THEORETICAL ARTICLE

# A new paradigm for the learning of a second or foreign language: the neurolinguistic approach

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## Abstract

*This article considers the contribution of research in neuroscience to resolving the question of how to develop communication skills in a second language in an institutional setting. The purpose of the article is to demonstrate how the findings of cognitive neuroscience can assist educators to understand the complexity of learning and, as a result, to develop more effective instructional practices. The article begins with a brief description of the two options for the learning of French as a second language currently offered in the Canadian school system and the deficiencies inherent in these programs for a country attempting to foster English-French bilingualism in its anglophone citizens. Secondly, the paradigm underlying the core French option, based on cognitive psychology, is examined and its limitations are discussed. The remainder of the article presents the Neurolinguistic Approach (NLA) as developed by the authors, explaining its bases in cognitive neuroscience, the ensuing five major principles of the approach, with the pedagogical consequences that each one entails. Reference is then made to two classroom applications of the NLA: intensive French implemented widely in Canada and another adaptation implanted in China. After comparing the approach briefly with French immersion, limitations of the NLA are presented, and the article concludes with some directions for future research. The positive results of the practical applications of the NLA indicate the important contribution research in cognitive neuroscience can make to improving learning in a classroom situation.*

## 1. Introduction

The Neurolinguistic Approach (NLA) to second/foreign language (L2/FL) acquisition is a new paradigm for the teaching/learning of communication skills in an L2/FL in the school system. This new pedagogical approach has been conceptualized by Netten and Germain in the context of the emerging influence of neuroscience on education. It is based primarily on the research of Paradis (1994, 2004, 2009), N. Ellis (2011) and Segalowitz (2010), and is also influenced by the research on social interaction by Vygotsky (1962). Research from four other Canadian applied linguists has also been incorporated into the new paradigm: Lyster (2007), Lyster & Ranta (1997) and Lightbown & Spada (1994).

## 2. Current options for learning French as a second language (FSL) in Canada

In Canada, since the 1960s, we have had two types of French second-language programs in the school system: the regular program, referred to as "core French" and French immersion. Core French generally consists of approximately 90 to 120 hours of instruction per school year, offered in daily periods of 30 to 50 minutes during which students learn the basics of the language through exercises and practice. This program, as offered in most provinces or territories of Canada, begins in grade 4, though in some situations instruction may begin in the primary grades, and continues to the end of grade 9 or 10. It may be continued as an optional subject to the end of secondary school. Students who remain in the program to the end of secondary school receive approximately 1200 hours of instruction (Sénéchal, 2004). Immersion consists of the appropriation of the second language through the use of French to learn the subject matter of the school curriculum. This program, first implemented in St-Lambert in the province of Québec in 1965, has expanded across Canada and is also widely known internationally. Initially introduced in the first year of schooling, other starting points have been adopted giving three variations of the approach: early, middle and late immersion (Rebuffot, 1993). In the first years of the program, nearly 100 percent of instruction is in French; as the program progresses through the grades, the percentage of instruction in French decreases. By the end of secondary school, students have received between 3000 to 5000 hours of instruction (Calvé, 1991). Theoretically, these two programs provide two alternate routes for the attainment of English-French bilingualism through the school system for anglophones. However, the programs are not comparable options, either in their results or in student participation.

With respect to results, it is widely known that students participating in the core French program do not attain fluency in French by the end of secondary school (Harley, Hart, Lapkin, & Scane, 1991; Hart & Scane, 2004; Netten & Germain, 2007). In contrast, students in the various options of the immersion program do (Rebuffot, 1993). Students participating in the immersion options, and their parents, are generally satisfied with the program; those participating in core French are not as much (Atlantic Provinces Education Foundation, 2004). The lack of satisfaction on the part of the core French students is reflected in high program dropout rates, low enrolments in the optional years, and a general feeling among anglophones that they "can't learn French". While immersion is the most effective program, participation is limited for a variety of reasons. In 2010-2011, of the number of students enrolled in French second language classes, 84 percent were in core French; only 16 percent were in immersion program options (Canadian Parents for French, 2012). This imbalance between results and participation creates a situation in which most anglophones in Canada do not have the opportunity to become bilingual.

This unfortunate situation gives rise to a research problem: is it possible for core French students to develop communication skills in French in a classroom situation? It is well-known that individuals can develop communication skills outside of a school situation, but developing communication skills in a second language seems to elude those learning the language in an institutional setting. For a number of years, various attempts have been made to improve the results of classroom instruction (LeBlanc, 1990), without success. A positive answer to the problem of attaining communication skills in the classroom, and indications as to the conditions necessary for their successful development, have now been provided by the recent research in cognitive neuroscience, and in particular in neurolinguistics. This research also provides reasons for the lack of success of current second language programs modeled on the tenets of cognitive psychology.

## 3. Paradigm based on cognitive psychology

The introduction of modern languages into the school curriculum followed on the tradition of the teaching of the classical languages, Latin and Greek. The grammar-translation method was the standard model for second-language teaching; students learned vocabulary, verb conjugations and grammar rules, and applied this knowledge to the translation of passages from the target language to their first language, and vice versa. This traditional approach

works well to develop explicit knowledge about a second language and how it works. However, with the advent of an emphasis on communication, particularly oral communication in a modern language, and the adoption of what has been called "the communicative approach", goals of second-language teaching expanded beyond explicit knowledge of the morpho-syntactic forms of the language to its use in communicative situations. With this change, the traditional paradigm of second-language learning became obsolete as a theoretical basis for classroom practices.

Various attempts were made to adjust the traditional paradigm to suit the new reality of second-language learning. Cognitive psychology, which studies the mental processes necessary in acquiring and using knowledge, appeared to provide the best explanation of how second-language learning could take place in the school system. Although researchers had accepted that the ability to speak in a second language required the development of an implicit competence in the language (a non-conscious, or automatic, use of language forms), it was still widely assumed that explicit knowledge of the second language (vocabulary, verb forms, grammar rules) was necessary before one could communicate spontaneously. As a result, developing communication skills in a second language was conceptualized as a process similar to that of learning other school subjects. The most widely accepted view of the process of second language learning was that of Anderson (1990) and DeKeyser (1998), which proposed that the learning took place in three steps: first, acquisition of knowledge about the language (vocabulary, rules, conjugations); second, solidification of this knowledge through exercises; and third, transfer of this knowledge to use in communicative activities. According to this paradigm, explicit knowledge about the language, through use in exercises, becomes so well-established in the mind that it can eventually be used automatically, or non-consciously, to communicate spontaneously: that is, knowledge, through practice, is transformed into an ability, or a habit. For cognitive psychology, the second-language learning equation is: **explicit knowledge + practice = implicit competence**.

Resources for the teaching of second languages have been produced according to this paradigm for the last twenty years. Commercially published texts contain vocabulary lists, verb conjugations, grammar rules, exercises to practice this knowledge, and various activities to engage in to use it automatically in spontaneous communication. However, the results of this approach to developing communication skills in a second language have been minimal. R. Ellis (1997) wrote of secondary Japanese students learning English that, after six years of studying English, much of which was taken up with the learning of grammar, "many of these students leave school with no procedural ability to communicate in English" (p. 75, note 10). Researchers at

the Ontario Institute for Studies in Education concluded, after testing of French language skills conducted in five provinces with core French students, that "in general, with some minor exceptions, the scores did not vary significantly at grade 8, whether the starting grade was kindergarten, grade 1, 3, 4, 6 or even grade 8" (Harley et al., 1991, cited by Lapkin, 2008). Ten years later, after the implementation of new resources developed for FSL classrooms based on the recommendations of the National Core French Study (LeBlanc, 1990), our research findings were similar to those reported by Lapkin (2008). They confirmed that the ability to speak French does not increase, despite the number of years of instruction in the core French program (Netten & Germain, 2009). Furthermore, they indicated that a level of spontaneous communication is generally not achieved by students of core French. More recently, testing undertaken with the DELF (*Diplôme d'études en langue française*) in several provinces indicates that students in the core French program do not achieve an independent level of language use. It would appear that the paradigm of learning how to communicate in a second language based on cognitive psychology does not produce the expected results.

## 4. Contributions of cognitive neuroscience to the conceptualisation of the neurolinguistic approach (NLA)

The missing link in the language learning equation might be provided by a new perspective on the learning of second languages proposed by Paradis in his neurolinguistic theory of bilingualism (1994, 2004, 2009). Based on his analysis of research on bilingual patients suffering from aphasia and Alzheimer's disease, he concluded that: (1) implicit competence, governed by the procedural memory, and explicit knowledge, retained in the declarative memory, are two distinct aspects of neuronal functioning; (2) there is no direct connection between the two. If there were a direct connection, then simply knowing the rules of a language would enable an individual to speak the language, and being able to speak the language would imply that the individual possessed knowledge of the rules of the language. And (3) explicit knowledge does not 'transform' into implicit competence, the ability underlying spontaneous communication. If this were not the case, then people suffering from some types of aphasia would also suffer from symptoms of Alzheimer's disease with respect to the degree of impairment of their L1 and L2 (Paradis, 2004, 2009).

These findings have enormous significance for the conception of the NLA. The contribution is not related to identifying the way in which an individual learns an L2/FL, but in the conclusion that implicit competence and explicit

knowledge are two separate and distinct elements, and that BOTH are necessary for the development of communicative competence in a second language. Implicit competence is required to be able to communicate orally; explicit knowledge is necessary in order to communicate accurately using the written forms of the language. Each is an independent, but insufficient, component of the ability to use a language for purposes of communication. From a neurolinguistic perspective on learning an L2/FL, the equation becomes: **implicit competence + explicit knowledge = ability to communicate.** The finding that two components must be developed to attain the ability to communicate provides the key element in the construction of the NLA.

A second contribution from neurolinguistics pertains to the development of implicit competence. Since both implicit competence and explicit knowledge are required for communication, the question arises as to how they can each be developed. Explicit knowledge does not present a problem as instruction has generally focussed on declarative learning; however, implicit competence does. Paradis indicates that the frequent oral use of the language is required. "What serves as input for the development of implicit competence is the frequency with which particular constructions are used, irrespective of their surface form" (2009, p. 80). Paradis further indicates that implicit competence is a non-conscious ability to use vocabulary and structures of the language in authentic communication. It is composed of pathways, or networks of neuronal connections, that are developed by using the language to express messages, or meaning. These language patterns are developed without any conscious attention on the part of the learner; they are simply the result of the frequency of use of the structures. Because of the non-conscious nature of implicit competence, it is developed when the learner concentrates on the message being transmitted, not on language forms, and is created without any conscious effort on the part of the learner. Learners are not aware of the development of implicit competence, nor of using it when they construct an utterance in the L2/FL. N. Ellis (2011), who also indicates that it is language use that is fundamental to developing the ability to communicate, further specifies that the process takes place most effectively when a small number of structures are used and re-used: "language form, language meaning, and language use come together to promote robust induction *by means of statistical learning over limited samples* [emphasis added]*"* (p. 1). The only way to develop implicit competence is to use and re-use structures over and over again until the connections between the morphosyntactic phenomena are well-established in the procedural memory. Furthermore, this language use, in the beginning stages, tends to occur effectively when a small number of structures are used and re-used by the learners in many different situations in order for the neuronal pathways to be established. These findings from

neurolinguistics, as to how implicit competence is created, are also of major significance in the conception of the NLA. They indicate that implicit competence is a skill, not knowledge, and that there are defined conditions necessary to encourage the development of the skill.

A third contribution from cognitive neuroscience to the conception of the NLA is the importance of oral language. According to the recent research in neuroeducation, the acquisition of oral language precedes the learning of explicit knowledge about the language. “Learning a foreign (second) language must focus on oral development, especially as oral language is associated with mimicry and gestures, and because of the importance of the role of prosody” (Huc & Vincent Smith, 2008, p. 31, own translation). The significance of this finding is that language instruction can begin immediately with using the language orally in authentic communication; to begin with learning knowledge about the language is an unnecessary detour. This perspective on language learning is significant in that it complements the notion of implicit competence as a skill, requiring the use of oral language for its development, and reinforces the concept of beginning with oral development.

Finally, a fourth contribution from cognitive neuroscience to the conception of the NLA is the principle of transfer appropriate processing (TAP). Research in cognitive neuroscience has indicated that the brain records data with its context. It is easier to retrieve data in the brain if the context in which it is used is similar to that in which it is learned (Segalowitz, 2010). The significance of this finding for the NLA is that, similar to the point of view of N. Ellis, language should be learned in context, and furthermore, that the contexts of learning should be similar to the contexts where the learned material will be used. This statement holds true both for oral and for written use of the language. An example of a learning practice that demonstrates an inappropriate learning strategy is the memorization of verb conjugations. In real conversation, only one appropriate form of the verb, followed by an adverb, object or appropriate completion of the utterance, is used. Memorizing a series of verb forms as a block makes it more difficult to locate the appropriate form for a particular sentence. While this principle does not affect directly the learning of communication skills, it does have considerable impact on the effectiveness of the types of learning situations and teaching strategies used in the classroom.

## 5. The neurolinguistic approach (NLA) to second-language learning

The NLA to second-language learning provides a new paradigm for the effective acquisition of communication skills in a second language in a classroom setting. The defining characteristic of the approach is the need to develop independently in the classroom the *two* components of effective communication: implicit competence, or the ability to use spontaneously an L2/FL, and explicit knowledge, a conscious awareness of how the language works, grammar rules, and vocabulary. In order to help teachers conceptualize these two components, we have used the terms *internal* and *external* grammar.

Explicit knowledge is conscious knowledge that an individual possesses of the vocabulary, grammar rules, and other aspects of language that can be found in a text, discussed and evaluated by exercises or tests and explained by a teacher. Such knowledge can be accessed consciously for use when writing in the second language, and for certain aspects of auto-correction. For pedagogical purposes, in order to explain our approach to teachers, we have called this component *external grammar*. The core French program enables students to obtain this knowledge, and the concept is very familiar to teachers.

Implicit competence is the non-conscious ability to use vocabulary and structures of the language in authentic communication composed of pathways, or networks of neuronal connections. As previously indicated, these patterns are created without any conscious attention on the part of the learner; the learner is not aware that he is developing, or using, these networks. The non-conscious nature of implicit competence means that its existence and development are not obvious to the teacher or the learner. In order to assist teachers to understand the non-conscious, yet essential, nature of implicit competence, we have called it an *internal grammar*, even though it does not possess any connection with grammar rules learned explicitly. Participation in a core French program does not permit the development in each student of the internal grammar necessary for spontaneous communication.

In order to determine how to improve the core French program in the light of the findings from neurolinguistic research, we condensed the major findings identified in the research into five basic principles that should underlie the pedagogy in a classroom where the acquisition of communication skills in an L2/FL is the goal of the instruction. We then re-conceptualized each of these principles in terms of their pedagogical consequences. These principles,

presented here first as findings from research and then restated in pedagogical terms, are:

- creation of implicit competence - acquisition of an internal grammar;
- primacy of oral development - use of a literacy-based pedagogy;
- focus on meaning rather than form - use of a project-based pedagogy;
- authenticity of language and communication situations - creation of authentic communicative situations in the classroom;
- interaction between students in the classroom - use of interactive teaching strategies.

Our first step was to examine the core French program to identify the extent to which these principles were respected in the resources and teaching strategies used. Our findings indicated that there was neither time nor sufficient individual student participation to develop internal grammar; the curriculum was overburdened with vocabulary and structures, and considerable reuse of language learned was not feasible. Oral development was often neglected; learning an L2/FL was generally conceived of as learning knowledge about the language rather than developing skill in using it.

The ability to read and write in French was generally assumed, not taught. The focus was primarily on learning correct forms rather than on the meaning of the utterances. When project activities were used, the emphasis was on the production of an object rather than on use of the L2/FL. In most activities, authenticity of language use was not a consideration; accuracy of language was. Utterances were often contrived to contain targeted grammatical structures. Interaction between students was virtually absent from the classroom. These findings indicated to us that new curriculum resources and teaching strategies had to be invented to operationalize in the classroom the findings of the neurosciences for effective learning of communication skills. We then conceived specific changes to curriculum resources and new teaching strategies, in order to create in a classroom the conditions necessary for students to develop spontaneous communication in an L2/FL. Each principle, stated as a pedagogical imperative, is described below, giving its source in neurolinguistics/cognitive neuroscience, followed by the instructional prescriptions that ensue.

### *5.1 Principle 1: Acquisition of an internal grammar*

According to neurolinguistic research, the acquisition of an internal grammar requires the use and re-use of a limited number of structures in authentic communication with sufficient frequency that the brain is able to detect underlying regularities and develop neuronal connections, or pathways, which are recorded by the students' procedural memory and thus permit the student to engage in spontaneous communication (Paradis, 2004; N. Ellis, 2011).

Two types of pedagogical consequences follow in order to create a classroom situation that provides learners with the opportunity to create an internal grammar: one curriculum-oriented and the other related to teaching strategies. With respect to the curriculum design, less vocabulary, fewer structures and more interactive activities are required than are currently provided in resources for L2/FL learners. In the NLA, in order to provide the opportunities to use and re-use a limited number of structures in authentic conversational situations, each unit presents three or four *communication functions* related to each other and to the unit topic. Each function is presented only orally first and used separately in several different situations to create short, personal conversations between the students. By the end of the unit, the functions are combined to create a somewhat more complex discussion on the topic. This realignment of the curriculum to permit skill development is a complete change from current resources that focus on the development of knowledge about the L2/FL.

With respect to teaching strategies, in order for the students to use and reuse each of the structures in meaningful situations, as close as possible to authentic communication, seven steps for the teaching of oral communication have been prescribed (Netten & Germain, 2007, 2012). These steps include:

1. modeling by the teacher of authentic sentences that contain a message to be communicated: to give a model for a reply;
2. questioning of several students by the teacher in order to elicit answers that are adapted and personal from the students: for students to learn how to construct a reply;
3. questioning of several more students by other students, based on the model given orally by the teacher with answers appropriately personalized by the students: to learn how to ask questions;
4. simultaneous questioning of all students of each other in pairs, for a very brief time limit, using the language structures already

modeled: to use new structures to communicate a personal message / interact;

5. questioning by the teacher of individual students about the personalized responses given by their partner in the preceding interaction: to re-use the new structures in a different situation, with limited changes to the structures;
6. repeating the interaction in step 4, with a different partner: to re-use the structures again, in another different situation requiring minimal changes to communicate;
7. repeating step 5, with questions pertaining to the answers of the new partner: to re-use the structures again with minimal changes in order to create pathways (procedural memory) that underlie the skill of speaking.

The steps reflect the finding that the ability to speak a language depends on the development of implicit competence, or a skill, through frequent use of a limited number of structures in authentic communication, rather than simply knowledge of what the structure is, as is currently the case in core French classrooms. Throughout these steps, the teacher may interrupt the sequence to ask any student about the answer given by a classmate, thus enabling the teacher to fashion the interactions to imitate more accurately a natural conversation.

The conception of an internal grammar developed from the findings of neurolinguistic research gives rise to another teaching strategy: the use of complete sentences when introducing new structures. Internal grammar consists of morphosyntactic connections which are horizontal in nature; it cannot be developed by using partial sentences and single word answers. In order to develop their internal grammar, the teacher ensures that the students always construct a complete sentence. The teacher also regularly corrects errors (phonetic, morphological, syntactic, lexical and discursive) in order to ensure that the grammar being internalized is accurate. In the NLA, the correction of errors is crucial, since it is this procedure that replaces, to a certain extent, the teaching of explicit grammar, which does not enter into the teaching situation until the introduction of writing (Netten & Germain, 2005).

With the use of a curriculum designed in this fashion, and the teaching strategies, oral language is learned in the context of a conversation and error correction is integrated into the learning process for effective transfer to other situations. Research in cognitive neuroscience has demonstrated the importance of transfer appropriate learning (TAP) in enabling students to use

skills in similar situations (Segalowitz, 2010); once students learn to use structures in a conversation they are more able to use them in similar contexts. The importance of integrating error correction into the structures used in second-language acquisition has also been confirmed by research (Lyster and Ranta, 1997).

Neurolinguistic research indicates that developing the ability to communicate orally in a second language is essentially a process of creating language habits. This process, as with the development of any skill, requires frequent utilisation of the skill to be developed (i.e. the L2/FL) in a short time frame. In an institutional setting, this need translates into time in the school day. Therefore, it is necessary to have recourse to a period of intensive instruction at the beginning of the learning experience. In general, students in regular L2/FL classrooms are not exposed to the L2/FL for long enough periods of time each day, or cumulatively during a school year, to create the internal grammar necessary for spontaneous communication. Without a certain intensity of exposure to use of the language, the neuronal pathways cannot be fully established. Spontaneous communication, or the development of an internal grammar, can only be achieved by relatively intense use of the second language. Language programs, such as core French, which proceed by a drip-feed approach (30-50 minutes a day), simply do not provide the continuous use of a second language needed to develop the language habits that form internal grammar. Our research has shown that, for learners aged 10 – 11, at least 270 hours of intensive instruction is required to create some spontaneity (Germain, Netten & Movassat, 2004). Since effective use of the NLA requires more time than the regular L2/FL program, a semester of intensive instruction is an essential component of the program in the first year. This aspect of the NLA is based on the concept of the importance of intensity of instruction in speeding up the learning process (Lightbown & Spada, 1994).

The perceived attainment of spontaneous communication by the learners also creates more positive motivation for language learning, therefore adding to the effectiveness of the learning conditions. In the core French program, students expect to learn to communicate in French. In actual fact, they do not. Their lack of ability to communicate is often cited as their reason for dropping from the program (Netten, Riggs, & Hewlett, 1999). In the NLA, students do learn to communicate spontaneously; their success increases substantially their self-esteem. In qualitative research undertaken with teachers and parents, all mentioned the positive change in self-esteem that resulted from participation in the NLA (Germain & Netten, 2004). It may be hypothesized that the ability to communicate, and the accompanying pride in being able to do so, increased the motivation of the students to continue their L2/FL

learning experience. The atmosphere in a NLA classroom is dramatically different from that in a core French classroom.

*5.2 Principle 2: Use of a literacy-based pedagogy*

Research in neuroeducation indicates that the learning of an L2/FL must prioritize oral development, especially since this aspect is associated with gestures and mimicry, and also because of the major role of prosodic features in language (Huc & Vincent Smith, 2008, p. 31). Furthermore, oral language use is required to develop internal grammar. In order to increase the emphasis on oral development, and to increase authentic use of the L2/FL, the NLA adopts a literacy perspective on language learning. A literacy perspective on language, and particularly on the learning of language, emphasizes both its oral foundations and nature as a skill. Literacy is generally defined as being able to *use* language (Government of Ontario, 2004). It is this perspective on language that complements the neurolinguistic research rather than the traditional view of second language learning that focuses on the acquiring of knowledge about the language. A literacy perspective enables teachers to view language learning as developing habits rather than knowledge, to place a priority on oral language development and confirms the sequence of oral development before reading and writing.

The adoption of a literacy perspective on second language learning gives rise to pedagogical consequences for both the curriculum and teaching strategies. With respect to curriculum design, in the NLA, each unit is constructed to begin with an oral phase. Students develop first of all the ability to talk about a certain theme. Reading and writing activities follow in sequence, generally in the same day as the oral introduction; students learn to read about a topic using primarily the same vocabulary words and structures as those already developed orally in order to maintain the use and re-use of a limited number of language structures (N. Ellis, 2011). Reading precedes writing because it is primarily a recognition activity; in reading, students are introduced to and learn to recognize the graphic forms of the sounds of the target language and they also observe features of the language specific to the written form. Writing follows reading because, in writing, observed knowledge is used in the production of the language forms. Explicit teaching of language forms is initiated with reading activities and continues with writing. Thus, learners can build from implicit competence to explicit knowledge about the language, as recommended by neurolinguistic research (Paradis, 2004, 2009). Learners also continue the use and re-use of a limited number of vocabulary words and structures essential to developing an internal grammar (N. Ellis, 2011).

Since cognitive neuroscience has shown that highly contextualized learning (TAP) translates into more effective learning (Segalowitz, 2010), the learning of explicit aspects of language (i.e. external grammar) has also been contextualized in the NLA. Not only is external grammar introduced after oral use, but also in a context. Language forms are first identified in the texts used for reading, and then are integrated into the learner's personal compositions.

With respect to teaching strategies, reading and writing are taught directly in the L2/FL, without any explicit reference to translation. The strategies used are similar to those used in the mother tongue classroom for literacy development, but with modifications required for the learning of a second language. Modifications pertain particularly to a greater emphasis on oral development before reading and writing, as well as a more intense oral preparation at the beginning of reading and writing activities. These changes devolve from the neurolinguistic concept of internal grammar. In an L2/FL classroom, students possess an internal grammar that is considerably more limited than that of students learning to read and write in their mother tongue. Extending internal grammar development through oral use of new or different structures in the L2/FL before reading and writing activities enables students to integrate these structures into their print-oriented activities without resorting to translation (Germain & Netten, 2005a; 2012).

For reading there are three phases: an oral pre-reading phase; the reading phase that has two or three exploitations of the text: one for the message, incorporating teacher modeling of the text and another (at the beginning) to understand the new sound symbol relationships; and the third to observe, and formulate, grammatical relationships. Attention is focused on meaning and form at separate moments, as recommended by Lyster (2007), but in the NLA approach, meaning always precedes form-focussed instruction (Krashen, 1981; N. Ellis, 2011). A post-reading phase integrates the new knowledge with that already learned. Writing also follows the three phases, for similar reasons. Once new vocabulary and structures have been appropriated in this sequence, they are then re-used in reading and oral activities to integrate them into the language that has been previously acquired. In this way, language learning from a literacy perspective begins and ends with oral use.

Error correction remains important in the teaching of reading and writing. For reading, the teacher models fluent reading of a text, that is, linking together words in groups that have meaning. Students are encouraged to read in a similar fashion, as fluent reading aids comprehension. This process occurs more easily when learners have already developed an internal grammar. For accuracy, it is important that learners recognize the sounds of the L2/FL in their written form and produce or read them correctly. If incorrect connections

are made, a correct model is given, and students re-read the complete sentence in which the correction occurs, to ensure that the correction is placed in context. Both strategies, fluent modeling and contextualization of error correction, derive from neurolinguistic research cited previously.

For writing, errors are placed into two categories reflecting the neurolinguistic bases of the approach which indicate that both knowledge and skill are required to develop the ability to communicate in an L2/FL: those that are the result of an incorrect internal grammar, or implicit competence, and those that are due to inaccurate knowledge of the written form of the L2/FL. Errors that are due to incorrect knowledge can be corrected by explanation and written use of the correct forms, and the new information stored, and accessed consciously, through use of the declarative memory. Errors that are due to an incorrect internal grammar, however, can only be corrected by repeated oral use of the structure in authentic conversation, as these errors are related to incorrect connections created by the procedural memory. It is only when an accurate internal grammar has been constructed that a learner will be able to write correctly, and spontaneously in the L2/FL. Thus, neurolinguistic research has enabled us to re-conceptualize the question of error and create a more effective pedagogical response to correction.

*5.3 Principle 3: Use of a project-based pedagogy*

Neurolinguistic research has shown that in order to acquire an internal grammar, attention must be focussed on a message rather than on the language, since internal grammar can only be acquired non-consciously, that is, without conscious attention to language forms (Paradis, 1994, 2004). N. Ellis (2011) also stresses the importance of the link between meaning and language forms used in the development of the ability to communicate.

The pedagogical consequence of this principle is primarily related to curriculum design. The learning of the second language must be based upon the use of interesting cognitive tasks that present an intellectual challenge to the students (Germain & Netten, 2011). In the NLA, use is made of a project-based pedagogy. To facilitate the creation of meaningful situations and interesting, cognitively-demanding tasks for the students, curriculum units are organized in a sequence of two to four mini-projects, each focusing on the use of the communication function previously learned orally, which culminate at the end of the unit in a related final project. This pattern encourages the re-use of the language structures in each unit, as the final project requires the integration of language structures used in each of the previous mini-projects. The use of a project-based pedagogy allows students to concentrate on the theme being developed, and the expression of their personal views on the

topic, rather than on language forms. Activities are not isolated, and require the continuous involvement of the student, thus implicating other areas of the brain necessary for effective language learning (Paradis, 2004; N. Ellis, 2011). Since the tasks are cognitively demanding, they contribute to the development of cognitive skills that can later be transferred to their first language (Cummins, 2001). The use of a project-based pedagogy also enables teachers to increase gradually in the course of a unit the difficulty of the tasks and the complexity of the language structures.

*5.4 Principle 4: Use of authentic communicative situations*

Neurolinguistic research has indicated that the use of authentic language in real communication is essential in order to acquire the internal grammar necessary for spontaneous communication. Both Paradis (2004) and N. Ellis (2011) mention the importance of using authentic language in real communicative exchanges for learning of the language structures to occur.

In addition, cognitive neuroscience has shown the complexity of the involvement of different centers in the brain, such as those related to motivation, when authentic communication takes place. For effective language acquisition, implication of these centers is required (Paradis, 2004). This is why internal grammar cannot be acquired by controlled practice or memorized dialogues; material that is learned in such a way is primarily focussed on language forms and represents declarative knowledge; it does not contribute substantially to the creation of procedural memory. Furthermore, each dialogue or exercise tends to be limited in its scope and integration into a sustained discussion of any topic: “Controlled practice exercises [...] do not afford students opportunities for [...] the sustained output [...] necessary for interlanguage development” (R. Ellis, 2002). Another aspect of the use of dialogues and practice exercises is that they are not sufficiently contextualized to be available for use in actual communication, as indicated by research on TAP (Segalowitz, 2010). Students need to be involved in authentic communication in the classroom in order to develop the ability to participate in authentic communication in the real world.

The pedagogical consequences of this principle are two-fold. With respect to curriculum design, units are created based on communication situations that are as authentic as possible on subjects that are of interest to the students. Language functions are chosen based on what the students would most likely wish to say. If students wish to say something that is not in the text, teachers have the liberty to construct a different utterance, provided that it fulfills the communicative function of the exchange. All activities focus on enabling the students to express their own personal reactions. At no point in the units are

the students required to produce language that does not reflect their own personal message. Teachers do not ask students questions that are not realistic, and student replies are always personalized.

With respect to teaching strategies, students do not repeat sentences that are untrue for themselves, simply to practise a language structure. For example, a student would not be asked to say that he is wearing a red shirt, if in fact he is wearing a blue sweater. Students are rarely asked to repeat an utterance in chorus, but if this strategy is used, the utterance must be changed to be authentic; therefore, students could repeat together, “Alice is wearing a green dress”, but never, “I am wearing a green dress”.

This emphasis on authenticity of conversations is also reflected in the way that teachers are asked to reply to student utterances. In core French classrooms where language is learned primarily as explicit knowledge, the standard reply to a student utterance focuses on the accuracy of the language. Expressions such as “Bravo, correct, right” are regularly used. In the NLA classroom replies to a student utterance focus on the meaning of the utterance, and extend the conversation: comments such as, “Yes, I do, too; Just like Martha”; or “Do you agree, Billy?”, are made. It is to be noted that, as explained under the first principle, if an error should occur, the error is immediately corrected, but correction is achieved through a modeling and re-phrasing of the interchange; the emphasis is still on the authenticity of the message.

Communication is always in the L2/FL. Should a new expression be required, it is modeled by the teacher and used immediately by the student.

*5.5 Principle 5: Use of interactive teaching strategies*

Neurolinguistic research indicates that it is through frequent use of language structures that the neuronal pathways necessary for spontaneous oral communication are created in the procedural memory (Paradis, 2004). It also suggests that this use of language must not be simple repetition of learned sequences, but authentic language used for purposes of communication (N. Ellis, 2011). Since internal grammar is a skill, not knowledge, and its creation depends upon use, students must engage in interactive exchanges in the classroom. However, in regular L2/FL classrooms, it is the teacher who does most of the talking; in the average L2/FL classroom, up to 85% of the talk is teacher-talk (Germain, Hardy, & Pambianchi, 1991). Therefore, in order to encourage language use by the learners, a less formal classroom atmosphere must be created; interaction between the students and the teacher, and between the students themselves, must be fostered.

Interaction is also important as it creates contextualization of the structures being learned in authentic conversational use of the language in the school situation. In effect, it creates a form of TAP (Segalowitz, 2010). Students learn to adjust to the deficiencies of real communication, such as a sentence only partially heard, a new word or word used unexpectedly, and asking for clarification, expressing disagreement, and so forth. As a result, students are more capable of transferring their communication skills to use of the second language in the real world.

However, the role of interaction has even greater significance. Interaction between the students contributes not only to the development of an individual internal grammar, but also to the overall social and cognitive development of the learner (Vygotsky, 1962). As students discuss the various themes contained in the units they not only negotiate meaning on a linguistic plane, contributing to the development of their language skills, they also engage in a sharing of ideas and understandings, which, it has been hypothesized, refines cognitive development. According to Perret-Clermont (1986), when engaged in social interaction, the individual learner rejects or modifies his previous conceptions, and as a result, develops new understandings and intellectual skills. Therefore, in order to ensure that each individual student develops his own internal grammar, it is essential that students participate regularly in social interactions in which they use the second language. This participation also appears to have a causal effect on cognitive development and the restructuring of thought patterns (Doise & Mugny, 1981; Vygotsky, 1962). It is this aspect of the neurolinguistic approach that enables it to make a much stronger contribution to the overall education of the child than the regular second language program (Germain & Netten, 2005b).

The pedagogical consequences of this principle primarily affect curriculum design. Opportunities for group activities, pair work and other forms of interaction are built into the units to ensure that interaction among students is a regular part of the classroom activities. In order for the interactive activities to produce valid language use, all structures must be modelled and used beforehand in short exchanges to encourage relatively accurate independent use. To ensure that students are adequately prepared linguistically for all interactive activities, their preparation forms an integral part of each unit. In addition, in the creation of project activities, attention is given to the task in order to ensure linguistic content and to encourage motivational implication on the part of the student, as well as an adequate cognitive involvement.

This view gives a different perspective on learning, showing not only the importance of skill development and procedural memory on an individual

basis, but also of the importance of social interaction in learning. It would seem important that, in adapting the concepts of cognitive neuroscience to the field of neuroeducation, the role of social interaction in developing cognition should not be overlooked.

## 6. Applications of the NLA in real classrooms

There are at the present time (2012) two classroom applications of NLA: the Intensive French program in Canada and a university-level French program in China, for young adults, aged 19, in one university (Gal-Bailly, 2011; Ricordel, 2012). The Intensive French program in Canada, which begins in grade 5 or 6 with students aged 11 or 12 and continues to the end of high school, began in Newfoundland and Labrador in 1998. Since that time, it has expanded to all provinces except Quebec, where there is Intensive English (a similar, but not identical program as it is not based on the NLA). Over 45,700 students have participated in Intensive French at grade 5 or 6 since the inception of the program. Results of the Intensive French program in Canada indicate that the NLA to the teaching of French as a second language is far more effective than the regular core French program. After one semester of instruction, approximately 300 hours, 70% of students in the program are able to communicate spontaneously in French on topics related to their age and curriculum. Oral testing of students from five different provinces, who participated in the Intensive French program, indicate that the average level of performance reached after five months of intensive instruction was at, or close to, 14, on the New Brunswick Oral Proficiency Interview Scale (OPI), a level that represents the beginning of spontaneous communication (Netten & Germain, 2009).

As students continue their instruction in the Intensive French program through to the end of secondary school, they are able to attain the ability to communicate spontaneously on a wide variety of subjects, a score of 17 or Intermediate Level on the New Brunswick OPI. Their communicative abilities, while not equal to those of students who have participated in immersion programs, are far superior to those of students who have participated in the core French program, based on categories of the DELF (*Diplôme d'études en langue français*e), as is shown in the graph below (Government of New Brunswick, 2010). It is interesting to note that, since 2008, the province of New Brunswick has replaced core French with the Intensive French program for all students who are not in immersion.

**Table 1.** Oral results for FSL students in New Brunswick in core, intensive and immersion programs at the end of secondary school (based on the DELF interview scale).

| Oral Language Competency (Key Stage Outcomes) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A1 | | | A2 | | | B1 | | | B2 |
| End of program | A1.1 | A1.2 | A1 | A2.1 | A2.2 | A2 | B1.1 | B1.2 | B1 | B2.1 | B2.2 | B2 |
| Core French 12th Grade | | | | | | | | | | | | |
| Intensive French 5th Grade | | | | | | | | | | | | |
| Post-Intensive French 8th Grade | | | | | | | | | | | | |
| Post-Intensive French 10th Grade | | | | | | | | | | | | |
| Post-Intensive / Blended High School Program 12th Grade | | | | | | | | | | | | |
| Late Immersion 10th Grade | | | | | | | | | | | | |
| Early Immersion 10th Grade | | | | | | | | | | | | |

The NLA, because of its bases in neurolinguistic research, is an approach to L2/FL learning that has positive implications for all types of L2/FL learners. Recent research in the field of education has indicated that the NLA provides a successful learning experience for immigrant children, enabling them to acquire French without interference to their English development (Carr, 2009). In addition, it has been demonstrated that learners with challenges respond positively to the program, due primarily to its oral and interactive nature (Joy & Murphy, 2012).

Further classroom applications of NLA are being developed in Canada by other professionals to teach certain First Nations' languages in the Yukon, the Northwest Territories and Prince Edward Island, as well as in the James Bay area to teach English, French and Cree. It appears from these initiatives that curriculum resources that conform to the principles of the NLA can be adapted to teach communication skills in a wide variety of second languages (Netten & Germain, 2009). While more research is necessary to confirm its

applicability, it would appear that the principles upon which the NLA is founded are universal with respect to the learning of communication skills in an L2/FL.

## 7. Relationship between the NLA and immersion

The immersion program is based on the premise that, if students learn subject matter in French, they will at the same time appropriate the L2. With respect to the five principles of the NLA, the following comments may be made. Firstly, the immersion program provides intensity of exposure to the L2 in the beginning stages, and develops internal grammar, as French is used as the language of communication for teachers and students throughout the school day. Secondly, immersion is based on a literacy approach to language teaching, as first-language instruction is always literacy based, even though the instructional practices for effective literacy development change over time. Thirdly, in immersion, the focus of the learning is primarily the content of the curriculum; language becomes a means to an end. Consequently, immersion focuses on the learning of subject matter rather than on the learning of forms of the language. Fourthly, authenticity of communication, at least for a classroom situation, is assured. Interaction is the only area that tends to be less prevalent in an immersion classroom. For a considerable period of time, research has shown that oral results are more positive in classrooms where more interaction occurs (Netten & Spain, 1989). However, it is only recently, as a result of the findings of neuroeducational research and a change in our understanding of literacy, that attempts have been made to encourage more student interaction in the immersion classroom. Teaching strategies in immersion have been primarily those of the subjects to be taught.

Perhaps the major weakness of the immersion program is that the teaching/learning of the L2 has been subordinated to the learning of subject matter. Consequently, there is room for improvement in the teaching strategies for L2 learning in the immersion classroom (Mandin, 2008). The concept of internal grammar, as well as many of the teaching strategies conceived for the NLA are pertinent, and could be used effectively in immersion classrooms to improve L2 communication skills. Among these strategies may be mentioned: the use of complete sentences to assist in developing an internal grammar; the importance of oral error correction for an accurate internal grammar; an increased emphasis on oral development, and the related adoption of a pedagogy for the teaching of literacy that is specific to an L2; and greater contextualisation of teaching language forms. In addition, a less formal classroom, with more use of project-type activities and student interaction to encourage personal, rather than academic, use of the

L2, would also improve L2 development for students in immersion. Furthermore, it may be mentioned that the characteristics identified by the neurosciences as being necessary to effective development of L2 communication skills occur most easily in early immersion (Netten, 2007). Because of the nature of the primary curriculum, language structures are somewhat limited and re-used, literacy development, with an emphasis on oral language, is a major focus, and learners are actively involved in their learning and interact to a certain extent with the teacher. Immersion programs with a later start could profit from an initial period devoted to L2 instruction before subject matter is introduced as well as the adoption of the L2 teaching strategies of the NLA to make them more effective and appealing. At the present time, there has been some interest expressed in adopting some of the teaching strategies of the NLA in immersion. Where this type of change has been undertaken, positive results have generally been reported, though no research has as yet been undertaken (Cogswell, 2008).

## 8. Limitations of the NLA

Reactions of parents, students, teachers and administrators to the NLA have been extremely positive. Not only have communication skills improved substantially, but primarily because of the ability to express themselves in French, motivation and attitudes towards the learning of French, as well as towards francophones have shown improvement (Germain & Netten, 2004). There are, however, some limitations, related particularly to the implementation of the approach in the school system. Due to the positive results achieved in Intensive French, some parents would like the program to start in the primary grades, kindergarten to grade 3 in the North American context. However, the program has been designed to begin in the elementary grades, with learners aged 10 - 11. Because of the need for some intensity in the beginning stages of the program to develop spontaneous oral communication, it is necessary to compact some elements of the regular curriculum. The nature of the primary program is such that much of the curriculum is devoted to literacy development in the first language; reducing the number of hours devoted to the first language curriculum at this stage is not recommended. The need for an intensive period of instruction at the beginning of the program also causes a reticence on the part of some administrators to implement it. Re-arranging the timetable for the grade 5 or 6 classes has implications on the timetables for other grades, often creating conflicts that are hard to resolve. Related to this issue is the question of the effects on the other subjects in the curriculum. Reducing the number of hours of regular instruction to increase exposure to the L2/FL requires some adjustments (compacting or integration) in the regular curriculum during five

months of the school year. This necessity causes concern that there will be long term negative effects on, or at least a reduction of, learning goals in the other subjects, a fear that restricts implementation in some areas. Results of standardized testing undertaken by school districts or provincial departments of Education, however, have shown that this is not the case; indeed, as is the case for the immersion program, in the long term there are positive effects on English language, and also on mathematics scores, with no lags in the other subject areas (Germain & Netten, 2010).

A further limitation with regard to implementation of an NLA is the need to have teachers who are qualified to implement the program. This requires a certain fluency in the L2/FL, in order to be able to carry on an authentic conversation; often teachers with this level of fluency are not available in the regular school system. In addition, teachers must be educated to understand the theoretical bases of the approach underlying the curriculum and to use the teaching strategies effectively. This imposes a certain burden on the school system. Also, the long tradition in core French of putting the emphasis on the teaching of knowledge rather than skill requires that teachers be open to the adoption of new, and radically different, ideas about the learning of an L2/FL. Adopting the approach, and using it effectively, demands a major change in their beliefs about L2/FL learning, and some teachers may require two or three years before they are able to understand the shift in pedagogy that is implicit in the NLA. Until the general tenets of neuroeducation are more widely diffused, the majority of teachers will have some difficulty in reorienting their beliefs about learning/teaching.

## 9. Directions for further research

The NLA opens up a whole new area of research for the teaching/ learning of an L2/FL. The concept of internal grammar, in particular, is a fruitful area for research on L2/FL acquisition. An effective way of operationalizing and measuring the level of internal grammar is required. There would appear to be a relationship between internal grammar and fluency that should be explored, as well as between internal grammar and spontaneous communication. Cummins (1976) hypothesized that there are two threshold levels of importance in L2/FL learning: the lower threshold that should be attained before beginning L2/FL learning and the upper threshold that marked the beginning of actual cognitive use of the L2/FL. Exploring the concept of internal grammar, and defining levels, could verify and expand the usefulness of these hypotheses. Research to examine the concept of internal grammar, and its development, in relation to the rhythm of individual learners in

developing literacy skills should also be useful to educators in both first and second language contexts, and could help to identify learners in difficulty.

At a more general level, a major contribution of the cognitive neurosciences to research in education is the important distinction between knowledge and skill, and the different ways in which these two products of learning are treated by the brain. It will be important for educators in all subject areas to identify more effectively those aspects of the curriculum that are knowledge-based and those that are skills, and to realize that learning may more often require complex re-organization in the brain rather than the simple storage of new information.

In addition, it may be of interest to researchers in the area of neuroeducation to examine their findings in the light of constructivist perspectives on instruction. ”While the processes of instruction follow their own logical order, they direct and awaken a system of processes in the child’s mind which is hidden from direct observation and subject to its own developmental laws” (Vygotsky, 1962, p. 102). What was hidden from direct observation for Vygotsky may now be observable with new imaging techniques. Furthermore, in the school situation instruction by its nature involves groups of individuals who interact in the learning situation. How social interaction shapes individual cognitive development is an important part of understanding learning and developing instructional prescriptions to create effective classroom conditions to promote that learning.

## 10. Conclusion

Conception of the NLA demonstrates the significant contribution that research in the neurosciences has made to the field of education. Until now the primary paradigm on which the resources and strategies for learning to communicate in an L2/FL have been developed has been that based on the tenets of cognitive psychology. While the results of this paradigm were unsatisfactory, the reasons for its deficiencies proved to be elusive. It is through the adoption of a neurolinguistic perspective on bilingualism that a more successful L2/FL paradigm has been conceptualized. The five principles of the NLA provide one example of how neurolinguistic theory can be incorporated into creating new and more effective conditions for developing communication skills. Other approaches may also be developed. Nonetheless, in its present form, the NLA has been highly successful in enabling students to communicate spontaneously in a second language in a school situation, and has demonstrated its applicability to the learning of second languages other than French.

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