



## Laureate's Language Development Programs: Theory and Research

*First Words, First Words II, First Verbs, First Categories, Simple Sentence Structure, LanguageLinks®: Syntax Assessment & Intervention, Prepositions!, Pronoun Perspective, and Nouns & Sounds Sterling Editions<sup>1</sup>*

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How do children around the world, no matter what their native language, begin speaking in sentences at the same age? The uniformity and rapidity of first language acquisition is possible because human infants are born with a biologically endowed innate language faculty within the brain that drives the course of language development. Although this premise was doubted fifty years ago, today biologists and linguists alike accept it. Our human language faculty orchestrates and shapes the acquisition of language. Typically developing children need only the surrounding language input to acquire language. In contrast, children with language disorders will need more than exposure to language if they are to develop adult competence in their native language. This monograph focuses on the theory and research bases of the programs in Laureate's *Language Development Packages: Levels 1 and 2*. Included in these packages are research based assessment and intervention programs to train early vocabulary, categorization, basic syntax, prepositions, narrative perspective taking, and environmental sounds associated with Nouns. These packages are designed to help students master language and become better communicators.

In the mid-twentieth century, Noam Chomsky's generative grammar proposals triggered what many called a revolution in linguistic theory (Chomsky, 1955; 1957; 1965; Harris, 1993). Suddenly the focus of linguistic inquiry shifted from description to explanation. Chomsky proposed that a grammar of a language must not simply describe sentences rather it must account for how sentences are created or generated, hence the term generative grammar. From the beginning, generative grammar has been concerned with not only adult knowledge of language but also how language is acquired. There is no longer any doubt that typically developing children acquire language primarily through exposure rather than direct teaching. How is this possible? Linguists explain that all human languages share a common underlying biologically endowed structure. While the lexicon or vocabulary of a language must be learned, language structure is based on universal principles (Abraham, Epstein, Thráinsson, & Zwart, 1996; Chomsky, 1981; 1995; 2002; 2004).

### Universal Grammar Principles and Parameters

Children all over the world learning thousands of different languages do so in a very similar manner. First words emerge, word combinations occur, and syntax is mastered at about the same age regardless of language or culture. What exactly is the nature of the genetic endowment of a language faculty that enables children

to acquire all languages on a very similar timetable? Linguists and biologists believe that the innate Universal Grammar humans are born with is composed of principles that are not dependent upon language input and only a small set of parameters that vary in a binary fashion across languages (Baker, 2001; Hornstein, Nunes, & Grohmann, 2005).

Unlike universal principles that require no language experience, parameters do require language input for their setting. Since all parameters have two possible settings, children must need language input to select the proper setting. A fixed set of parameters account for most of the syntactic variations among human languages (Atkinson, 1992; Baker, 2001; Chomsky, 1981; Crain, 1991; Leonard & Loeb, 1988; Radford, 1990; Radford, 2004; Roeper & Williams, 1987; Wexler, 1998). Parameters determine such things as word order in a language and whether question words (e.g. Who, What, How) move to the front of a sentence (they do in English; they don't in Chinese).

The acquisition of language competence can be viewed as a matter of "setting" grammatical parameters through exposure to appropriate receptive language input combined with the learning of a lexicon or the vocabulary of a language. In children with language disorders this does not happen with exposure alone. Language intervention must help them in learning words and setting grammatical parameters.

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## The Lexicon and Early Vocabulary Development

In current linguistic work, the lexicon (the mental dictionary of lexical items or words with their linguistic properties) has taken on a greater role in the grammar than it had in earlier generative grammar theory. Developing an early core lexicon is an important step in the acquisition of language. Most think of word learning as simply a process of linking a word's sound to meaning but the representation of a word consists not only of phonological and semantic properties (sound and meaning), but also syntactic features. Each word or form in the lexicon contains syntactic information such as categorial membership (i.e., whether it is a Noun, Verb, Determiner, etc.), inflectional behavior (e.g., how it is marked for number, person, and gender), and in the case of Verbs, syntactic Argument Structure (e.g., run requires only one argument, a subject "The girl runs"; kiss requires two arguments, a subject and an object "The father kisses the baby"; and give typically requires three arguments "The girl gives the baby a toy").

Contemporary linguistic theory emphasizes that even children in the one word stage must be learning the syntactic features of words in relation to the parameter settings of the language being acquired – the grammatical options that distinguish one language from another. Further, children are learning a great deal about the inflectional properties of the language they are acquiring. That includes such things as how a language marks number agreement of Subjects and Verbs (e.g. "The boy\_ runs/The boys

run\_") and how time is expressed (e.g. "The boy **is** playing/The boy **played**"). There is also evidence that by this time a number of crucial parameters have already been set. Hirsh-Pasek, Golinkoff, and their colleagues showed that when children as young as sixteen months (still in the one word stage) were presented with two television screens with one showing *Big Bird* tickling *Cookie Monster* and the other *Cookie Monster* tickling *Big Bird*. and then were told, "Oh look! **Big Bird** is tickling **Cookie Monster!**" or vice versa, they preferentially attended to the appropriate visual stimulus (Hirsh-Pasek, Golinkoff, Fletcher, et al., 1985; Hirsh-Pasek & Golinkoff, 1996). This finding demonstrates that the two word order parameters had already been set. The children already knew that English is a Subject-Verb-Object word order language.

Important within linguistics is the division of the lexicon into two categories. *Lexical Category* words are the familiar Nouns, Verbs, and Adjectives. *Functional Category* words and elements serve essentially grammatical functions. This category includes such things as Pronouns and the inflections associated with Verbs. The *Functional Category* includes Determiners which are associated with Nouns, Tense (in earlier work called Inflection or INFL) which is associated with Verbs, and Complementizers which includes question formation. Table 1 gives examples of Determiners and Tense which emerge before Complementizers.

Even those not familiar with the current linguistic distinction between *Functional* and *Lexical Categories* will immediately

| Functional Categories   | Examples  |
|---|---|
| <b>Determiners:</b> Specify or determine that to which a Noun expression refers.  |   |
| Prenominal Determiners<br>Pronouns<br>Nominative<br>Accusative<br>Pronominal Possessives<br>Independent Possessives<br>Anaphors (Reflexives)  | <b>this, that, these, those</b><br><br><b>I, we, you, he, she, they, it</b><br><b>me, us, you, him, her, them, it</b><br><b>my, your, our, his, her, their, its</b><br><b>mine, yours, ours, his, hers, theirs, its</b><br><b>myself, yourself, ourselves, himself, herself, themselves</b>   |
| <b>Tense:</b> Refers to elements that inflect and mark Verbs.   |   |
| Tense & Aspect<br>Regular Past "-ed"<br>Future Modal "will"<br>Present Progressive<br>(Aux. "be"+V+ "-ing")<br><br>Negation<br>Auxiliary "be" + Negative<br>Auxiliary "do/have" + Negative<br><br>Agreement<br>Copula "be"<br>Auxiliary "be"<br>Third Person Singular | .<br><br>Joe <b>fixed</b> the house.<br>He <b>will</b> set the table.<br>He <b>is driving</b> the car.<br><br>He <b>is not</b> wearing a hat.<br>She <b>doesn't, hasn't</b> , set the table.<br><br>I/we/you/he/she/it/they...<br>... <b>am, are, is, was, were</b> hungry.<br>... <b>am, are, is, was, were</b> skiing.<br>Joe <b>fixes</b> the house. |

Table 1. Functional Categories with Examples



Calvert, 2000).

Laureate's newest programs, the *Sterling Editions*, feature two pioneering advancements. *Optimized Intervention*<sup>®</sup> technology provides automatic assessment, research-based instruction, highly individualized intervention, and extensive data collection. The *Sterling Administration System* offers control over all aspects of learning, a single interface for unlimited numbers of students, easy student management, and built-in reports to ensure accountability.

### **Optimized Intervention<sup>®</sup>**

The *Optimized Intervention* system in Laureate's *Sterling Edition* software is the culmination of research and development efforts which have been supported by Small Business Innovation Research (SBIR) grants from the National Institutes of Health, National Institute on Deafness and Other Communication Disorders (NIDCD), and the National Institute on Child Health and Human Development (NICHD). The system uses artificial intelligence methodology to select appropriate training material and to adjust instructional support in relation to emerging skills and competencies, resulting in highly individualized and efficient language instruction. Each *Sterling Edition* language intervention program has an *Optimized Intervention* uniquely designed to test and train the curricular targets. Words, concepts, and forms are arranged in developmental order for testing and training. All the programs begin by probe testing in developmental order to ascertain the appropriate place to begin training. Once training begins, *Optimized Intervention* determines what material a student needs to work on and how much instructional support the student may require to make progress. As a training session proceeds, the training material and degree of support are continually adjusted based on the student's performance. As powerful as *Optimized Intervention* is, it couldn't be easier to use:

- Enter or choose the student's name
- Select the program
- Press *GO*

Once the student has achieved mastery over the material being trained, *Optimized Intervention* continues to probe and introduce new stimuli until the student has achieved mastery over the entire curriculum for that program.

### **The Sterling Administration System**

The *Language Development Packages* include all *Sterling Editions* programs that operate under the *Sterling Administration System* which provides for extensive data collection, management, and reporting. Student data collection, analysis, and reporting are necessary to ensure accountability. In addition to the attention we have paid to instructional integrity in the *Sterling Edition* programs, through the *Sterling Administration System* we provide tools for making data collection, analysis, and reporting easy. The *Sterling Administration System* carefully tracks all variables related to a student's progress through the curriculum and stores that information in the Student File. The Report Writer has been designed to access this Student File and extract meaningful information to include in student reports and other documentation. All *Sterling Edition* programs come with built-in reports.

In addition to built-in reports, *Sterling Edition* programs provide several hundred labeled data items that can be used to customize the built-in reports or to create entirely new custom templates that can be applied across students. For example, you could create a *LanguageLinks* report to send home to parents that showed what forms a student had mastered and what they could encourage in production. You can then simply apply the report to any student using the program. You can also export student data into spreadsheets for graphing and statistical analysis. The *Sterling Administration System* makes this easy. With the *Sterling Administration System* and *Optimized Intervention*<sup>®</sup>, the *Sterling Edition* programs promise to deliver more effective and efficient assessment and intervention while at the same time providing the data clinicians, special educators, teachers, and administrators need for accountability. Laureate's two *Language Development Packages* include *Sterling Editions* programs that address building a core lexicon, setting word order parameters, establishing syntactic competence, and assisting with auditory processing.

### **Applying Theory & Research: Language Development Package- Level 1**

Programs included in this package are: *First Words*, *First Verbs*, *First Words II*, *First Categories*, and *Simple Sentence Structure Sterling Editions*. Developmentally, the first programs in this package are *First Words*, *First Verbs*, and *First Words II Sterling Editions* Laureate's early vocabulary development programs. They help build an initial core vocabulary of 100 Nouns and 50 Verbs. Current linguistic theory and research suggest that even early language intervention intended to develop a core lexicon during the one word stage should not merely focus on teaching the phonological and semantic features of the lexical categories such as Nouns and Verbs. Rather, intervention should also place considerable emphasis on illustrating the syntactic features of the word; i.e., the use of the *Functional Categories* in association with those Nouns and Verbs in various syntactic settings. Without this input, children with language impairments will find it more difficult to establish a rich and complete lexicon and to acquire syntax.

#### **First Words, First Verbs, and First Words II**

In *First Words*, *First Verbs*, and *First Words II Sterling Editions*, we enhanced traditional approaches to vocabulary instruction based on current research findings. During instruction and feedback, words in training are always presented in the context of full sentences. By using full albeit short sentences we are providing multiple examples of appropriate parameter settings for English. Additionally, the sentences employed are designed to provide systematic receptive language input illustrating *Functional Category* forms associated with the *Lexical Category* of the word being trained. In the case of Noun instruction, Determiners are included such as the use of Articles (a, the) before and after reference is established, and the proper use of Prenominal Determiners in singular and plural contexts (*this/these*). In the case of Verbs, systematic input illustrates the Tense elements associated with Verbs. Verbs are more complex than Nouns, however, so in addition to including examples of Tense elements, we have included systematic receptive input focusing

on the Argument Structure(s) and Thematic Roles (e.g. *Agent, Theme*) associated with each Verb. *First Verbs* includes examples of Verbs with only one argument also known as Intransitive Verbs (e.g. *run, jump*), Transitive Verbs with two required arguments (e.g. *hit, wash*), and finally Ditransitive Verbs with three required arguments (e.g. *give, bring*). Since Tense, the *Functional Category* associated with Verbs, assigns Nominative Case, instruction also includes the substitution of Nouns with third person Nominative Case Pronouns (*I, he, she, and they*). Furthermore, once a student has moved past the basic training levels, each word is associated with a unique reinforcement animation that provides additional examples of the word in full sentences. Nouns are presented in additional sentences that illustrate Determiner constructions; i.e., the Noun is Merged with a Determiner to form a Determiner Phrase. Included are sentences featuring articles, Pronouns, the Genitive (Possessive) 's inflection, and Determiner Phrases that include one or more Adjectives. In the case of Verbs, these sentences provide receptive language input illustrating Tense and Tense Phrases; i.e., several morphological forms of the Verb (e.g., *past tense, present progressive, third person singular, and future modal "will"*) in complete sentences. All of this happens during reinforcement animation; a point when one would expect the student's attention to be most fully engaged.

### **First Categories**

After a student has established a core Noun vocabulary, *First Categories Sterling Edition* can be introduced. Categorization is a key component in language and concept development. In terms of objects, three levels of categorization have been described: basic (e.g. dog, apple, shoe), superordinate (e.g. Animal, Food, Clothing), and subordinate (e.g. Poodle, Boxer, Golden Retriever). *First Words* and *First Words II* train basic category Nouns. This level is essentially one of object labeling and is associated with the establishment of an initial Noun vocabulary. It is at this level that semantic divisions are applied to abstract categories of objects in the world. The number of members in a basic level semantic category can be infinite. For example, there is no practical limit to the number of different dogs, apples, or chairs in the world. The superordinate level is more general than the basic level and includes heterogeneous items. For example, "furniture" is a superordinate category that includes such diverse objects as chairs, table, and dressers. In terms of order of acquisition, basic level categories are acquired first, followed by superordinate categories, and finally subordinate categories (Mervis & Crisafi, 1982). *First Categories* tests and trains six superordinate semantic categories (Animals, Food, Body Parts, Clothing, Furniture, and Vehicles) using ten basic level semantic categories (e.g. chair, hat, nose) for each superordinate category.

### **Simple Sentence Structure**

Clinically we all have encountered children who produce sentences with "mixed up" Subject-Verb-Object word order and thus encounter difficulty interpreting reversible sentences. Linguistic theory provides us an explanation for their difficulties. The word order parameters have not been set to their appropriate English values. *Simple Sentence Structure* was designed to provide what are believed to be salient "triggering" data for setting the

Subject-Verb-Object (SVO) canonical word order of English. The SVO order is determined by two different parameters. One parameter determines whether an Object (Complement) comes before or after the *Head* of the phrase. In English an Object comes after the Verb. The other word order parameter determines whether Subjects (Specifiers) come before or after the *Head* of the phrase. In English the Subject comes before the *Head*. These two parameters and their settings determine word order in all the languages. *Simple Sentence Structure* systematically takes students through contrasting Verbs, contrasting Complements (Objects), contrasting Specifiers (Subjects), and finally to a set of reversible sentences (e.g., The girl is splashing the boy/The boy is splashing the girl). In a clinical study using an intervention strategy based on *Simple Sentence Structure*, Loeb and Armstrong (2001) found the SVO strategy was effective in increasing the production of SVO constructions.

## **Applying Theory & Research: Language Development Package- Level 2**

The *Language Development Package- Level 2* takes students from the early two word stage through the establishment of the critical *Functional Category* syntax forms of Determiners, Tense, and Prepositions, as well as narrative perspective taking, and the auditory processing of Nouns and the sounds associated with them. The programs included on this level are: *LanguageLinks®: Syntax Assessment & Intervention Levels 1-6, Prepositions!, Pronoun Perspective, and Nouns & Sounds Sterling Editions*. The programs in Level 2 build on the language competencies children have established on the first level. Following the progression suggested by current linguistic theory, the next step in language intervention after the word order parameters are set is to provide targeted training on *Functional Category* forms. An important step towards mastering syntax is learning Determiner and Tense forms and the syntactic structures associated with these forms. Complementing this should be instruction in Prepositions. In typically developing children Determiners, Tense, and Prepositions begin appearing in the early two-word stage.

### **LanguageLinks**

*LanguageLinks* is a software system that covers a broad range of Determiner and Tense forms in six developmentally ordered levels. *LanguageLinks* provides an evidence-based practice approach to helping children with syntactic deficits achieve language competence. It is the first comprehensive syntax intervention system to be based on current linguistic theory, instructional research, and have field test data to support its use. Each of the Levels in *LanguageLinks* contains six Modules which train either two or three grammatically contrasting Determiner or Tense forms per Module. The *LanguageLinks* system will take children with language impairments from the early two-word development stage (typically developing children are in this stage from 18-24 months of age) through the mastery of a broad range of syntactic forms in the Determiner and Tense categories. In typically developing children this takes place by five years of age. Children with language disorders may need to work on these *Functional Category* forms throughout their elementary school years.

### **Prepositions!**

*Prepositions!* trains 10 important Prepositions and can be introduced at the same time a student is working on *LanguageLinks*. Spatial or locative Prepositions are especially important in early syntax development. They are used to express concepts of location or position. Knowledge of spatial Prepositions is critical to commenting on the position of objects in the environment. These Prepositions enter the lexicon early in the word combination stage. The Prepositions “in” and “on” are typically cited as the two earliest developing spatial Prepositions. They were among the 14 grammatical morphemes studied in Brown’s classic 1973 book *A First Language: The Early Stages*.

Finn, Futernick, and MacEachern (2005) reported on a study conducted in the Medford Massachusetts Public Schools using prototype modules from *LanguageLinks* and *Prepositions!* Twenty-two pre-school children with language impairments served as subjects. Half the children used the *LanguageLinks* syntax intervention system and the other half used other Laureate software that focused on vocabulary and concept acquisition. The language status of each child was evaluated using the Comprehensive Assessment of Spoken Language (CASL: Carrow-Woolfolk, 1999) both prior to computer use and twelve weeks later.

As anticipated both groups made considerable progress. On each subtest of the CASL, score increases were larger among children using the *LanguageLinks* syntax software. Considered in terms of Test-Age Equivalents, advances in the functional language of children using the vocabulary and concept software averaged 5.3 months across the three core subtests, while advances of those using the syntax software averaged 8.7 months.

More recently an additional study using *LanguageLinks* was conducted at Clarke School for the Deaf in Northampton Massachusetts (Merchant, de Villiers, & Smith, 2008). Ten oral deaf kindergarten and first grade students served as subjects. The children were pre-tested on vocabulary using the Expressive One-Word Picture Vocabulary Test (EOWPVT; Gardner, 1990) and on expressive morphosyntax using a portion of the Diagnostic Evaluation of Language Variation (DELV; Seymour, Roeper, & de Villiers, 2003). The children were divided into two groups. One group used the *LanguageLinks* syntax training software and the second group worked with software that trained vocabulary. After 10 weeks (time 2) all subjects were re-tested with the EOWPVT and the DELV. The groups then traded software programs and received training for another 10 weeks, after which they were again tested (time 3). As such, all of the children received training with both the syntax and the vocabulary programs, but in a different order.

The children’s scores on the expressive morphosyntax test (DELV) were significantly improved at the completion of the study. A paired t-test on scores at time 3 versus time 1 was significant ( $t(9)=2.61, p<.03$ ). The more important question, however, was whether differences in children’s pre- and post-test scores on the DELV were simply due to the passage of time, or differed depending on whether they had been in *LanguageLinks* syntax training or vocabulary training for that period. Comparisons of pre- and post-training scores on the DELV revealed that improvements in expressive morphosyntax were significant when children had

been in *LanguageLinks* syntax training ( $t(9)=2.53, p<.032$ ) but not when they had been in vocabulary training ( $t(9)=.68, n.s.$ ). Clearly, *LanguageLinks* syntax training *per se* was associated with significant improvements in expressive morphosyntax.

What about expressive vocabulary growth? Since all children used both the syntax and vocabulary programs, a growth in vocabulary from time 1 to time 3 was predicted and this was found ( $t(9)=6.19, p<.001$ ). Additional comparisons to determine whether the two training programs had a differential effect on post-training EOWPVT scores revealed that improvements in expressive vocabulary were significant when children had been in vocabulary training ( $t(9)=3.5, p<.001$ ) and when they had been in syntax training ( $t(9)=2.44, p<.04$ ). Thus while differential improvements in expressive morphosyntax could clearly be attributed to *LanguageLinks* training, the analogous pattern was not seen with vocabulary training; vocabulary growth during the study was not dependent upon which program was being used. To summarize, this study found that the expressive morphosyntax scores of oral deaf children increased significantly after using *LanguageLinks* for 10 weeks, but not after using vocabulary software for a similar period of time. It is also notable and encouraging that, while the *LanguageLinks* software provides receptive syntax training, the measured gains were in expressive syntax.

While the effectiveness of using language intervention software has been previously demonstrated, those experiments have often involved impractically intensive intervention schedules. The outcomes of the Medford and Clarke studies are noteworthy because the intervention was conducted under entirely naturalistic conditions. These two well-controlled field studies demonstrate the effectiveness of classroom use of *LanguageLinks* and *Prepositions!* in improving the expressive syntax abilities of pre-school and school age children.

### **Pronoun Perspective: 1st and 2nd Person**

The next program in the package is *Pronoun Perspective: 1st and 2nd Person*. It was designed to assist students in the development of 1st and 2nd Person Pronoun reference in narrative contexts. In other words, the student is an observer taking a 3rd Person view of the speakers and listeners on the screen. This is different from the context presented in *LanguageLinks*. In *LanguageLinks* 1st and 2nd Person Pronouns are trained in a context where the speaker on the screen is always the 1st Person and the student using the program is always the 2nd Person to whom the speaker refers.

Students should be introduced to *Pronoun Perspective* only after they have demonstrated mastery of 1st and 2nd Person Pronouns in the context provided in *LanguageLinks* where the student is the 2nd Person and the character on the screen is always the 1st Person speaker who says for example, “These skates are for me. Those skates are for you. Find the skates for me/you.” The context provided in *Pronoun Perspective* asks the student to identify, for example, “Who says, ‘The frog hopped over to me/you,’” where both the speaker and the listener are on the screen and the student is an observer. This narrative perspective is more difficult and often poses difficulties for young children who have not been extensively exposed to narrative texts before their entry into kindergarten. Even children with

typical language development have some difficulty with terms that require a shifting perspective. Typically developing children are able to perform well on perspective-taking tasks only after they have mastered Pronouns with their shifting reference.

### **Nouns & Sounds**

The last program in the *Language Development Package: Level 2* is *Nouns & Sounds*. This program encourages individuals to listen to and discriminate environmental sounds. Students learn to match common environmental sounds with 100 Noun photographs. Activities which help children perceive, identify, and discriminate environmental sounds are frequently included in intervention programs for children with autism and other communication disorders (Maurice, Green, & Luce, 1996). *Nouns & Sounds* includes seven different activities that provide students with opportunities to develop their auditory awareness, perception, and discrimination skills.

The evidence-based software programs included in the *Language Development Packages (Levels 1 and 2)* can provide consistent encouraging language intervention to help students more quickly master the vocabulary and syntax necessary for communication competence.

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