory exercises. It is suggested that students should have both good comprehension of auditory input and audio materials on topic for high performance on production of sounds and correct placement of stress within words. Voice production is closely related to auditory comprehension of the learners (Kaunzner, 1997). So, from the very beginning Arab learner should know how to decode auditory input and then after that articulatory pronunciation exercises should follow enhanced with audio-materials on the topic.

Furthermore, the learners should be accustomed to learning accentual pattern of a word as they meet it for the first time because stress in English words is a significant factor essential in both the form and the intelligibility of words. Arab Learners should improve their articulatory production of stress by (1) listening carefully to the lecturer or the native speaker, by (2) identifying their errors (with the help of their instructor) and trying to avoid them in the future, by (3) using reliable standard pronouncing dictionaries and limiting themselves to one system of phonetic notation.

CONCLUSION

Word-stress in English poses several problems for Egyptian learners as the performance of the students tends to be low in the tests whether written or audio-recorded. In polysyllabic words, the length of the words is the main source of difficulty. In compound words, there are two factors that are responsible for low performance of the students. These are: the phonological structure of the second syllable which is regarded by students as a superheavy syllable that should receive stress instead of the first syllable, and the lack of extrametricality of a whole syllable in EA which is responsible for wrong placement of stress on second element as the students ignore the extrametricality of the last syllable, hence, they incorrectly stress the second element. However, in the post tests, the improvement in the performance of the students indicates that they are able to acquire the stress rules and the metrical parameters of English. As for the improvement of the groups: the first group which had received extra instruction as well as extra audio materials on English stress rules showed the highest improvement in the post tests in comparison to the other two groups. Therefore, the need for audio materials on the topic after lectures, in which stress rules of English is provided, is an important factor that leads to the improvement of the performance of the students. Additionally, the students should have some knowledge on the

phonological systems of two languages, namely, Arabic (specifically Egyptian Arabic) and English, as this knowledge will allow them to see their errors and their reasons; consequently, they will avoid those errors in the future.

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APPENDIX A: HIERARCHIES OF DIFFICULTIES

The following two hierarchies are for both the written and recorded tests. They show the order of difficulty for the polysyllabic words used in the tests according to the performance of the Egyptian students in both of the pre and post tests, whether written in hierarchy 1 or audio recorded in hierarchy 2. The words are classified into groups in descending order of difficulty. Consequently, the group which entitled Zero at the top of the hierarchy represents the most difficult words, according to the performance of the students, while the last group in each hierarchy represents the least difficult words in terms of stress assignment. There are nine groups in hierarchy 1 which is for the written tests, ranging from zero to eight; and sixteen groups in hierarchy 2 for the audio- recorded tests, from zero to fifteen.

The subtitle letter-number of the groups refers to the number of correct placement of stress in the pre test according to the performance of the Egyptian students, while the figure-numbers of the subgroups refers to the numbers of correct assignment of stress in the post-test. The super script number beside each word refers to the numbers of syllables of that word. In addition, the classification of each word whether it represents a match or a mismatch with the metrical stress patterns of Egyptian Arabic (EA) as well as the stress placement rules of EA is given in rounded brackets beside each word, that is for ease of reference.

Hierarchy 1: Continuum of Difficulty for Words Used in the Written Tests

Zero

- 3. Possible³ (3 match). broadcast² (1 mismatch).
- 4. Injurious⁴ (2 mismatch).
- 5. Tranquility⁴ (3 match). digest² (N. /Adj.) (1 mismatch).
- 7. Bury² (2 match).

One

- 2. Deliberation⁵ (2 match). personality⁵ (3 match).
- 3. Wiretap² (2 match). suitcase² (1 mismatch). ornament³ (V.) (2 mismatch). Possibility⁵ (3 mismatch).
- 4. Withdraw² (1 match). proverbial³ (2 match). committee³ (2 match). semicircle³ (2 mismatch).

5. Biology⁴ (3 match). devilish³ (3 match). underestimate⁵ (2 mismatch). armchair² (1 mismatch).
6. Advantageous⁴ (2 match). perfection³ (2 match).
7. Compose² (1 match). compare² (1 match). walkout² (1 mismatch). democracy⁴ (2 mismatch).
8. Forget² (1 match). castle² (2 match). secret² (2 match).
10. Console² (N. /Adj.) (1 mismatch).

Two

3. Apologetic⁵ (2 match). creativity⁵ (3 match).
4. Determine³ (2 match).
5. Developmental⁵ (2 match). heartfelt² (1 mismatch). photography⁴ (2 mismatch).
6. Balloon² (1 match). console² (V.) (1 match). anchorage³ (2 mismatch). passable³ (2 mismatch).
7. Climatic³ (2 match). soundproof² (1 mismatch). credible³ (2 mismatch).
8. Suppose² (1 match). mellow² (1 mismatch). escort² (N. /Adj.) (1 mismatch).
12. Money² (2 match).

Three

5. Begin² (1 match).
6. Outrun² (1 match). overpower³ (1 match). open² (2 match). background² (1 mismatch). poisonous³ (2 mismatch).
7. Academic⁴ (3 match). blackboard² (1 mismatch). honest² (1 mismatch).
8. Desert² (N. /Adj.) (2 match). greenhouse² (1 mismatch).
9. Desert² (V.) (1 match). permit² (1 match). refusal³ (2 match).
10. Carry² (2 match). lovely² (2 match). shutdown² (1 mismatch).

Four

5. Biological⁴ (3 match).
6. Larynx² (1 mismatch).
7. Ornament³ (N.) (2 mismatch).
8. Correct² (1 match). widen² (2 match).
12. Arrive² (1 match). handout² (1 mismatch).

Five

5. Product² (1 mismatch).
7. Withstand² (1 match). equal² (2 match). even² (2 match).
8. Divine² (1 match).
9. Accent² (V.) (1 match). yellow² (1 mismatch).
11. Apply² (1 match). accent² (N. /Adj.) (2 match).

Six

8. Estate² (1 match). shallow² (1 mismatch).
10. Deceive² (1 match).

11. Alive² (1 match). follow² (1 mismatch).

Seven

14. China² (2 match).

Eight

9. Design² (1 match).

12. Clever² (2 match).

13. Graphic² (2 match).

Hierarchy 2: Continuum of Difficulty for Words Used in the Audio-Recorded Tests

Zero

3. Developmental⁵ (2 match).

4. Broadcast² (1 mismatch). injurious⁴ (2 mismatch).

5. Underestimate⁵ (2 mismatch).

6. Possible³ (3 match).

7. Proverbial³ (2 match).

One

1. Devilish³ (3 match).

3. Anchorage³ (2 mismatch). withdraw² (1 match). ornament³ (V.) (2 mismatch). creativity⁵ (3 match). committee³ (2 match).

4. Product² (1 mismatch).

5. Apologetic⁵ (2 match).

8. Compose² (1 match).

Two

3. Photography⁴ (2 mismatch).

4. Larynx² (1 mismatch).

5. Advantageous⁴ (2 match). deliberation⁵ (2 match). credible³ (2 mismatch)

7. Passable³ (2 mismatch).

8. Compare² (1 match).

9. Suppose² (1 match).

Three

4. Balloon² (1 match). console² (V.) (1 match).

5. Tranquility⁴ (3 match). determine³ (2 match).

6. Personality⁵ (3 match).

6. Biological⁴ (3 match). biology⁴ (3 match).

7. Democracy⁴ (2 mismatch).

8. Desert² (N. /Adj.) (2 match).

9. Console² (N. /Adj.) (1 mismatch).

Four

8. Correct² (1 match). permit² (1 match).

9. Academic⁴ (3 match). armchair² (1 mismatch). ornament³ (N.) (2 mismatch).

Five

6. Perfection³ (2 match). poisonous³ (2 mismatch).

9. Escort² (N./Adj.) (1 mismatch).

10. Possibility⁵ (3 mismatch).

Six

8. Mellow² (1 mismatch).

10. Forget² (1 match). soundproof² (1 mismatch).

11. Walkout² (1 mismatch). yellow² (1 mismatch).

12. Accent²(V.) (1 match).

Seven

7. Digest² (N./Adj.) (1 mismatch).

8. Heartfelt² (1 mismatch).

9. Suitcase² (1 mismatch). shallow² (1 mismatch). semicircle³ (2 mismatch).

10. Secret² (2 match).

11. Alive² (1 match). bury² (2 match).

12. Apply² (1 match).

Eight

10. Wiretap² (2 match).

11. Overpower³ (1 match).

12. Withstand² (1 match). desert² (V.) (1 match).

13. Follow² (1 mismatch). background² (1 mismatch). arrive² (1 match). blackboard² (1 mismatch)

Nine

10. Divine² (1 match).

12. Widen² (2 match). greenhouse² (1 mismatch). shutdown² (1 mismatch). climatic³ (2 match).

Ten

14. Castle² (2 match).

12. Handout² (1 mismatch). open² (2 match).

13. Equal² (2 match). outrun² (1 match). lovely² (2 match).

Eleven

13. Begin² (1 match). even² (2 match).

Twelve

13. Refusal³ (2 match).

15. Money² (2 match).

Thirteen

14. Carry² (2 match). deceive² (1 match). honest² (1 mismatch).

15. Design² (1 match). estate² (1 match). accent² (N. /Adj.)

Fourteen

15. China² (2 match). graphic² (2 match).

Fifteen

15. Clever² (2 match).

APPENDIX B

Table 4. Students' Performance in the Pre and Post Written Tests

No. of words	100% score	No. of students	Pre-test correct placement of primary and secondary stresses		Post-test correct placement of primary and secondary stresses		Improvement of the students
			value	%	value	%	
6	90	-	-	0.0	27	30	30
24	360	1	24	6.667	126	35	28.333
17	255	2	34	13.333	106	41.569	28.236
17	255	3	51	20	135	52.941	32.941
7	105	4	28	26.667	58	55.238	28.571
9	135	5	45	33.333	74	54.815	21.482
5	75	6	30	40	48	64	24
1	15	7	7	46.667	14	93.333	46.666333
3	45	8	24	53.333	34	75.556	22.223
Total 89			243	18.2022	622	46.592	28.3898

Table 5. Students' Performance in the Pre and Post Audio-Recorded Tests

No. of words	100% score	No. of students	Pre-test correct placement of primary and secondary stresses		Post-test correct placement of primary and secondary stresses		Improvement of the students
			value	%	value	%	
6	90	-	-	0.0	29	32.222	32.222
9	135	1	9	6.667	33	24.444	17.777
8	120	2	16	13.333	46	38.333	25
10	150	3	30	20	60	40	20
5	75	4	20	26.667	43	57.333	30.666
4	60	5	20	33.333	31	51.667	18.334
6	90	6	36	40	62	68.889	28.889
9	135	7	63	46.667	86	63.704	17.037
8	120	8	64	53.333	97	80.833	27.5
5	75	9	45	60	58	77.333	17.333
6	90	10	60	66.667	77	85.556	18.889
2	30	11	22	73.333	26	86.667	13.334
2	30	12	24	80	28	93.333	13.333
6	90	13	78	86.667	87	96.667	10
2	30	14	28	93.333	30	100	6.667
1	15	15	15	100	15	100	0
Total 89			530	39.7	808	60.524	20.824 %

Table 6. Performance (Correct Placement of Stress) Vs. Word-Length in Written Tests

Groups (9 groups)	Number of words				Average length	Combined average length
	2 syllables	3 syllables	4 syllables	5 syllables		
0	3	1	2	0	2.8333	2.92483
1	11	6	3	4	3	
2	8	5	1	3	2.94118	
3	13	3	1	0	2.29411	2.240895
4	5	1	1	0	2.42857	
5	9	0	0	0	2	
6	5	0	0	0	2	2
7	1	0	0	0	2	
8	3	0	0	0	2	

Table 7. Performance (Correct Placement of Stress) Vs. Word-Length in Audio-Recorded Tests

Groups (16 groups)	Number of words				Average length	Combined average length
	2 syllables	3 syllables	4 syllables	5 syllables		
0	1	1	1	2	3.8	3.16722
1	3	4	0	2	3.1111	
2	3	2	2	1	3.125	
3	4	1	4	1	3.2	
4	3	1	1	0	2.6	
5	1	2	0	1	3.25	2.295
6	6	0	0	0	2	
7	9	1	0	0	2.1	
8	7	1	0	0	2.125	
9	4	0	0	0	2	
10	6	0	0	0	2	2.1
11	2	0	0	0	2	
12	1	1	0	0	2.5	
13	6	0	0	0	2	
14	2	0	0	0	2	
15	1	0	0	0	2	2