

On the Internal Mechanisms of L₂ Acquisition: Linguistic and Cognitive Accounts

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ABSTRACT---- *The purpose of the present study is twofold. In its theoretical part, it focuses on accounts of L₂ acquisition that are cognitive in nature and those that are linguistic in orientation. My discussion of these two accounts is based on the premise that it is perfectly proper for Second Language Acquisition (SLA) research to postulate theories of its own to explain its own area. It is, also, appropriate for SLA research to take insights and methods from other disciplines when they are useful to it. In its empirical part, the present study reports on the outcomes of two experiments carried out by the author on some second language learners. The first experiment was designed to examine the written output of foreign students enrolled in the English Language Institute at the University of Pittsburg, USA (Beginners). It attempts to find answers for the following questions: (1) are students' errors in grammatical structures, as they will appear in their written output, due to deficiency in their conscious grammar rules, or to deficiency in their abilities to transfer this knowledge (if it exists) to other language tasks such as writing compositions in English?, and (2) can conscious rules of grammar guide students' performance in monitoring (self-correcting) their written output once their attention is drawn to an error? The second experiment was designed to investigate 'advanced' students' multilingualistic ability in solving multi-dimensional grammatical problems. It is an attempt to highlight the role of "focus on form" instruction in shaping L₂ learners' performance. The findings of both experiments were interpreted from both linguistic and cognitive perspectives.*

Keywords---- Linguistic approaches to L₂ acquisition; Cognitive approaches; Attention, Knowledge representation.

1. INTRODUCTION

The study of Second Language Acquisition (SLA) had its origins in attempts to solve practical problems. Until quite recently, research in this area was widely regarded as falling entirely within applied linguistics, and many still see the primary motivation for this research as that of contributing directly to the solution of the complex and socially important problems surrounding foreign and L₂ instruction (Ritchie and Bhatia, 1996; Gass & Mackey, 2011; Lillis & Curry, 2011; Larsen & Cameron, 2007). Broadly speaking, SLA research grew out of many language-related disciplines. Linguistics was influential through linguists who were concerned with society and bilingualism, such as Weinreich. First language acquisition came in through the adaptation of the 1960s techniques and ideas originally devised to confirm or disconfirm Chomsky's ideas. Language teaching was brought in by applied linguists trying to develop language teaching through a better understanding of language, such as Lado and Corder (Cook, 1993). In another words, five major groups of researchers have contributed to our understanding of L₂ acquisition: (1) foreign-language educators who are worried about their students' progress; (2) child-language researchers who noticed that L₂ acquisition might be similar in interesting ways to L₁ acquisition; (3) linguists who wanted to use L₂ acquisition to test notions about language universals; (4) psycholinguists who were interested in language processing issues, and (5) sociolinguists and anthropologists who are interested in how language is used in various social settings (Snow, 1998; Sebba et al., 2011; Van Patten and Williams, 2008). Specifically speaking, linguistics provides a useful perspective on L₂ learning and has led to stimulating ideas and research. Yet it must be remembered that linguistics is only one of the disciplines that SLA research can draw on; the full richness of the disciplines rests on the variety of ways that second languages impinge on the minds and lives of L₂ users. Multiple sources of information are needed to build a picture of the language knowledge in the mind (Cook, 1993: 269).

2. THEORETICAL FRAMEWORK

Over the last two decades, a variety of approaches to L₂ acquisition (SLA) have appeared. Each of these approaches has contributed crucially to what is now a conceptually richer field. According to Atkinson (2011: xi), diversity is the ground But efforts to bring the diverse approaches into engagement and interaction are crucial for progress to be made in the field. It must be kept in mind, however, that squeezing diverse SLA approaches into a single comparative framework is no easy task. It is increasingly apparent that SLA is an extremely complex and multifaceted phenomenon. For this reason, it, now, appears that no single theoretical perspective allows us to understand SLA

adequately. It, therefore, becomes necessary for all the varied perspectives to engage, one another, to 'talk' to each other, to discover how they relate, differ, complement, overlap, contradict in order to show how they can lead us toward a richer, more multidimensional understanding of SLA (Atkinson, 2011: xi). It is fair to say that the dominant theoretical influences in [SLA] have been linguistic and psycholinguistic (Mitchell & Myles, 1998: x).

The field of linguistics and cognitive psychology contain separate paradigms for describing second language acquisition. Linguistic theories assume that language is learned separately from cognitive skills, operating according to different principles from most learned

behaviors (Spolsky, 1985). It may be worth-mentioning, at the outset, that it is not always possible to classify particular theories of L₂ acquisition as exclusively 'cognitive' or 'linguistic' as often both perspectives are drawn on. As Ellis (2008: 347) has maintained, the two perspectives are not mutually exclusive, and in all probability, a comprehensive theory of L₂ acquisition will need to incorporate elements from both. It is perfectly proper for SLA research to postulate theories of its own to explain its own area. It is also proper for it to offer its discoveries to other disciplines to help them solve their problems. It is, also, appropriate for SLA research to take insights and methods from other disciplines when they are useful to it. SLA research cannot redesign the whole of the human mind to fit its own convenience, ignoring all the disciplines that also deal with the mind (De Bot et al., 2007; Eskildsen, 2008). In this connection, Cook (1993: 8) points out that "second language acquisition began to be recognized as a discipline in its own right during the 1970s. Yet there had already been approaches to L₂ learning that made use of ideas from linguistics, either directly or indirectly via first language acquisition research". She, further, argues that although linguistics provides a useful perspective on L₂ learning and has led to stimulating ideas and research ... yet it must be remembered that "linguistics is only one of the disciplines that SLA research can draw on ... Multiple sources of information are needed to build up a picture of the language knowledge in the mind" (p. 269-70). I do, personally, believe that there is no single scientific truth. As McLaughlin (1987: 6), correctly, points out, "disciplines tend to become fragmented into 'schools', whose members are loath to accept, and are even hostile to the views of other schools using different methods and reaching different conclusions. Each group becomes convinced that it has a corner on 'truth'. One philosophical position contends that truth can never be known directly and in its totality. Multiple ways of seeing result in multiple truths:

Scientific progress is achieved as we come to illuminate progressively our knowledge in a particular domain by taking different perspectives, each of which must be evaluated in its own right".

3. LINGUISTICS AND SECOND LANGUAGE ACQUISITION RESEARCH

Linguistic approaches to second language (L₂) research deal with minds that are acquiring, or have acquired, knowledge of more than one language. In this connection, Cook (1993:1) maintains that "relating second language acquisition to linguistics means looking at the nature of both linguistics and second language research". Chomsky (1986) defined three basic questions for linguistics: 1) what constitutes knowledge of language? 2) how is knowledge of language acquired? and 3) how is knowledge of language put to use? As Cook (1993) has maintained, for second language research these questions need to be rephrased to take in knowledge of more than one language, in other words as, multilingual rather than monolingual goals. Cook, also, argues that the above three questions are central to the relationship between linguistics and second language research. The following section will shed light on these questions.

The major goal of linguistics is to describe the language contents of the human mind; its task is to represent what native speakers know about language; their linguistic competence. In this sense, "linguistics is based on the internal reality of language in the individual mind rather than on the external reality of language in society" (Cook, 1993: 1). Second language research answers the 'knowledge' question by describing the grammars of the second language speaker, their differences and similarities from that of a monolingual speaker, and how they interact with each other. A second goal for linguistics is discovering how knowledge of language comes into being; that is, how linguistic competence is acquired by the human mind. Cook (1993) argues that Chomsky proposes to achieve this goal by describing how innate principles of the child's mind create linguistic competence, that is to say how the child's mind turns the language input it encounters into a grammar by using its built-in capabilities. Phrased in another way, knowledge of language is not only created by the human mind but also constrained by its structure. Second language research answers the 'acquisition' question by seeing how this complex state of knowledge of two languages originates (see Wong, 2004; Wyse, 2001). A third goal for linguistics is discovering how knowledge of language is put to use. This means, according to Chomsky, seeing how it relates to thinking, comprehension, and communication (see Firth & Wagner, 2007; Lightbown & Spada, 2006). Second language research answers the 'use' question by examining how knowledge of both languages is put to use (Cook, 1993: 3). In the light of the above discussion, it may be clear that the main foundation of the present study is the Chomskyan goals for linguistics, in which knowledge of language is the central issue. One reason for concentrating on the Chomskyan view is its central position as the most comprehensive theory in current linguistics. Another reason is that linguistic theories such as functionalism have not been applied to L₂ learning (see Tomlin, 1990).

Moreover, Chomsky divides linguistics into E-language (External language) and I-language (Internal language) approaches. The former approach is concerned with behavior and with social convention, that is, it is concerned with language as an external social reality. The latter approach, on the other hand, is concerned with mental reality and with

knowledge; that is, it is concerned with representing the internal aspects of the mind and, hence, it is based on linguistic competence. As Chomsky puts it, “linguistics is the study of I-language, knowledge of I-language, and the basis for attaining this knowledge” (Chomsky, 1987: 18). A related distinction that underlies linguistics is that between ‘competence’ and ‘performance’. According to Chomsky (1965: 4), the speaker’s knowledge of language is called linguistic competence, whereas the speaker’s use of this knowledge is ‘performance’. Linguistics is mainly concerned with ‘competence’, not ‘performance’.

4. LINGUISTS’ APPROACHES TO SECOND LANGUAGE ACQUISITION (DIACHRONIC PERSPECTIVE)

4.1. Weinreich and Robert Lado

The approaches represented by Weinreich and Lado posed questions about the relationship of the L1 to the L2 and about the nature of language learning that have continued to concern SLA research in one form or another ever since (Cook, 1993). While Weinreich was interested in interference between two language systems, Lado saw benefits as well as disadvantages coming from the first language system. Weinreich and Lado share not just an overall belief in the importance of the L₁/L₂ relationship but also the concept of language structure through which this relationship takes place. Their ideas fall within the broad American structuralist tradition of phrase structure, going back at least to Bloomfield (1933).

First, in his discussion of how two language systems relate to each other in the mind of the same individual, Weinreich (1953) introduced the well-known concept “interference”, defined as ‘those instances of deviation from the norms of either language which occur in the speech of bilinguals as a result of their familiarity with more than one language’. Weinreich’s views can be summarized as follows: 1) interference can happen in all the systems of language knowledge; 2) speakers may carry over the L₁ phonological system by ignoring distinctions made in the L₂ but not in the L₁; 3) interference covers not only the effects of the L₁ on the L₂ but also the effects of the L₂ on the L₁, as in the gradual loss of the L₁ by some bilinguals (Seliger and Vago, 1991); and 4) interference happens on two dimensions; the actual speech of the bilingual and the bilingual’s knowledge of language. In addition, Weinreich, deeply, analyzed the relationship of the two languages in the individual mind. In this regard, he introduced the following three terms: 1) coordinative bilingualism; 2) compound bilingualism and 3) subordinative bilingualism. Coordinative bilingualism takes place when bilingual speakers have two separate words; that is, they know, for example, what English ‘book’ means and they know what Russian ‘kniga’ means but there is no direct link between the two languages in their minds: the two language systems coexist side by side. On the other hand, compound bilingualism occurs when bilinguals have a single concept of a (book) which is related to the two different words / kniga / and / buck / in the two languages. The two languages, then, are related via a single concept. Finally, subordinative bilingualism occurs when the concept leads, not to the L₂ word directly, but to the L₂ word via the L₁ word. That is, the second language is derived from the first rather than having a separate existence (Cook, 1993).

Second, according to Lado (1957), the most difficult areas of the L₂ are those that differ most from the L₁; “Those elements that are similar to his native language will be simple for him, and those elements that are different will be difficult” (Lado, 1957: 2). In this view, L₂ learning consists largely of the projection of the system of the L₁ on to the L₂. This will be successful when the two languages are the same; called ‘positive’ transfer. It will be unsuccessful whenever the L₂ fails to correspond to the L₁ ‘negative transfer’ (see Mangubhai, 2006). Lado talks of grammatical structure as ‘a system of habits’; that is, speakers control habits which they use to produce speech automatically and without thinking. Such habits are acquired through exposure and practice, and they are based on ‘laws of language learning’ such as ‘exercise’, ‘familiarity of response’ and so on (Lado, 1964:45). This reflects the mainstream behaviourist views of language learning prominent in linguistics from Bloomfield (1933), and reaching its climax in the psychological work of Skinner (1957). However, Chomsky (1959) insisted that behaviourist accounts of language learning ignored the nature of language itself; that is, a human language enables one to say and understand sentences one has never heard before. Chomsky saw ‘this creative aspect of language use’ as the core of human language. Out of Chomsky’s ideas, a major concept was developed during the 1960s, which can be termed the independent grammars assumption. This concept refers to the belief that the child should be treated as a speaker of a language of his or her own rather than as a defective speaker of adult language who has inefficiently mastered the rules (Mc Neill, 1966). In this sense, the child’s ‘mistakes’ conform to regular rules in his own knowledge of language; they are only wrong when measured against adult speech. Accordingly, the major change in first language acquisition in the 1960s was the growing importance of the mind compared to that of the environment.

According to Chomsky (1965: 26), ‘we can think of general linguistic theory as an attempt to specify the character of the device’. This device in the mind is specific to language; it works quite differently from other forms of learning, and leads to knowledge that is distinctively linguistic rather than sharing properties with other aspects of knowledge. The question which imposes itself, here, is that ‘How do children construct grammars in their mind from the actual language they hear?’. The answer is that ‘children are active participants in acquisition rather than passive sponges. Children’s minds create a grammar from the materials they are given. Language acquisition is a process in which a highly complex state of knowledge is created out of the utterances that are heard’ (Cook, 1993: 16). Relatedly, ‘how do children change their grammars into adult linguistic competence?’. According to Chomsky (1965), to acquire

language, a child must devise a hypothesis compatible with presented data he must select from the store of potential grammars a specific one that is appropriate to the data available to him. For example, children hypothesising that English negation occurs at the beginning of the sentence might say 'No singing song'; they, then, assess how successful they have been by getting feedback from their parents or by comparing their own sentence with more sentences they hear. According to their success or failure, they will go on to revise their hypothesis into a form that is closer to the negation rules for English. As Cook (1969) points out, each successive hypothesis is an interim grammar accounting more successfully 'for the data he is exposed to. The last hypothesis is the final adult grammar of competence in the language. This can be called the hypothesis-testing model.

In summary, mentalist views of L₁ acquisition posited the following: 1) language is a human-specific faculty; 2) language exists as an independent faculty in the human mind; 3) the primary determinant of L₁ acquisition is the child's 'acquisition device', which is genetically endowed and provides the child with a set of principles about grammar; 4) the 'acquisition device' atrophies with age, and 5) the process of acquisition consists of hypothesis-testing, by which means the grammar of the learner's mother tongue is related to the principles of the 'universal grammar' (Ellis, 1986: 44). Now, the question that we should ask is, 'what is the impact of mentalist theories and empirical research on accounts of Second Language Acquisition (SLA)?' In the following section, I wish to concentrate on relating the concept of interlanguage to its background in mentalist views on language acquisition.

4.2. Approximative Systems and Interlanguage

The starting point was the realization that seeing L₂ learning only as a relationship between the L₁ and the L₂, as Weinreich and Lado argued, was over-simplistic insight. As Cook (1993) points out, a learner at a particular point in time is using a language system which is neither the L₁ nor the L₂: a third system is involved; that of the L₂ learner, which also needs to be described. Nemser (1971: 7) captured this insight through the term 'approximative system': Learner speech at a given time is the patterned product of a linguistic system, L_a [approximative language], distinct from L_s [source language] and L_t [target language] and internally structured.

Interlanguage was the term introduced by Selinker (1972) that became widely accepted for the L₂ learner's independent language system. Selinker emphasized not just the existence of interlanguage but also where it came from. He looked for its origin in the processes through which the mind acquires a second language. According to Selinker (1972), L₂ learning differs from first language acquisition in that it is seldom completely successful; 5 per cent of L₂ learners have 'absolute success' in his view. These learners take advantage of a 'latent language structure' in the mind like that used in L₁ acquisition, that is to say the Language Acquisition Device (LAD). 95 per cent of L₂ learners fail to reach target language competence. That is, they do not reach the end of the interlanguage continuum. They stop learning when their interlanguage contains at least some rules different from those of the target language system. Selinker referred to this as fossilization. Selinker explained this by suggesting that these unlucky learners are unable to reactivate the "latent language structure" or the 'acquisition device'. Rather they fall back on more general cognitive mechanism, which he labeled "latent psychological structure". Selinker (1972) claims that interlanguage depends on five central processes that are part of the 'latent psychological structure': 1) language transfer; 2) overgeneralization of L₂ rules; 3) transfer of training; 4) strategies of L₂ learning, and 5) communication strategies. To sum up, Selinker's views provided the theoretical framework for interpreting SLA as a mentalistic process and for the empirical investigation of language-learner language. As a result of interlanguage theory and the evidence accumulated from Error Analysis, errors were no longer seen as 'unwanted forms' (George, 1972), but as evidence of the learner's active contribution to SLA (see Echevarria et al., 2004; Rosenberg, 2009).

Interlanguage Theory can be examined as an example of a cognitive account of L₂ acquisition and, it has, also, informed linguistic approaches in SLA research. Linguistic accounts of interlanguage are directed at describing learners' competence, conceptualized as an abstract system of rules and items that underlie actual performance. They are concerned with what learners 'know', not with what they 'do' (Ellis, 2008: 348). Interlanguages, according to Adjemian (1976) are 'natural languages' and, therefore, subject to all the same constraints. They consist of 'a set of linguistic rules which can generate novel utterances' (Adjemian, 1976: 299). In addition, 'interlanguages' should be amenable to linguistic analysis, like natural languages, and the goal should be to describe and explain the nature of the learners' competence at different stages of development. The focus; then, should be on 'the grammatical nature of a learner's interlanguage rather than strategies (1976: 306). In this sense, Adjemian put the case for a linguistic approach to the study of interlanguage (see Eckman, 1991; Selinker, 1992).

4.3. Grammatical Morpheme Research

Dulay and Burt (1973) attempted to answer the question "is there a common sequence with which children acquiring English as a second language learn certain structures?". They found that there does seem to be a common order of acquisition for certain structures in L₂ acquisition. This result was important for the emerging discipline of SLA research in the early 1970s. "Demonstrating the existence of an L₂ sequence of acquisition proved there was a point to developing SLA research separately from the study of the L₁ and the L₂ and from L₁ acquisition; in short, L₂ learners had interlanguages of their own that were valid objects of study (Cook, 1993: 27). Moreover, Dulay and Burt (1980) went beyond a sequence of particular items to group the morphemes into 'hierarchies' of those that tend to go together in the

sequence (Dulay and Burt, 1974). In this connection, Krashen (1977) argued that it was more meaningful to discuss acquisition in terms of a hierarchy of morphemes than morpheme by morpheme. The general picture that emerges is that the 'acquisition order' for various grammatical morphemes is more or less the same, irrespective of the subjects' language backgrounds, of their age, and of whether the medium is speech or writing. The only time that a different order occurs is when the elicitation instrument required the subjects to focus on the form rather than the meaning of their utterances. As Krashen (1977:148) puts it, where the data represented a focus on meaning there is "an amazing amount uniformity across all studies" (see Lee, 2000; Poole, 2003, 2005; Reynolds, 2010).

4.4. SLA in the Late 1970s

During the late 1970s Stephen Krashen put forward an account of SLA first known as the Monitor Model. In the early 1980s this was expanded into a broader-based model, described in Krashen (1981; 1982). The aspect of the model that became most developed was termed the Input Hypothesis (Krashen, 1985). The question that concerns us, here, is the linguistic aspect of Krashen's views, and how linguistics contributes to our understanding of SLA. Krashen's theory consists of five linked 'hypotheses': input; acquisition/learning; monitor; natural order; and affective filter. Krashen proposes a general theory of L₂ acquisition that attempts to answer the three questions: 1) What constitutes knowledge of languages?; 2) How is knowledge of languages acquired?, and 3) How is knowledge of languages put to use?. As mentioned before, these questions are related to the basic three questions for linguistics, defined by Chomsky (1986).

First, Krashen suggests that knowledge of language in L₂ users takes two forms: acquired and learnt knowledge. In the acquisition/learning hypothesis, Krashen claims that adult or adolescent language learners have two processes at their disposal to help them in developing language fluency. One is acquisition, the other, learning. Acquisition is subconscious and takes place through natural language interactions, similar to those available to children when they acquire their mother tongue. Learning, on the other hand, requires conscious thought and analysis and takes place predominantly in formal instruction. According to Krashen, only language that has been acquired is available for use in spontaneous communication. In this connection, Cook (1993: 32) argues that 'in many ways Krashen's [views] are within the general agenda set by linguistics. The division into acquired and learnt knowledge reflects the division of the mind into modular faculties; the language faculty is separate from other faculties, such as the number faculty or the faculty of mathematics (Chomsky, 1980). Linguists often assume that language itself is learnt only through the language faculty, without utilizing other faculties or general learning abilities. Krashen makes the Chomskyan Language Acquisition Device (LAD) a core element in his model. The fact that acquisition relies on built-in abilities of the mind reflects on assumption of the Chomskyan theory already seen in Selinker's concept of 'latent language structure'.

Moreover, Ellis (1986) points out that 'acquired' knowledge are located in the left hemisphere of the brain (in most users) in the language areas; it is available for automatic processing. 'Learnt' knowledge is meta-linguistic in nature. It is also stored in the left hemisphere, but not necessarily in the language areas; it is available only for controlled processing. Thus, 'acquired' and 'learnt' knowledge are stored separately. In performance, 'acquired' knowledge serves as the major source for initiating both the comprehension and production of utterances. 'Learnt' knowledge is available for use only by the Monitor.

Second, according to the Input Hypothesis, humans acquire language in only one way-by understanding messages or by receiving 'comprehensible input' (Krashen, 1985: 2). To be useful to the learner, the input must be neither too difficult to understand nor too easy. This is conceptualized by Krashen in terms of the learner's current level, called *i*, and the level that the learner will get to next, called *i+1*. As Cook (1993) points out, for the learner to progress rather than remain static, the input has always to be slightly beyond the level at which he or she is completely at home; the gap between the learner's *i* and the *i+1* that he or she needs is bridged by information drawn from the situation and from the learner's previous experience. Moreover, comprehensible input relies on the actual language forms being incomprehensible, not the total message. Learners have to struggle to derive meaning for the parts they do not understand rather than understanding the sentence completely (White, 1989; Jiang, 2007; Sheen, 2005).

Third, knowledge comes into play through the 'Monitoring' of speech. Monitoring provides a conscious check on what the speaker is saying. Anything the learner wants to say comes from acquired knowledge; learnt knowledge can monitor this speech production before or after actual output. Monitoring takes place 'before we speak or write or after [self-correction] (Krashen, 1982: 15). The 'Monitor Hypothesis' claims that consciously 'learnt' knowledge is only available for Monitoring rather than usable in other ways. In addition, the extent to which a given learner uses Monitoring depends on several factors: tasks that focus on 'form' rather than meaning will encourage Monitoring; the personality of learners varies between those who under-use, monitoring, over-use monitoring, or use monitoring optimally. The question which imposes itself is 'why is not acquisition equally successful for all L₂ learners, even when they receive apparently identical comprehensible input?' According to Krashen (1982: 66) 'comprehension is a necessary condition for language acquisition but it is not sufficient' "something more than comprehensible input is needed. For acquisition to take place, the learner has to be able to absorb the appropriate parts of the input. There can be a mental block that prevents acquirers from fully utilizing the comprehensible input they receive for language acquisition' (Krashen, 1985:3). This block is called "the affective filter." That is, the acquirer may be unmotivated, lacking in self-confidence, or anxious. If the filter is 'up', comprehensible input cannot get through; if it is 'down', they

can make effective use of it. In Krashen's words, 'comprehensible input and the strength of the filter are the true causes of second language acquisition (1982: 33). (see Loewen & Thompson, 2009; Kimberly, 2009; Hoey, 2007).

In his evaluation of Krashen's theory, Cook (1993) argues that this theory attempts to answer the three questions previously posed. In many ways Krashen's theory is within the general agenda set by linguistics. First, Krashen, suggests that knowledge of language in L₂ users take two forms: acquired and learnt knowledge. Such knowledge is created by two separate processes; 'acquisition' using the natural built-in processes of the mind, and 'learning' using conscious rational processes. This division (acquired and learnt) knowledge reflects the division of the mind into modular faculties; the language faculty is separate from other faculties (Chomsky, 1980). Linguists often assume that language itself is learnt only through the language faculty, without utilizing other faculties or general learning abilities (Cook, 1993: 58). In addition, the use of the L₂ can involve a distinct process of Monitoring which brings the speaker's learnt knowledge to bear on the sentences produced by acquired knowledge. The fact that 'acquisition', according to Krashen, rules on built-in abilities of the mind reflects an assumption of the Chomskyan theory. On the other hand, Krashen is, also, proposing something which is often linked to LAD (language Acquisition Device). According to Krashen, the learner does not test hypotheses, as the hypothesis-testing model of the 1960s suggested, but progresses along a pre-ordained sequence (The Natural Order Hypothesis).

5. LINGUISTIC UNIVERSALS, L₁ AND L₂

The study of linguistic universals has contributed to explanations of SLA. The study of linguistic universals can help to overcome one of the major problems of the Contrastive Analysis hypothesis, namely that not all the linguistic differences between the native and target languages result in learning difficulty. Linguistic universals can be used to help predict which differences lead to difficulty and which ones do not. Thus, the study of linguistic universals has helped to revamp transfer theory (Ellis, 1986).

Two rather different approaches to describing linguistic universals have been adopted. Chomsky (1965, 1980, 1981) seeks to identify linguistic universals by the in-depth study of a single language. He argues that only in this way is it possible to discover the highly abstract principles of grammar that constrain the form of any specific grammar. He refers to these principles as universal Grammar. In contrast, Greenberg (1966) and others (for example, Comrie, 1981) have set about identifying universals by examining a wide range of language from different language families in order to discover what features they have in common. The universals established in this way are referred to as typological universals. Cook (1985: 15) in a lucid explication of the Chomskyan view of Universal Grammar writes: "The language properties inherent in the human mind make up 'Universal Grammar', which consists not of particular rules or of a particular language, but a set of general principles that apply to all languages". Universal Grammar is composed of different kinds of universals. Chomsky (1965) identifies two types: substantive and formal; substantive universal consist of fixed features such as the distinctive phonetic features of which sounds are made, or syntactic categories such as noun, verb, subject and object. Formal universals are more abstract. They are statements about what grammatical rules are possible. Much of Chomskyan linguistics is taken up with the search for formal universals.

Chomsky's explanations for the innateness of Universal Grammar are that without a set of innate principles it would not be possible for a child to learn the grammar of his mother tongue. This is because the data available from the input are insufficient to enable the child to discover certain rules. The rules that the child discovers with the aid of Universal Grammar form the core grammar of his language. However, not all rules are core rules. Every language also contains elements that are not constrained by Universal Grammar. These comprise the 'periphery'. The child's knowledge of his mother tongue is made up of rules determined by Universal Grammar (the core) and those that have to be learnt without the help of Universal Grammar (the periphery). White (1981) argues that a less marked grammar is easier to acquire than a marked one, because it requires less elaborate triggering experience. In other words, the child finds it easier to acquire the unmarked rules comprising the core grammar of his mother tongue than the marked rules that form the periphery. This is because the unmarked rule is considered to be immediately available to the child, whereas more marked rules require varying amounts of positive evidence from the input. In this regard, Cook (1985: 17) maintains that: "The child prefers to learn unmarked rules that conform to Universal Grammar rather than marked rules that do not square with it... Core Grammar and peripheral Grammar are weighted differently in the Child's mind". Finally, Chomsky's primary justification for Universal Grammar is that it provides the only way of accounting for how children are able to learn their mother tongue. As Ellis (1986) explains, Universal Grammar, then, is the solution to what is called 'the logical problem of language acquisition'. The child needs to be constrained from making incorrect hypothesis. These constraints are not provided by the input data, so they must be part of the child's biologically determined endowment. Without Universal Grammar it would not be possible for a child to acquire a language successfully.

6. LINGUISTIC UNIVERSALS AND L₂

Universal Grammar theory does not concern itself with second language acquisition. The application of the theory to this domain has come about through recent work of a number of second-language researchers. In other words, Chomskyan theory has been concerned almost exclusively with the acquisition by the child of a first language. As

McLaughlin (1987: 96) maintains, "in his early writings Chomsky seemed to believe that second language learning used other faculties of the mind than did first-language learning and so fell outside the domain of universal Grammar theory".

The role of linguistic Universals in SLA is more complicated than in L₁ acquisition. This is because SLA involves two languages: the target language and the learner's native language. Thus, the L₂ learner brings two types of linguistic knowledge to the task of SLA: his knowledge of linguistic universals, and the specific grammar of his L₁. Furthermore, he must presumably 'know' which rules in his L₁, belong to the core and which to the periphery. Most second-language researchers who adopt the Universal Grammar perspective assume that the principles and parameters of Universal Grammar are still accessible to the adult language learner. They have used the concept of markedness to examine various acquisition problems. Mazurkewich (1984a, 1984b) has argued that Chomskyan Universal Grammar theory and the associated theory of markedness can serve as powerful predictors of the acquisition of dative structures by L₂ learners. She reported (1984a) that L₂ learners were more likely to judge as correct sentences with the unmarked dative prepositional phrase complement (Give the book to Mary) than the marked double noun phrase construction (Give Mary the book). In another study, Mazurkewich: 1984b) found that unmarked passivized direct objects (A football was thrown to Phillip) were learned before marked passivized indirect objects (Phillip was thrown a football). These findings were seen as evidence for the claim that the determining factor in the acquisition of interlanguage syntax is markedness as defined within Universal Grammar theory.

The following reflect widely held views: 1) learners transfer unmarked L₁ forms when the corresponding L₂ forms are more marked; 2) the effect of the L₁ will be observed more strongly where peripheral rules in the L₂ are concerned; 3) marked forms are not transferred into interlanguage, particularly when the L₁ possesses both marked and unmarked constructions; 4) marked forms may be transferred in the early stages of SLA, and 5) an L₁ pattern that corresponds to an interlanguage can accelerate or delay SLA, depending on whether the correspondence is with an early - or late occurring developmental pattern (Ellis, 1986). UG allows for variation between languages through parameters; languages can only vary within the pre-set limits for a particular parameter. The parameter itself is universal but the values it may take vary from one language to another.

The question that most L₂ researchers often consider is whether UG is actually involved in L₂ learning. This has been posed as a choice between three possibilities (Cook, 1985). In the no-access position, L₂ learners acquire the L₂ grammar without any reference to UG, that is, the grammar is learnt through other faculties of the human mind and, probably, in the same way as any other aspect of knowledge-cookery, physics or whatever. In a direct-access position, L₂ learners learn in exactly the same way as L₁ learners. In an indirect-access position, L₂ learners have access to UG through what they know of the L₁, but they start with the L₁ parameter settings rather than as part of the synchronic state of the mind. A major controversy surrounds the issue of whether all the principles and parameters are present in the mind to start with or whether they come into being over time. In other words, "are the principles and parameters like the heart, which is structurally complete at birth, or like the teeth, which grow and are replaced over many years"? (Cook, 1993: 203). Borer and Wexler (1987) proposed that the UG properties themselves 'grow' in the mind over time.

To conclude, much of the previous discussion has assumed that language is represented and acquired by the human mind in ways that are different from any other knowledge. Linguistics theories have often assumed that language is learned separately from cognitive skills and operated according to principles that differ from most learned behaviors (Spolsky, 1985). This assumption is represented in analysis of unique language properties such as developmental language order, grammar, knowledge of language structures, social and contextual influences on language use, and the distinction between language acquisition and language learning.

7. COGNITIVE FRAMEWORKS: BRIEF HISTORICAL DEVELOPMENT

The systematic cognitive study of SLA began in North America in the 1950s, although its roots lead back to Rene Descartes, the main founder of modern western philosophy (Atkinson, 2011). Chomsky (2007: 38) has called Descartes' ideas "the first cognitive revolution" and perhaps the only real one.

The cognitive revolution was a direct response to American behaviorism. Behaviorists banned cognition as an unscientific explanatory variable, partly because mental activities could not be directly observed or measured, and partly because their theories gave it no place (Atkinson, 2011). The result, accordingly, was a vision of humans as more or less blank slates at birth, rote learners, and mechanical actors. As Gardner (1985: 11) explains, "the mathematical psychologist George Miller and his colleagues promoted a vision of human beings as both active, constructive problem solvers and limited-capacity information processors.

The cognitive revolution was positively affected by the development of the digital computer. In this regard, Atkinson (2011: 8-9) has referred to Herbert Simon and Alan Newell who "produced a program that solved logic problems using thought-to-be humanlike strategies; paving the way for more ambitious attempts to stimulate human problem-solving". Another force behind the cognitive revolution was Noam Chomsky's review of Skinner's "Verbal Behavior", which demolished behaviorism. Chomsky's subsequent influence on the cognitive revolution was profound. Chomsky showed the inadequacies of structuralist linguistics. However, Chomsky's greatest impact came via his radical amputation of cognition from behavior (the famous competence-performance distinction). Another force behind the

cognitive revolution was the developmental psychologist Roger Brown whose research was primarily language-oriented, focusing on L₁ acquisition. In this regard, Atkinson (2011: 100) made the following remark, “Brown and his research associates were not the only researchers studying language acquisition during the cognitive revolution, but they were the most influential. They also helped establish the field of SLA”.

The systematic study of SLA, that grew directly out of the cognitive revolutions, was grounded on the theoretical developments initiated by Corder (1967)’s paper, “The significance of learner’ errors’, which is often cited as the founding manifesto of the field” (Atkinson, 2011: 11). In this paper, Corder framed his proposal squarely in cognitive psychology’s critique of behaviourism, Brown’s L₁ acquisition research, and Chomsky’s linguistic theory. To sum up, “if Corder’s paper was the original theoretical impulse for organized SLA studies, then pioneering research by others furnished its empirical foundations (Atkinson, 2011: 12). Examples of such a research are; for example, Krashen (1985); Richard Schmidt (1990a,b; 1992; 1993a,b; 1994a,b; 1995a,b; 2001).

7.1. Cognitive Frameworks: Basic Premises Preliminaries

Wallace (2007: 18) points out that the term, “Cognitivism” is typically used to denote the doctrine that (1) “the mind/brain is the necessary and sufficient locus of human thought and learning; and (2) such thought and learning is a form of information processing”. “The common research objective of cognitive science is to discover the representational and computational capacities of the mind and their structural and functional representation in the brain”. (The Sloan Foundation, 1978: 75-76). Larsen-Freeman (2007: 775) described the cognitive approach to SLA as “one that does not see language as behavior, one that no longer ignores the mind, one that puts cognitivism squarely at the forefront of its explanations”. As Atkinson (2011: 1) points out “language may be a social semiotic”, but above all it is a cognitive product. Its development is, therefore, first and foremost a cognitive process. Davis (1995: 427-428), also, states that “theorists and researchers tend to view SLA as mental process, that is, to believe that language acquisition resides mostly, if not solely, in the mind”. As Doughty and Long (2003: 4) have argued, language learning, like any other learning, is ultimately a matter of change in an individual’s internal mental state. As such, research on SLA is increasingly viewed as a branch of cognitive science.

The following criteria are widely shared by mainstream cognitive science (see for more details, Boden, 2006; Coastal, 2007; Wheeler, 2005): (1) Mind as computer; that is, cognition is information processing which is carried out through a set of operations that take in input, process it, and produce output on the model of a computer; (2) Representationalism; that is, cognitive knowledge is stored as internal representations; (3) learning is defined as abstract knowledge acquisition; (4) Centrality of language, and language as code; that is, language has a central place in cognitive doctrine and it is a tool for decoding and encoding information (Atkinson, 2011; 4-5).

7.2. Discussion

The next section spells out some alternatives to the linguistics-based approach to L₂ research. Language can be accommodated in a broader framework of how people store and acquire knowledge in general rather than being seen as something unique and peculiar of its own (See Schmidt, 1990a, b; 1992; 1993a, b; 1994a, b). As O’Malley, Chamot and Walter (1987: 288) maintain language and linguistic processes are often viewed as interacting with cognition but nevertheless maintaining a separate identity that justifies investigation independent from cognitive processes. The claim behind a cognitive theory of L₂ acquisition is that L₂ acquisition cannot be understood without addressing the interaction between language and cognition. This interaction is only poorly understood. In addition, L₂ acquisition is best understood as a complex cognitive skill.

The cognitive framework of learning emerges from cognitive psychology and is based, in part, on information processing and, in part, on studies and theory that have evolved over the past fifteen years or so, on the role of cognitive processes in learning (see Wong, 2004). In cognitive psychology, mental processing plays a central role in all learning and is the basic mediating variable for influences on learning that are external to the learner, such as task characteristics and complexity, or internal influences such as developmental level, ability, or motivation. Rather than stressing innate, universal linguistic processes, affective factors, input, or interaction as causative factors for L₂ development, Cognitive Theory sees second language learning as a mental process, leading through structured practice of various component subskills to automatization and integration of linguistic patterns (Schulz, 1991). For more details, see Segalowitz, 2011; Tyler, 2011; Robinson & Ellis, 2011; Conley, 2008).

Cognitive Theory maintains that skills become automatic or routinized only after analytical processes. Controlled analytical processes are seen as 'stepping stones' for automatic processes (McLaughlin 1987). Rather than positing a hierarchical development of linguistic structures, such as suggested by Interlanguage Theory, Cognitive Theory posits a hierarchy of complexity of cognitive subskills which lead from controlled practice to automatic processing of language. As the learner develops increasing degrees of mastery, he or she engages in a constant process of restructuring to integrate new structures with those previously learned. The following are some common factors in the cognitive approaches to L₂ acquisition:

- 1) The mind is seen as a single overall 'network' in which everything is connected; "language universals" derive from universal properties of the human mind" (Mac Whinney and Bates, 1989: 6);

- 2) Speech production is information-processing; a process of activating the network in all its complexity, driven top-down to achieve particular goals;
- 3) Learning is a progress from declarative, 'controlled', well-attended, data to procedural, 'automatic' non-attended, processes (Leow, 2000, 2001).
- 4) Learning is acquiring strengths for parts of this network based on frequency of occurrence; "language acquisition is cue-driven distributional analysis" (Mac Whinney and Bates, 1989: 26) (see Sharwood-Smith, 2004).

Human beings are capable of learning an almost limitless number of skills. Research has shown that improvement is possible with practice. However, there seem to be definite limits to the level of proficiency that an individual may reach in the performance of any particular skilled activity. The prediction of performance limits is of major interest to human performance theory. On the other hand it is seldom possible to predict when or if an individual has reached the limits of his capacity in a particular activity because actual performance approaches these limits so slowly. The changes in performance that occur when learning multidimensional activities, which require the individual to do more than one thing simultaneously, require time and effort. Attention must be devoted to each component of the movement, and beginning attempts at the skill are often slow and error prone. Eventually, with practice, performance improves to the point where multidimensional tasks can be carried out quite rapidly and accurately. The development of automaticity for tasks requiring multiple dimensions may require many hours of practice. Research indicates that the rate of acquisition for complex tasks may be enhanced by developing an appropriate practice schedule. In this regard, Ellis (2011) argues that although cognitive accounts of L₂ acquisition are still concerned with what the learner 'knows', knowledge is considered to be inseparable from actual use. The focus, then, is not an abstract linguistic knowledge, but on the extent to which the learner has achieved mastery over the formal and functional properties of language and mental processes involved. The basic assumption of all cognitive theories is that 'mastery' is gradable and that there are degrees of 'knowing'. It is with regard to this notion of 'mastery' that the theories can be seen as cognitive in nature" (Ellis, 2011: 348). Ellis' views may be more clarified in the following discussion.

7.3. Interlanguage Theory in the Cognitive Account

Cognitive theories of interlanguage postulate that, with the assistance of learning strategies, learners build mental grammars of the L₂. These grammars account for performance in the same way as a native speaker grammar; that is; learners draw on the 'rules' they have constructed to interpret and produce utterances. These mental grammars are perceived as dynamic and subject to rapid change. Thus, the interlanguage continuum consists of a series of overlapping "grammars". The following points can be made:

1. Each grammar shares some rules with the previously constructed grammar, but also contains some new or revised rules;
2. Each grammar or interlanguage is likely to be characterized by competing rules, leading to a set of co-existent approximative systems;
3. Accordingly, L₂ acquisition is characterized not by "simplification", but by "complexification", that is, each grammar that the learner build is more complex than one that preceded it;
4. L₂ learners, unlike L₁ learners, generally do not reach the same level of competence as native speakers and their 'final state' grammar is not the target-language grammar because certain rules and items fossilize (see Ellis, 2011; Selinker, 1972; Mukkatesh, 1986).

7.4. Attention and Human Performance

Attention capacity refers to our ability to do more than one task at the same time. Many experiments have shown that our ability to attend to several sources of information simultaneously is severely restricted (Broadbent, 1971). The human can be regarded to have limited-capacity that can, only transmit a limited amount of information per second. Whenever this amount is exceeded, people make errors. According to Broadbent's (1971) model of attention, a human who must process information that exceeds channel capacity will make mistakes. Two characteristics of attention are selectivity and mental effort. Selectivity is necessary to keep us from becoming overloaded with too much information. Early theories of attention (Broadbent, 1958; James, 1890) thought selectivity occurred at a bottleneck, a stage that could process only one message at a time. Broadbent's filter theory specified that the bottleneck occurred at the perception or pattern recognition stage, and attention was represented by a filter that preceded this stage. Treisman (1960) modified Broadbent's filter theory to allow for the occasional recognition of words on an unattended channel. She proposed that a filter mechanism attenuated to an unattended message. Important words or expected words could be recognized on the unattended channel if their thresholds were low enough to be exceeded by the attenuated message. Unlike Broadbent and Treisman, Deutsch and Deutsch (1963) suggested that the bottleneck occurs after perception and determines what is selected into memory.

The results of many experiments on selective listening failed to agree on the location of the bottleneck. This limitation led to a shift in theorizing that encouraged more flexible views of the stage at which the selection of attended information occurs. Capacity theories emphasize the amount of mental effort that is required to perform tasks and are concerned with how effort is allocated to different activities. A capacity theory supplements a bottleneck theory by

proposing that the ability to perform simultaneous activities is limited when the activities require more mental effort than is available. An important issue to consider when looking at attention is how an individual changes his resource allocation so as to be able to go from the performance of a single task to the performance of multiple tasks. Understanding this phenomenon is critical for developing skill in performing either high workload tasks or tasks which require multiple concurrent levels of processing. William James (1890: 403-404) suggests that:

Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought. Focalization, concentration, of consciousness is of its essence. It implies withdrawal from some things in order to deal efficiently with others.

James (1890) identified two important features within the phenomenon of attention. First, attention is limited. An individual can attend to only one thing at a time or think only one thought at a time. Attention also appears to be serial in that we appear to attend to or perform first one thing, then another, and we find it very difficult (sometimes impossible) to mix certain activities. Furthermore, attention is often conceived as a relatively slow and serial activity, the focus of attention being in one "place" at one time (see Tomlin & Villa, 1994; Schmidt, 1995a, b; 2001). It has been equally clear to researchers in the field of attention that normal human behavior could not take place if all activity had to be governed by attentive processes operating in such a limited fashion. Almost any skilled activity, whether involving actions (e.g., sports, music performance, typing, automobile driving, flying an airplane) or mental operations (e.g., reading, retrieving information from memory, perceiving) is carried out with such a complex set of operations occurring in parallel that much of the behavior must be occurring outside the normal focus of attention. Partly for this reason, researchers have incorporated various types of automatic processes into their theories (Schneider & Fisk, 1982a; Schneider & Fisk, 1982b; Schneider & Fisk, 1984; Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977).

7.5. Automatic versus Controlled Processing

Automatic/controlled processing theory suggests that two qualitatively different forms of processing can account for the marked changes that can occur in performance with consistent practice (Schneider, Dumais, & Shiffrin, 1984; Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977). Controlled processing is characterized as slow, effortful, capacity-limited, and largely under subject control. Automatic processing is characterized as fast, parallel, relatively effortless, and largely not under subject control. The processing demands of most complex tasks typically reflect neither purely automatic nor purely controlled processing, but rather a mixture of the two (Schneider & Fisk, 1984). One of the most common findings in the training literature is that increased practice almost always leads to improved performance in terms of both quality and speed (Newell & Rosenbloom, 1981). It has been widely suggested that skilled performance is due in large part to a decrease in the total amount of attentional capacity that must be devoted to a task and to an increase in the efficiency of responding through the removal of unnecessary elements (Kahneman, 1973).

The mechanisms by which reductions in attentional capacity can be made without reducing performance have not been completely specified; however, there is substantial evidence that as stimuli become increasingly familiar, they are more likely to be recognized before entering working or short-term memory. The processing of highly familiar stimuli is believed to occur in what is termed a preattentive processing stage (Shiffrin & Schneider, 1977). Such preattentive processing has at most a minimal effect on the available resources of working memory so that the individual can process other information simultaneously without deficit. The available evidence indicates that automatization develops when conditions permit lower level processing regions of the brain to assume control over encoding and responding (Gabriel, Foster, Orona, Saltwick, & Stanton, 1980; Thatcher & John, 1977). Automatized processing seems to develop only under particular conditions. Increasing practice or stimulus familiarity is a necessary but not sufficient condition for automatization to develop. It is critical that there also be consistency of practice or stimulus presentation (Schneider & Fisk, 1982). For example, in visual-search experiments in which the subject must look for particular items (targets) in an array or field of irrelevant stimuli, large increases in performance speed are found when the same targets are used consistently over different trials (Logan, 1979). The occurrence of parallel search and processing of stimuli by subjects is indicated by the findings that set size functions, i.e., the number of targets, and the time it takes to find them is reduced as practice becomes extended. On the other hand, if the targets are changed from trial to trial, then automatized encoding does not seem to develop even after prolonged practice (Kristofferson, 1972).

Fisk and Schneider (1981) showed that both qualitative and quantitative differences existed in stimulus processing in consistent, as opposed to variable, stimulus-search conditions. Fisk and Schneider (1984) also showed high transfer of automatized processing to stimuli in the same class as the original stimuli. Nevertheless, the similarities between the original and the transfer task must be substantial, at least on those dimensions that have become automatized, for such positive transfer to be demonstrated.

On the other hand, Schneider and Fisk (1984) have shown that automatized processing can occur to task components that have consistent requirements even if there are other task components that are not consistent. In general, there seems to be at least an initial deficit in performance even with small changes in the transfer task (Bitchener & Knoch, 2008; Bitchener, 2008; Bitchener et al., 2005). One implication of automatized stimulus processing is that the reduction of an attentional resources devoted to one task makes the simultaneous performance of a second task more feasible. In the most favorable case, a fully automatized task should permit Task 2 training of a second task (not

incompatible with the first) without deficits in the simultaneous performance of either of the tasks (Rieck, Ogden, & Anderson, 1980). It should be noted that dual task performance can also be affected by task restructuring (Cheng, 1985), although the effects of restructuring would not necessarily produce identical dual-task performance compared to automatization.

7.6. Part-Whole Training

For several decades serious attention has been devoted to the study of techniques by which materials may be organized for presentation to the learner. Much of this investigation has centered on the topic of whole versus part learning. Part-task training refers to practice on a subset of components comprising a whole task. The logic behind part-task training is that learning can proceed more efficiently. The so-called Naylor hypothesis is embodied in two principles: 1) as complexity is increased for relatively highly organized tasks, training the whole task should work better than training parts of the task; and 2) as complexity is increased for relatively less organized tasks, training parts should become more efficient than training the whole task. These principles suggest that the more independent a task's parts, the more it should be learned as a whole; the more interdependent a task's parts, the more its parts should be separated for training. Stammers (1982) conducted four experiments to evaluate the generality of these principles by evaluating part and whole learning in a procedural control panel task and a list learning task made up of operational instructions. On the whole, Stammers (1982) found little support for the notion that practicing parts of a task produces advantages over practicing the whole task. Differences between training groups were small, with whole training gaining a slight advantage. Nevertheless, he cautioned that deciding to use one form of training over another should be made on the basis of empirical observations rather than on some analytical principles. Although Stammers has helped to illuminate a literature filled with conflicting results, it should be noted that neither the studies reviewed nor his own experiments adequately address the issue of task interdependence and complexity as it pertains to the relative efficacy of part-task practice for concurrent tasks. Several researchers examining part-whole learning in dual-task situations emphasize whole-task practice. An alternative to decomposing a complex task into its component parts and practicing them separately exists in the form of adaptive training. In adaptive training the task is first simplified and is then made progressively more difficult as the learner acquires greater levels of expertise. Typically the learner is exposed to the whole task or almost the whole task to be mastered. In this way, each component is practiced in the context of the whole task. Johnson and Haygood (1984) have found that progressively challenging the learner in a primary simulated driving task (tracking) and a secondary visual detection task resulted in better performance than training in the single-task conditions.

Although cognitive psychology can offer a variety of theoretical frameworks for multi-task performance, there are no models that predict single- to multi-task transfer. None of the present frameworks directly address the issue of transfer from single- to multiple-tasks. To understand issues related to transfer, much more research is required. Also, the part- whole training literature does not provide a strong support for either part or whole training. Nor does it identify critical variables that can predict when and how much part-task training should precede multi-task training. In general, most complex, real-world skills, e.g. piloting, driving, and programing are initially developed via part-task training until at least some basic level of proficiency is reached before multi-task training is begun.

8. EMPIRICAL EVIDENCE

Study (1): Conscious Knowledge and L₂ Writing

The first experiment was designed to examine the written output of foreign students with a view to finding answers for the following two questions (1) are student's errors in grammatical structures, as they will appear in their written output, due to deficiency in their conscious grammar rules, or to deficiency in their abilities to transfer this knowledge (if it exists) to other language tasks such as writing compositions in English?, and (2) can conscious rules of grammar guide students' performance in monitoring ? (Self-correcting) their written output once their attention is drawn to an error? The main hypothesis of this study was that the foreign students who participated in the experiment would not be able to utilize their conscious knowledge of grammar effectively in writing because it was too vague or fragmentary and the complexity of L₂ writing as a multidimensional cognitive skill.

Fifteen subjects participated in this study. There were nine females and six males. The subjects were asked, first, to write an essay of about two hundred words. The topic was 'the value of learning English'. It was chosen because it was related to students' interest and not technical. Second, all subjects performed on two tasks: unfocused and focused correction tasks. The basis of these two tasks was the morphosyntactic errors that appear in each student's essay. In the unfocused correction task, all sentences with morphosyntactic errors were provided. Each sentence contained one or more errors from the individual's essay. Each student was told that there were grammatical errors in the sentence and was asked to correct them. Having done this task, students were given written instructions on how to work on the 'focused correction task'. In this task, the same sentences from the student's essay were presented. This time, the student's attention was drawn to the specific errors (the errors were underlined). Finally, each student was interviewed to explain his/her performance in the essay, the unfocused correction task and the focused correction task. During the interview, students were asked to explain why changes were made and were probed to clarify as often as necessary. Students' explanations were tape-recorded and transcribed.

The data analysis had a qualitative and a quantitative, interpretative part. The quantitative part consisted of a statistical comparison of the number of errors in the composition, unfocused correction and focused correction tasks (by means of one-way ANOVA). The qualitative part was an analysis of each student's conception of the grammatical rules that were violated in order to explain any discrepancies between their performances in the tasks. The following table presents the number of students' errors in the essay, unfocused correction and focused correction tasks.

Table (1). Number of students' errors in the essay unfocused correction and focused correction tasks.

Subject	Essay	Unfocused Correction			Focused Correction		
		Remaining	New	Total	From Remaining	From New	Total
1	8	4	3	7	1	2	3
2	27	8	5	13	1	3	4
3	9	3	1	4	0	0	0
4	18	7	4	11	0	4	4
5	23	7	1	8	3	2	5
6	17	11	1	12	12	0	12
7	9	1	5	6	3	0	3
8	12	6	0	6	0	2	2
9	12	4	5	9	2	1	3
10	7	1	4	5	0	0	0
11	15	8	0	8	6	2	8
12	11	2	2	4	2	1	3
13	9	2	4	6	6	1	7
14	11	5	0	5	3	1	4
15	25	8	2	10	3	2	5

The following analysis represents the frequency distributions and descriptive statistics for students' errors in the essay, unfocused correction and focused correction tasks.

Table (2). The mean standard deviation and other measures of central tendency of subjects' errors in the essay.

Mean	14.200	Std err	1.665	Median	12.000
Mode	9.000	Std dev	6.450	Variance	41.600
Kurtosis	-0.383	S P kurt	1.121	Skewness	0.920
S F Skew	0.580	Range	20.000	Minimum	7.000
Maximum	27.000	Sum	213.000		

Table (3). ANOVA Summary Table.

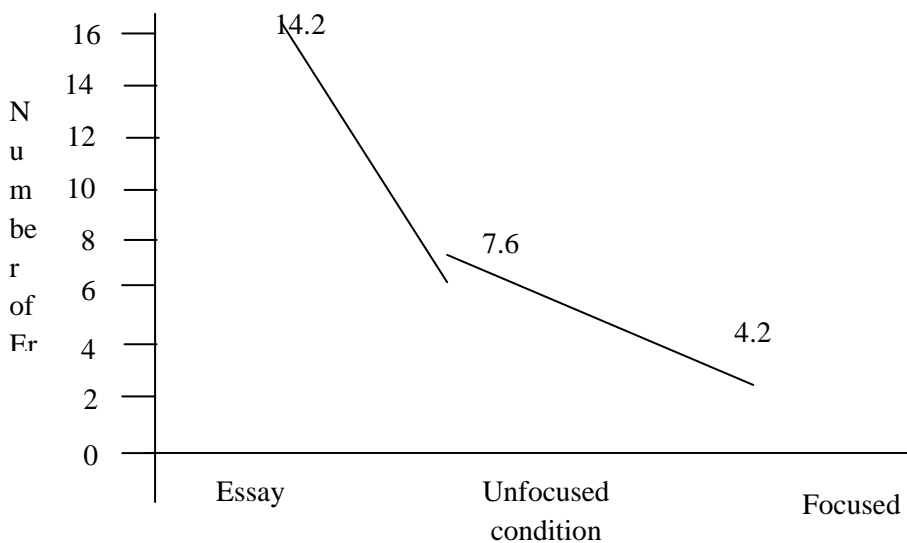
Source	SS	D.F	MS	P
Type of task	775.60	2	387.80	35.53*
Error	305.73	28	10.92	

* p < 0.001

The statistical analysis indicates that the condition (essay, unfocused correction, focused correction) affected the number of errors made by students. Students made the most errors in the essay, the fewest errors in the focused correction task. The mean number of errors in the essay is 14.2 with a standard deviation of 6.5. The mean number of errors in the unfocused correction task is 7.6 with a standard deviation of 2.9, while the mean number of errors in the focused correction task is 4.2 with a standard deviation of 3.1.

The following figure illustrates the decrease in the number of errors made by the subjects in the three tasks.

Figure (1). Plot of mean number of errors under the three conditions (the essay, the unfocused correction and the focused correction task).



From a linguistic point of view, the results of this study demonstrate that deficiency in students' knowledge of grammar results in inaccurate composition writing and unsuccessful correction of errors. When asked to correct their errors, L₂ learners with deficiency in conscious knowledge of grammar seem to rely on their 'feelings' about the structures of the target language. However, since these 'feelings' are based on incorrect knowledge, L₂ learners tend to follow false assumptions and, in turn, their corrections of errors are unsuccessful. This conclusion is based on four pieces of evidence. First, many errors do not get corrected in the unfocused correction task. An examination of the performance of the subjects shows that none of the subjects was able to correct his/her errors in the unfocused correction task. Second, even when the error is identified (as in the focused correction task), students often fail to correct it. Third, many new errors are introduced, even when the subjects are paying attention. Finally, even when the subjects' errors are eliminated, it is often because students tend to write new sentences instead of correcting them.

In addition to the above analysis, another interpretation can be provided, which is based on cognitive psychology's perspective. That is, in addition to the deficiency in grammar knowledge as a reason for students' inaccurate composition writing, there is another possible reason that makes these students commit many morphosyntactic errors in writing such as the many constraints that writing in a foreign language imposes on foreign language learners and deficiency in students' abilities to transfer their knowledge of grammar to complex tasks such as writing. It can be argued that composing in English as a second language is a multidimensional activity which requires L₂ learners to do more than one thing simultaneously. This argument is compatible with the principles of the attention theory. Two important features within the phenomenon of attention have been identified: 1) an individual can attend to only one thing at a time or think only one thought at a time; 2) attention appears to be serial, and we find it very difficult to mix certain activities, that is, the focus of attention is only on one place at one time. Our ability to attend to several sources of information simultaneously is severely restricted. Consequently, a human who must process information that exceeds his channel capacity will inevitably make errors (see Chan, 2010; Brown, 2009; Ellis et al., 2008).

Moreover, L₂ learners may appear to have the necessary knowledge to make correct responses; however, they are unable to transfer this knowledge while writing; listening to spoken English; reading written texts, and solving certain types of grammatical problems (El-Dali, 1999). In this regard, Gelman & Meck (1986: 30) rightly points out that knowledge of the correct principles does not guarantee correct performance. Principles specify characteristics that a correct performance must possess, but they do not provide recipes for generating a plan for correct performance. Nor do they guarantee correct execution of plan (see Hartshorn et al, 2010).

Study (2): Focus on the Nature of the Task: Types of Knowledge, and Access to Knowledge

Eighty Advanced students in the department of English, Faculty of Arts, Minufiya University participated in this study. They were equally divided into two groups: 1) the male group (N = 40), and the female group N=40). The instruments used in this study were of two kinds: 1) sentence completion task (15 sentences); and 2) error correction task, which consists

of (25) grammatical problems. In the second task, students were asked to do three things: 1) to detect the word or phrase that must be corrected for the sentence to be correct; 2) to provide correct form for the sentence to be correct; 2) to provide correct form for the erroneous item, and 3) to provide their rationalization for their detection and correction of

the error. The first task (Sentence Completion) was analyzed quantitatively. Each sentence was worth one point; so, the total score of this task was 15 points. Some descriptive statistical procedures were applied to see the difference between the males and the females in the sentence completion task; if there- is any. The subjects' performance in this task was used just as an indication of their accumulative linguistic progress. The rationale, here is that L₂ learners' metalinguistic performance is said to be interrelated to their linguistic progress or level in a language (See Appendix 1). The subjects' performance in the second task (error correction) was analyzed qualitatively. The subjects' performance in the Error Correction task is presented in Appendix (2).

Analyzing the subjects' performance in both tasks shows that both males and females perform at a high level, particularly in the first task. This can be taken as an indication of high level of linguistic ability. One may expect, then, that these subjects will demonstrate the same high level of performance in the second task. This expectation can be true if their performance is systemic and stable across various language tasks. However this is not the case in the present study. Comparing the subjects' performance within and between groups clearly shows that these advanced students' metalinguistic ability is not a unitary construct. That is, regardless of being classified as advanced students, their performance varies from one language task to another. It all depends on three factors: (1) the nature of the language task/ grammatical problem: whether it is simple or complex: whether it requires straightforward application of a rule. or thinking strategically; (2) the type of knowledge required by the task itself, and (3) the accessibility of such knowledge. These three factors will be, next, discussed.

1. The nature of the language tasks/ grammatical problems

A convenient means for dichotomizing language tasks is to consider their relative emphasis on code - related features of the language or communicative use of the language. This distinction has been expressed by the terms "Formal" and "Functional" language respectively (Rialystok, 1981). In this regard, Alien (1980) has included a third component which is intermediary to these. Thus, according to his interpretation, when a fluent speaker uses language he draws upon three aspects of language: a structural aspect, which is concerned with the formal features of language including pronunciation, grammatical rules and vocabulary; a rhetorical aspect, which is concerned with the development of generalized rules of spoken and written discourse; and an instrumental aspect, which involves the ability of the speaker to interpret or express the conceptual meaning which is appropriate to a given context. In this regard, Bialystok (1981: 33) rightly points out that

The application of this tricomponential model to the description of language tasks concerns the extent to which the purpose of the task is to focus the learner's attention on the formal, the rhetorical, or the instrumental aspects of language. A grammar task, for example, relies primarily on knowledge of the formal features of language, while a communication task can incorporate formal, rhetorical and instrumental aspects in various degrees.

With the above - discussion in mind, one can argue that the first task (Sentence Completion) is an example of communicative task, in which the subjects draw upon the structural, rhetorical and instrumental aspects, previously discussed. On the other hand, the second task (Error Recognition) relies primarily on knowledge of the formal features of language. As previously stated, the subjects of the study (both males and females) perform at a remarkably high level in the first task. This is why we can argue that these subjects are quite aware of the structural, rhetorical and instrumental aspects of English as a foreign language. Unfortunately, this argument turns out not to be necessarily true. Their performance in detecting the error; correcting it, and providing accurate rationalizations for their detection and correction of the error, was not at the same high level of excellency to put it simply, some grammatical problems were very easy for the subjects to solve correctly, and some other problems were extremely difficult to handle. In other words, some problems were easy because they require simple and straightforward application of certain rules. As Skemp (1978) points out, such problems require what he calls instrumental understanding". Other grammatical problems require what he calls "relational understanding", because of its complexity; and therefore, students had to think strategically to solve the problem.

In addition to the nature of the grammatical problem (being simple or complex; requires instrumental or relational understanding) as a factor in shaping foreign language learners' metalinguistic ability, the type of the knowledge required by the task is another factor.

2. The type of knowledge required by the task;

In thinking about foreign language learners' performance as an object of study, the essence of the underlying knowledge that accounts for their performance must be examined. This examination of the learners underlying knowledge will in turn uncover the basis for the strategies they use in solving language problems. In this regard, Gass (1983) suggests that for foreign language learners the ability to think and talk about language might involve abstract analyses of a number of different types. It might include, for example, analyses of their own language, a comparison between their native language and the target language, a comparison between their native language and other languages previously learned, or even a comparison between the target language and other languages previously learned. And, as Johnson (1988) maintains, when learning a language is viewed as learning skills, the process appears to be usefully

broken into two or three phases. The first is the development of declarative knowledge: however, "declarative linguistic knowledge cannot be employed immediately but only through procedures activating relevant parts of declarative knowledge in speech reception and production" (Farch and Kasper, 1986:51). In the second or associative phase, the skill is performed. In the third phase, the skill is continually practiced, and becomes automatic and faster.

With the above background in mind, one can argue that deficiency in the subjects' declarative knowledge may result in (1) failure to detect the erroneous item that must be corrected for the sentence to be correct; (2) failure to decide whether the sentence is correct or incorrect; and, in most cases, the sentence seems grammatically correct although it violates a certain "invisible" grammatical rule. The data provide us with many examples that sustain the above argument. Twenty-nine subjects (13 males and 16 females) were not able to detect the erroneous item in grammatical problem (2). Also, twenty-nine subjects (16 males' and 13 females) failed to correct the error they previously identified. They also failed to provide any rationalizations for their seemingly successful detection of the error. Only seven subjects, out of 80, were able to detect and correct the error, and their rationalizations were correct. This situation can be clearly seen in problems (4; 5; 9; 13; 16; 17; 24; and 25). In addition, because there was no link between declarative and procedural knowledge, many subjects (males and females) failed to correct the item they identified as erroneous, or provide accurate rationalizations for their performance. Therefore, examining the relationships between declarative and procedural knowledge is a worthwhile pursuit since students often fail to recognize or construct these relationships, and, sometimes are able to reach correct answers for problems they do not really understand. In his discussion of this issue, Carpenter (1986) points out that three different models have been proposed to describe the relationship between conceptual and procedural knowledge. The first model hypothesizes that advances in procedural knowledge are driven by broad advances in conceptual knowledge. The second proposes that advances in conceptual knowledge are neither necessary nor sufficient to account for all advances in procedural knowledge. The third model concurs with the first that advances in procedural skills are linked to conceptual knowledge but proposes that the connections are more limited than those suggested by the first model.

It seems that the best way for effective classroom instruction and for improving our students' performance is to link conceptual with procedural. Hiebert and Lefevre (1986) maintain that linking conceptual and procedural knowledge has many advantages for acquiring and using procedural knowledge. These advantages are: (A) Enhancing problem representations and simplifying procedural demands. (B) Monitoring procedure selection and execution. (C) Promoting transfer and reducing the number of procedures required.

Moreover, linking conceptual knowledge and procedural knowledge has some benefits for conceptual knowledge. According to Anderson (1983), problems for which no routine procedures are available are solved initially by applying facts and concepts in an effortful and laborious way. As similar problems are solved repeatedly, conceptual knowledge is gradually transformed into set routines (condition-action pairs) (for solving the problem. The condition-action pairs constitute the basic elements of the procedural system. Thus knowledge that is initially conceptual can be converted to knowledge that is procedural. In addition, procedures can facilitate the application of conceptual knowledge because highly routinized procedures can reduce the mental effort required in solving a problem and thereby make possible the solution of complex tasks). Case (1985) explains this phenomenon by pointing out that efficient procedures require less of one's limited cognitive processing capacity.

To sum up this section, I would like to cite Gelman and Meck (1986: 30):

Knowledge of the correct principles does not guarantee correct performance. Principles specify characteristics that a correct performance must possess, but they do not provide recipes for generating a plan for correct performances. Nor do they guarantee correct execution of plans.

3. Access to knowledge

The results of this study show that the existence of knowledge for a learner is not sufficient to distinguish skilled or fluent performance from less skilled. Through practice and experience the learner must gain easy access to that knowledge. Cognitive psychologists describe this difference in access as "automatic" or "not automatic" or "controlled". In other words, foreign language learners may appear to have the necessary knowledge to make correct responses; however, they are unable to display this knowledge in multi-dimensional tasks such as "Error Correction" task used in the present study. In such a task, learners are required to do more than one thing simultaneously. This argument is compatible with the principles of the attention theory (James, 1890). Two important features within the phenomenon of attention have been identified: 1) an individual can attend to only one thing at a time or think only one thought at a time; (2) attention appears to be serial, and we find it very difficult to mix certain activities. That is, the focus of attention is only on one place at one time. In this regard, James (1890) suggests that "[attention] is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought, focalization, concentrations, of consciousness are of its essence. It implies withdrawal from some things in order to deal efficiently with others" (p. 403 - 404). Relatedly, Broadbent (1971) pointed out that our ability to attend to several sources of information simultaneously is severely restricted. Consequently, a human who must process information that exceeds his channel capacity will inevitably make error. This implies that our students' failure to perform on language tasks may be due, sometimes, to cognitive deficiency; rather than linguistic one. And, in broad terms, language acquisition may not be

fully understood without addressing the interaction between language and cognition. Therefore, further research is needed in this area, at least, to know how our students think and how to teach them to think strategically.

9. CONCLUDING REMARKS

Having reviewed the literature on the issues involved, and presented the results of the experiment, I can make the following remarks:

1. Although linguistics provides a useful perspective on L₁ learning and has led to stimulating ideas and research, it must be remembered that linguistics is only one of the disciplines that second language acquisition (SLA) research can draw on.
2. Relatedly, although it is perfectly proper for SLA research to postulate theories of its own to explain its own area, and to offer its discoveries to other disciplines to help them solve their problems, it is, also, appropriate for SLA research to take insights and methods from other disciplines when they are useful to it. The rationale, here, is that truth can never be known directly and in its totality; and multiple ways of seeing result in multiple truths.
3. Linguistic theories have often assumed that 1) language is represented and acquired by the human mind in ways that are different from any other knowledge. (2) language is learned separately from cognitive skills and operates according to principles that differ from most learned behaviors.
4. The claim made in the present study is that language can be accommodated in a broader framework of how people store and acquire knowledge in general rather than being seen as something unique and peculiar of its own. Accordingly, the present study spells out some alternatives to the linguistics-based approach to L₂ research, represented in the cognitive framework.
5. The claim behind this cognitive framework is that L₂ acquisition cannot be understood without addressing the interaction between language and cognition. In this sense, L₂ acquisition is best understood as a complex.
6. The cognitive framework sees L₂ acquisition as a mental process, leading through structured practice of various component subskills to automatization and integration of linguistic patterns. That is, rather than positing a hierarchical development of linguistic structures, as suggested by Interlanguage Theory, the cognitive framework posits a hierarchy of complexity of cognitive subskills which lead from controlled practice to automatic processing of language. And as the learner develops increasing degrees of mastery, he or she engages in a constant process of restructuring to integrate new structures with those previously learned.
7. According to the cognitive framework adopted in the present study, the changes that occur in L₂ learners' performance, when learning multidimensional activities, which require the individual to do more than one thing simultaneously, require time and effort. Accordingly, attention must be devoted to each component of the movement, and beginning attempts at the skill are often slow and error prone. Eventually, with practice, performance improves to the point where multidimensional tasks can be carried out quite rapidly and accurately.
8. In the experimental study conducted by the author, and reported in the present study, L₂ learners' performance in essay writing was examined from both linguistic and cognitive psychology perspectives. From a linguistic point of view, the results of this study demonstrate that deficiency in students' knowledge of grammar results in inaccurate composition writing and unsuccessful correction of errors. From a cognitive psychology perspective, there is another possible reason that makes the subjects of this study commit many morphosyntactic errors in writing such as the many constraints that writing in a foreign language imposes on foreign language learners, and the deficiency in students' abilities to transfer their knowledge of grammar to complex tasks such as writing. As Collins and Gentner (1980: 67) argue "much of the difficulty of writing stems from the large number of constraints that must be satisfied at the same time. In expressing an idea the writer must consider at least four structural levels: overall text structure, paragraph structure, sentence structure (syntax, and word structure... clearly the attempt to coordinate all these requirements is a staggering job".
9. Based on the above interpretation, it was argued that composing in English as a second language is a multidimensional activity which requires L₂ learners to do more than one thing simultaneously. This argument is compatible with the principles of the attention theory. In addition, it was argued that L₂ learners may appear to have the necessary knowledge to make correct responses; however, they are unable to transfer this knowledge while working on complex tasks. This argument is compatible with Gelman and Meck's view (1986: 30).

To conclude, L₂ learners should not be treated as two native speakers in the same mind but seen as having the unique compound system called 'multi-competence' (Cook, 1993). They are successful bilinguals, not failed monolinguals. L₂ users are not imitation monolinguals in a second language but possessors of a unique form of competence in their own right. Finally, more research is needed to see the extent to which the principles of the cognitive theory can be applied to other language skills such as listening and reading. It is also hoped that the principles of the cognitive theories can be further clarified by researchers, and adopted by practitioners and language teachers.

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Appendix (1)

Table (1). Subjects' raw scores in the sentence completion task.

No.	Males' Scores (TS = 15)	S.	Males' scores (TS = 15)	No.	Females' scores (TS = 15)	No.	Females' scores (TS = 15)
1	14	21	10	1	14	21	11
2	14	22	10	2	14	22	10
3	13	23	10	3	14	23	10
4	13	24	10	4	14	24	10
5	13	25	10	5	14	25	10
6	13	26	10	6	13	26	10
7	12	27	10	7	13	27	10
8	12	28	09	8	13	28	09
9	12	29	09	9	13	29	09
10	12	30	09	10	12	30	09
11	12	31	09	11	12	31	09
12	12	32	09	12	12	32	9
13	12	33	09	13	12	33	09
14	11	34	08	14	12	34	08
15	11	35	07	15	12	35	08
16	11	36	07	16	12	36	08
17	11	37	07	17	12	37	07
18	11	38	07	18	11	38	07
19	10	39	06	19	11	39	06
20	10	40	05	20	11	40	05
Total			410	Total Score			425

Table (2). Means and standard deviation of both males and females in the Sentence Completion Task.

	Number	Means	Standard Deviation	T	Significant
Males	40	15.25	2.15	0.75	Insignificant
Females	40	10.63	2.31		

Table (3). Summary of the subjects' performance in the Error Correction Task.

# of problem	(+ detection (+) correction (+) Ration			(+ detection (+) correction (-) Ration			(+ detection (-) correction (-) Ration			No response			(-) detection		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
1	37	34	71	3	1	4	-	3	3	-	-	-	-	2	2
2	5	2	7	3	2	5	16	13	29	3	7	10	13	16	29
3	34	37	71	-	1	1	4	-	4	-	-	-	2	2	4
4	20	16	36	2	3	5	3	1	4	1	-	1	14	20	34
5	20	22	42	7	7	14	2	1	3	-	-	-	11	10	21
6	10	16	26	13	6	29	3	7	10	2	4	6	12	7	19
7	32	24	56	3	8	11	2	-	2	-	-	-	5	6	11
8	8	4	12	6	5	11	22	27	49	-	-	-	4	4	8
9	-	-	-	-	-	-	23	28	51	5	2	7	12	10	22
10	17	25	42	11	6	17	7	6	13	-	-	-	5	3	8
11	01	-	01	-	-	-	19	20	39	5	4	9	15	16	31
12	20	12	32	12	12	24	-	5	5	2	-	2	6	11	17
13	5	10	15	4	6	10	4	12	16	2	3	5	25	9	34
14	31	19	50	-	8	8	2	1	3	3	4	7	4	8	12
15	31	24	55	-	8	8	4	2	6	1	-	1	4	6	10
16	19	25	44	6	4	10	-	-	-	1	1	2	14	10	24
17	13	17	30	4	2	6	5	1	6	5	2	7	13	18	31
18	28	35	63	8	-	8	-	-	-	2	3	5	2	2	4
19	29	33	62	5	2	7	-	2	2	2	-	2	4	2	6
20	22	31	53	15	5	20	-	2	2	2	2	4	01	-	01
21	5	4	9	2	-	2	15	28	43	8	2	10	10	6	16
22	13	14	27	4	4	8	10	11	21	5	4	9	8	7	15
23	22	15	37	11	16	27	01	5	06	01	2	3	5	2	7
24	01	-	01	-	-	-	17	24	41	08	3	11	14	13	27
25	20	19	39	02	-	02	-	3	03	9	1	10	9	17	26

Appendix (3): Error Correction Task

1. Small animals can survival the desert heat by finding shade during the daytime.
2. Motoring authorities credit mandatory seat-Belt laws for the reduces in traffic fatalities.
3. Vancouver, British Columbia, was named after the man which explored the area in 1792.
4. Belgian chocolates is considered by many to be more finer than any other in the world.
5. The dream of building a permanently staffed space station it may soon become a reality.
6. It is well-known fact that Camels can go for extend periods without water.
7. Several expedition have attempted to find the remains of Noah’s ark on the slopes of Mount Ararat.
8. Scientists worry what the continued use of certain pollutants may damage the earth’s ozone layer.
9. The artists John Constable and Thomas Gainsborough were born at a few miles of each other.
10. Starches provide people with important nutrients which they need them.
11. Sunlight can be used to generate electricity by means of cells containing substances that emit electrons that bombard with photons.
12. Norma Jean Baker was the real name of the famous Hollywood actress known such as Marilyn Monroe.
13. The capital of Yemen is situating 2.190 meters above sea level.
14. Bleak house is in many ways the most controversial of the novel that Charles Dickens wrote.
15. The Aswan High Dam has protected Egypt from the famines of their neighboring countries.
16. Some 2.300 years ago, Greek philosophers gave the name ‘atom’ to the smaller particle of matter in nature.
17. A budget is a plan that estimate how much money will be spent, what it will be spent on, and how much money is left over.
18. When Lake Victoria was discovered by John Speke in 1858, he was believed to be the source of the Nile.
19. With the discovery of Pluto’s moon, Charon, astronomers now think Pluto is smallest planet in our solar system.
20. The psychological school of behaviorism it was founded by J. B. Watson.
21. The first Wagon train on the Oregon Trail setting out from independence, Missouri, in 1941.
22. The discovery of gold in 1849 brought California nationwide attentive.
23. The Kerma civilization was some of the earliest indigenous African tribal groups.
24. Human beings who live longer than one hundred years are a rare.
25. Scientists have identified several hundred subatomic particle held together by a nuclear force.