Chapter 3

Definitions of problems in language development classified in a clinical diagnostic model

Abstract

Discussions concerning the terminology and classification of language problems are common among both researchers and clinicians. Language problems in young children can be approached from different points of view, depending on the background of professionals. A review of the literature shows that definitions of language development and language problems can be grouped according to any of a number of taxonomies, each of which may focus on descriptive and explanatory stages in language development, on factors that influence language development, or on linguistic categories. This paper describes various classifications of definitions of language development and language problems that are found in the literature. These orientations are subsequently integrated into a general and clinical diagnostic model for screening, testing, examining, and mapping (STEM) language problems in young children. The STEM model can function as a protocol for identifying and diagnosing children with language problems. The four levels are interrelated; together, they comprise a complete approach for addressing children with language problems.

3.1 Introduction

Researchers engage in considerable discussion concerning the terminology and classification of language problems. A previous study showed that professionals in Dutch healthcare define language problems in several ways (Luinge et al. 2002) and that there was apparently no “gold standard” for diagnosing language problems in children. The perspectives from
which researchers address language development and language problems differ from those
used by healthcare professionals (Ziegler et al. 1990; Bishop 1997; Kahmi 1998).

The original aim of this study was to formulate a definition of language problems. It
proved difficult to arrive at a single, unambiguous definition, however, as language
problems in young children can be approached in several ways, depending upon professional
background. For example, the following are among the descriptions that are found in the
literature: 1) “Children have a language problem whenever their language abilities are be-
low those expected for their age and their level of functioning” (Leonard 1998 p. 177) and
2) “The most useful diagnostic distinction is between developmental language delay that
is secondary to other conditions (mental retardation, pervasive developmental disorder or
autism, physical handicap, hearing loss, brain damage and environmental deprivation) what
which we call secondary language delay, and developmental language delay that occurs
when a child’s nonlinguistic cognitive skills and physical abilities are developing normally,
what we call specific language delay” (Whitehurst and Fischel 1994, p. 614). Language
problems can be classified according to any of a number of taxonomies, each of which may
focus on descriptive and explanatory stages in language development, on many factors that
influence language development, on linguistic processing, or on linguistic categories. In
fact, a definition of language depends on the context within which the question, “What is
language?” is asked (Bloom and Lahey 1978).

The descriptive orientation characterizes stages according to points at which there is
active change in language development (Ingram 1989). Descriptive stages roughly describe
the aspects of language comprehension and production that children learn at certain de-
velopmental stages. For example, the early linguistic stage (1 year to 2.5 years) can be
described roughly by the production of the first words, followed by a word spurt and the
production of two-word utterances (e.g., “daddy book”). Delays in language development
become noticeable when developmental milestones do not emerge at certain ages. Descrip-
tive stages identify changes in language development. In contrast, explanatory stages seek
to give reasons for those changes. Explanatory stages are intended to consider how children
acquire language, based on linguistic input. For example, before children produce their first
words, they must discover which sound sequences are words. Children must discover units
that belong to their native language from a continuous sound stream (Saffran et al. 2001).

In the categorical orientation, language development can be defined according to in-
fluencing factors (Bloom and Lahey 1978; Kahmi 1998). The development of the speech
and language system is possible only if children have sufficient opportunities for hearing,
moving, learning, and language input; disorders in one of these aspects may give rise to
language problems. More detailed categories of abilities that are considered necessary for
learning and using language include aspects of language processing, such as those involved
in memory, discrimination, and association. These molecular categories comprise the spe-
cific abilities orientation (Bloom and Lahey 1978). Within this orientation, children with
language problems can be described in terms of the relative strengths and weaknesses of
certain processes or abilities. The categorical orientation and the specific abilities orienta-
tion are both based on the etiology of language problems. In addition, language problems
may subsequently interfere with a child’s further development, as language plays an important role in cognitive and social-emotional development. Language problems may be related to behavioral problems (Beichtman et al. 1986; Cantwell and Baker 1987; Benasich et al. 1993; Coster 2001). Moreover, language problems have also been linked to learning difficulties (Silva et al. 1987; Stothard et al. 1998).

In the linguistic orientation, language problems are described in detail according to several symptom-oriented manifestations (Bloom and Lahey 1978). Problems with language can occur at several levels of language, including phonology, morphology, syntax, semantics, and pragmatics. Subtypes of language problems can subsequently be formulated according to combinations of problems in these aspects of language.

Although the definition of language problems can differ according to the orientation toward language development, researchers and professionals generally agree that children with language problems should be identified and diagnosed as early as possible (Blackman 1999; Mattson et al. 2001; Rescorla and Alley 2001), as the neurological system of speech and language develops during the first years of life (Mayeux and Kandel 1999; Mehler and Christophe 2000; Stromswold 2000).

This study introduces a literature-based model for diagnosing language problems in children. The model is similar in many ways to more general clinical diagnostic models. The first phase of diagnosis consists of screening for and detecting problems. The second phase involves testing to determine if actual problems exist and, if they do, to identify possible causes. These problems should be examined in order to apply the appropriate therapy (American Academy of Pediatrics 2001).

The diagnosis of language problems is influenced by these theoretical approaches and by the various backgrounds of professionals. This paper describes various classifications of definitions of language development and language problems that are found in the literature. These orientations are subsequently embedded within a general clinical diagnostic model for screening, diagnosing, and examining language problems in young children.

3.2 Classifications of language problems

In the literature, language development and language problems in young children are approached from a number of different perspectives. The descriptive orientation describes language problems according to language milestones that characterize several developmental stages. The aim of explanatory stages is to describe the underlying processes of changes that take place during these descriptive stages. The descriptive orientation uses both language comprehension and language production to describe language problems. The categorical and specific-abilities orientations define the conditions for language development and language problems according to the etiology of the language problems, whereas the linguistic orientation describes language development and language problems in detail, focusing on the manifestation of the problems.
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3.2.1 Descriptive orientation

Developmental stages

In the literature, there appears to be consensus among researchers concerning the milestones in descriptive stages (Foster 1990; Goorhuis-Brouwer and Schaerlaekens 2000; Mayeux and Kandel 1999; Needlman 2000). These stages can be divided into the pre-linguistic stage, the early linguistic stage, the differentiation stage, and the completion stage.

In the pre-linguistic stage (0 to 1 year), crying, reflexive vocalization (e.g., burps), and consonant-like vowels [k,g] followed by a range of vowels are the first marks after birth (about 0 to 6 months) (Ingram 1989). The crying is loud and hard, the air escapes in a continuous flow, and articulation is not yet involved. Children start to vocalize between six weeks and four months of age, thereafter discovering vocal capacity (e.g., resonance). At first, children produce simple vowels. Afterwards, they manipulate vocalizations and gain more control over the vocal breath stream. Reciprocal smiling between parents and children is also an important milestone in communicative development during the pre-linguistic stage. Reciprocal smiling emerges after the first three months of life. This reciprocity gives structure to the interaction between parents and children (Breeuwsma 1994). At the canonical babbling stage, which is at the end of the pre-linguistic stage, syllabic timing constraints on the relationship of openings and closures of the mouth are discovered. After seven months, children begin to produce monosyllabic babble, which is a combination of consonants and vowels, characterized by reduplicated diphthongs with considerable variation (e.g., boe, boe, tie, die [in Dutch]). Between eight and ten months, babbling takes on a new complexity, involving many syllables and inflections that mimic the native language. The babble becomes language specific by the age of roughly one year.

The early linguistic stage (1–2.5 years) is a period of single utterances, which is followed by a word spurt and the production of two-word utterances (e.g., “daddy book”). The most important difference between this stage and the former is the emergence of the first meaningful and language-specific words. The one-word stage begins when a word emerges more than once and when it sounds roughly similar every time (Hendriks et al. 1997). Most children produce their first words around nine to fifteen months of age. During the eight months that follow, the vocabulary expands to include between fifteen and fifty words. At this age, children produce jargon, follow simple commands, and label objects in the world around them. At the age of eighteen months, children are able to name pictures and identify one or more body parts. The moment of the lexicon explosion is different for each child. The average age at which children are able to produce fifty words is around twenty months. Children name objects based on over-generalization and under-generalization. Over-generalization implies that children use one word for many things (e.g., every four-legged animal is a “cat”). Under-generalization implies that children use common nouns instead of proper name (e.g., only the child’s bike is named “bike.” The bikes of other children have other names). Around the age of twenty months, children also start to produce two-word sentences. Two-word utterances are primarily oriented toward their own needs (“more cookie”) and, to a lesser extent, toward events in the immediate
3.2 Classifications of language problems

Environment (“mommy go”) (Zuckerman et al. 1999). Two-word utterances become combinations of three or more words, children learn to use language beyond certain actions (asking for cookies without pointing at a cookie), and communicative intentions become increasingly more explicit (Breeuwsma 1994).

During the differentiation stage (2.5–5 years) sentences become increasingly complex. At first, children produce short sentences, producing compound sentences later on. This stage also encompasses the onset of inflections (plural, past tense) and pronouns, prepositions, and auxiliaries. In addition, children begin to tell stories.

Finally, the completion stage (>5 years) can be characterized by the expansion of the lexicon and sentences. At this stage, the language approaches adult levels of speech competence.

Milestones that are not reached by a certain age (e.g., the absence of babbling by ten months, not using single words at eighteen months, or not using short utterances at twenty-four months; Kelly and Sally, 1999) are initial indicators of language problems. The descriptive orientation focuses on rough descriptions of language problems and does not distinguish between different types of language problems. The advantage of a descriptive orientation is that it allows differentiation between normal and delayed language development in a large population in a short time. However, this orientation has limitations with regard to the diagnosis of language problems. It provides neither a description of factors that contribute to the language problems nor a detailed description of the language problems in order to determine the facets of language development that are actually affected.

Explanatory stages

Before children show changes in the early linguistic stage (e.g., producing object-like words), they must discover which sound sequences are words in the pre-linguistic stage. Children must identify units belonging to their native language out of a continuous sound stream (Saffran et al. 2001). One way to examine the mechanisms underlying the stages of language development is to present children with artificial languages consisting of specific features of natural language. For instance, some experiments involve presenting a new artificial language after young children have become accustomed to another artificial language. The subsequent reactions of the children can be measured according to how long they pay attention to the new language. Artificial languages allow researchers to isolate certain aspects of language. In this way, Saffran et al. (1996) found that, among eight-month-old children, word segmentation within a continuous stream of sounds was based on the statistical relationships between neighboring speech sounds during only two minutes of exposure. Children seemed to detect the probabilities with which one syllable predicts another.

For the production of words in the early linguistic stage, children must use symbols and connect sounds or gestures arbitrarily to specific concepts or percepts (Christiansen and Kirby 2003). Language is a conventional and referential system, and children must discover its symbolic value. The relation between a verb and a noun can be semantic (Hendriks et al. 1997). Children may be unaware of word categories (e.g., verb, noun), and may combine two meaningful units without using underlying sentence structure. For instance, the utter-
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ance “daddy sleep” can be analyzed in several ways, involving context or intonation: “daddy is sleeping,” “daddy is sleepy,” and “is daddy sleepy?” Gomez and Gerken (1999) showed that, from the age of twelve months, children become sensitive to linguistic cues in early development. Their experiments verified how children learn artificial grammar. These children could distinguish new grammatical strings from ungrammatical strings after less than two minutes of exposure to the artificial grammar. By this age, therefore, children seem to be sensitive to grammatical structures. These results provide no information about the production of grammar structures. Mintz et al. (2002) stated that, by the age of 2.5 years, children produce utterances that display some rudimentary syntax and knowledge of grammatical categories. Using a database of speech directed toward children, they examined information that might be available in speech to children younger than 2.5 years. They were interested in knowing how children learn the grammatical category structures of their native languages. Their results showed that words (nouns and verbs) could be successfully categorized according to their co-occurrence patterns with surrounding words, based on speech directed toward children under the age of 2.5. These results provide support for theories of grammatical category formation involving distributional analysis. Distributional analysis means that the distributional context of a word provides information about its grammatical category. In accord with these results, Marcus et al. (2001) suggest that infants can represent, extract, and generalize abstract algebraic rules. Furthermore, adults were also found to use distributional analysis in an artificial learning task (Mintz et al. 2002). In contrast, adults with language or learning disabilities seem to have difficulty distinguishing between grammatical and ungrammatical word strings (Plante et al. 2002).

In the differentiation stage and the completion stage, sentences become increasingly complex. Hauser et al. (2002) hypothesized that the faculty of language in the narrow sense includes only recursion which is its only uniquely human component. Recursion is the ability to use one rule that can be applied infinitely, such as making embedded sentences of unlimited length. Recursion may play an important role in the ability to make compound sentences. “Semantic bootstrapping” and “syntactic bootstrapping” may also play a role in the discovery of linguistic structures in sentences (Pinker 1994; Hendriks et al. 1997). Semantic bootstrapping refers to a process whereby children acquire syntactic structures according to the division of roles in sentences (agent, patient, and goal). Syntactic bootstrapping describes a process whereby children discover the meaning of words through verbs, which occur in different contexts. Children must implicitly discover and use the grammar of their language to determine who-did-what-to-whom in each sentence and to determine grammatical endings (-s, -ed, -ing) and the function words (of, to, the) in order to convey the further combinatorial meaning of an utterance (Saffran et al. 2001).

The differentiation stage also involves the onset of inflections (plural, past tense) and pronouns, prepositions, and auxiliaries. Children initially use correct forms of the past simple tense of strong verbs (e.g., went, came). They may subsequently discover a rule for inflecting weak verbs into the past simple tense and then apply this new rule to strong verbs as well (e.g., singed, comed). Finally, children discover the exceptions to regular conjugations, and they produce the correct past simple tense of strong verbs. The specific
rules that they use remain unclear, however, as does their discovery and how it is involved in the language acquisition of young children (Gomez and Gerken 1999; McClelland and Seidenberg 2000).

Language production and language comprehension

The literature also provides descriptions in terms of language production and language comprehension (Diedrich and Carr 1984; Tomblin et al. 1997). Language production refers to spoken language, and language comprehension refers to the reception of language. It is customary to include measures of both language comprehension and language production in any examination of language problems (Tomblin et al. 1996).

The classical distinction between expressive and receptive language abilities is also made between patients with anterior aphasics (Broca’s aphasia) and posterior aphasics (Wernicke’s aphasia). Broca’s aphasia is best characterized by profound expressive deficit and relatively good auditory language comprehension. (. . . most migratory bird . . . start . . . way . . . winter home . . . weather . . . summer home . . . . still fairly warm . . . [. . . 
Kalat 1998).

Wernicke’s aphasia, in contrast, is characterized by dense auditory language comprehension in the context of well-articulated and fluent speech. (The following conversation is between a woman with Wernicke’s aphasia (W) and a speech therapist (T): T: (Holding picture of an apron) Can you name that one? W: Um . . . you see I can’t, I can barely do: he would give me sort of umm . . . T: A clue? W: That’s right . . . just a like, just a . . . T: You mean, like, You wear that when you wash dishes or when you cook a meal? W: Yeah, something like that [. . . , Kalat 1998).

One way of determining the presence of a language problem is to compare the level of language production and language comprehension to the average level of functioning for a certain age (Diedrich and Carr 1984; Tomblin et al. 1996; Bishop 1997). Assuming age equivalents, however, makes it easy to overlook normal variations in language acquisition. Age equivalents consist of the average functioning of a certain age group. This implies that some children should perform above average and that some children should perform below average, in addition to those who perform exactly on average. As specified by Bishop (1997), p. 28, “[. . . ] they convey the impression that any child who scores below age level has a problem, when in fact, a certain proportion of children must score below average, by definition.” It is important to have a reasonable idea of the range of ability at different ages and not just of the average level of language ability at those ages (Bishop 1997).

Normal variation on standardized tests, as determined by the standard deviation (SD), is another way of determining the presence of a language problem. Different standard deviations are used, and they can vary from 1 SD to 2 SD or more below the mean level of language functioning (Hall 1997; Luinge et al. 2002).

3.2.2 Categorical and specific abilities orientation

Many authors differentiate between specific language impairments (SLI) and non-specific language impairments (non-SLI). This categorical orientation is based on the idea that many
factors can influence the processing of language (Whitehurst and Fischel 1994; Chapman 2000). The development of the language system is possible only if children have sufficient opportunities for hearing, moving, learning, and language input. A disorder in any one of these aspects may give rise to language problems. In specific language problems, the language problem is the only developmental problem. Non-specific language problems are related to other factors (Whitehurst and Fischel 1994; Tomblin et al. 1996; Goorhuis-Brouwer and Schaerlaekens 2000), such as hearing loss, mental retardation, emotional problems, pervasive developmental disorder and autism, physical handicaps, neurological problems, environmental deprivations, or a combination of these factors.

If none of these factors can be identified, the language problem is specific. Specific language problems have no clear-cut etiology. The exact specificity of SLI, however, remains debatable, given the reported level of co-morbidity (Law et al. 2004). In addition, specific language problems may be gender modified, as language problems occur more often in males than in females (Tomblin et al. 1997). Furthermore, genes may have an influence on specific language problems (Bishop 1997).

The special abilities orientation is based on detailed categories of abilities that are considered necessary for learning and using language. For example, the overview of Bishop (1992) of several cognitive processes and abilities underlying language problems addressed hypotheses concerning failures in programming speech or auditory perception, impairments in mastering grammatical relations and in developing concepts, failure to apply hypothesis-testing procedures, and limited information-processing ability.

It is important for diagnostic evaluation to be conducted from an interdisciplinary perspective in order to obtain the broadest possible view of the child and family. For example, language tests that take place in non-medical settings may cause a tendency to overlook the physical health component (Blackman 1999). The distinction between SLI and non-SLI seems to be useful for determining an adequate choice of therapy. For instance, children with SLI seem to benefit from speech therapy, whereas children with language problems in co-morbidity with cognitive delay seem to benefit more from special education (Knijff and Goorhuis-Brouwer 2001). The cause of a language problem determines the application of the appropriate therapy, and a multidisciplinary approach toward language problems is therefore thought to be of utmost importance.

The greatest advantage of this orientation is that it examines why language problems exist. Nonetheless, the examination of contributing factors is time-consuming and says nothing about the language problems themselves.

### 3.2.3 Linguistic orientation

The categorizing principle within the linguistic taxonomy is the manifestation of the language problem instead of the etiological orientation (Bloom and Lahey 1978). Language problems can be described according to one or more different language modalities (Gavin et al. 1993; Eyer and Leonard 1995; Hall 1997; Leonard 1998), such as phonology, semantics, syntax, morphology, or pragmatics. For example, possible problems include difficulties with sentence structure, reflexives, or word retrieval, omissions of phonemes, or problems
with language use in social contexts. The advantage of the linguistic orientation is that it examines language problems in detail, which in turn can be useful for determining language therapy. The detailed examination of language profiles is time-consuming, however, and should be applied repeatedly. This orientation also involves a risk of neglecting the etiology of the language problem.

Language profiles

It is possible that language problems occur independently in various modalities. If this is the case, subtypes of language problems could be formulated according to combinations of problems involving these aspects of language. For example, Rapin and Allen (1987) formulated several descriptive, clinically based subtypes of language disorders. The syndromes they distinguished were verbal auditory agnosia (comprehension –, understanding of gestures +, and speech –)\(^1\), verbal dyspraxia (comprehension +, production –), phonologic programming deficit syndrome (fluency +, understanding of speech –, comprehension +), phonologic-syntactic deficit syndrome (speech –, comprehension +/-), and semantic-pragmatic deficit syndrome (fluency +, content language –, comprehension +/-, turn taking –, maintaining a topic –). McGregor et al. (2002) studied semantic representation and naming in children with SLI. Children with SLI make more naming errors than do their age-mates. Their study demonstrated that naming performance was consistent with hypothesized relations between semantic memory and information retrieval.

Other researchers have identified different subtypes of language problems by using either descriptive, clinically based accounts or statistical methods (e.g., cluster analysis procedures). None of the sub-typing approaches, however, has gained either general acceptance or widespread use (Watkins 1992). Clear and objective diagnostic criteria are lacking (e.g., outcomes on language profiles are dependent on the measures used in the analysis), and the boundaries between the various subgroups are unclear (Bishop 1997). One possible explanation for this lack of clarity is that individual children move across subgroups over developmental time (Conti-Ramsden and Botting 1999).

Language profiles in non-SLI

Language profiles sometimes provide information about the etiological background of language problems. Children with hearing loss may have difficulty grasping the meaning of metaphorical or abstract language use (Kievit et al. 1992). They are able to name objects and events in their own world and know how to communicate, but these children have difficulty learning grammatical rules. Children with hearing loss may also be unable to discriminate between several (similar) phonemes (/w, b/) of language, omit or substitute phonemes (/p-t-k/), or omit function words (e.g., “the,” or “at”) (Goorhuis-Brouwer and Schauerlaekens 2000). Their ability to comprehend language and to articulate (e.g., “blii” instead of “bril,” in Dutch) may also be insufficient, and they may hesitate to join conversations because of insecurity about the perceived information. Briscoe et al. (2001) investigated phonological

\(^1\) + refers to sufficient; – refers to insufficient
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processing, language, and literacy in children with mild-to-moderate sensory-neural hearing loss and those with specific language impairment (SLI). The main finding of their research was that children with mild-to-moderate sensory-neural hearing loss showed the same degree of impairment SLI on tests of phonological discrimination, phonological awareness, and non-word repetition as did normally hearing children. The hearing-impaired children, however, exhibited none of the pervasive language and literacy difficulties that characterize SLI.

The development of mentally retarded children is usually delayed in several ways. The most obvious characteristic is sub-average intellectual functioning. An IQ that is two standard deviations or more below the mean as determined by scores on standardized general intelligence instruments is considered indicative of sub-average intellectual functioning (Baumeister and Baumeister 1995). Mentally retarded children have problems with communication, self-care, home living, social skills, community use, self-direction, health and safety, functional academics, leisure, and work. Mundy and Kasari (1995) found that children with Down syndrome demonstrated a disturbance in non-verbal requests, and that this disturbance was apparent across all developmental levels. This finding may indicate a specific characteristic of children with Down syndrome, as the disturbance was not observed in children with mental retardation of unknown etiology. Mervis and Robinson (2000) found that toddlers with Williams syndrome had substantially and significantly greater expressive vocabularies than did the CA-matched children with Down syndrome.

Emotional attachment can also influence language development. Emotional problems can lead to mutism (not speaking) or elective mutism (only speaking in certain contexts) (Goorhuis-Brouwer and Schaerlaekens 2000). These symptoms are also observable in autistic children. The basic symptoms of autism are major deficits in the ability to relate to others, deficits in verbal and non-verbal communication, and abnormalities of routine and behavior (e.g., rocking, hand waving, or head banging) (Harris 1995; Spreen et al. 1995). Manifestations of disordered communication in autistic children include failure to speak, echolalia, (parrot-speech), abnormal non-verbal communication, and strange pitches in speech and long-lasting monologues (Kievit et al. 1992). Very young autistic children show a lack of communicative babbling and substantial delays in the onset of rudimentary speech (Harris 1995). In contrast to autistic children, children with Asperger syndrome (a special case of the autistic spectrum) have early onset of language development and are more intelligent than autistic children are, but exhibit other signs of autism and tend to be unusually clumsy (Spreen et al. 1995). Adams et al. (2002) compared the conversational behavior of children with Asperger syndrome with that of children with conduct disorders (i.e., complex behavioral problems, involving disobedience, lying, cheating, stealing, hitting, or similar behaviors). They found that the responses of the children with Asperger syndrome showed significantly more pragmatic problems than did those of children with conduct disorders.

Children with motor problems of the speech organs (physical handicaps) have difficulty controlling the lips and the tongue (transformation of vowels), the velum and pharynx (open or closed nasal speech), or the larynx (hoarseness). Furthermore, these children show prosodic problems (e.g., monotonic speech) and co-ordination problems of respiration and
voice (e.g., production of short words in a single respiration stream). Maassen et al. (2003) found that subtle auditory processing deficits contribute to such part-of-speech output disorders as apraxic speech disorders. Cleft palate is another physical handicap that affects language development. The main characteristics of children with cleft palates are delayed language development at all levels of language functioning and speech problems (e.g., nasal speech) (Goorhuis-Brouwer and Schaerlaekens 2000).

Aphasia and other neurological problems can also lead to language problems. In contrast to autistic children, children with developmental aphasia frequently use and understand gestures as a means of social communication (Spreeen et al. 1995). When speech is present, however, aphasic children tend to have more problems with articulation.

Many studies have also concluded that parental education and socio-economic status (SES) is likely to be related to language development (Hack et al. 1992; Smith et al. 1994; Vohr et al. 1988; Wright et al. 1983; Tomblin et al. 1997). Low SES seems to be a contributing factor in delayed language development.

### 3.3 A diagnostic model for children with language problems

In our opinion, the various ways in which language problems can be described can be classified into the following four levels of a diagnostic model for language problems (STEM): screening, testing, examining, and mapping (see Table 3.1). STEM describes the diagnostics of language problems systematically, according to the language-development orientations described in the previous sections. It demonstrates that different orientations toward language problems are useful at different diagnostic levels. In STEM, screening is based on descriptive stages in language development. Testing is based on the distinction between language production and language comprehension. Examination is based on both the categorical and the specific-abilities orientations. The mapping level is based on the linguistic orientation.

The diagnosis of language problems is becoming increasingly specific and embedded within the various approaches to language problems that appear in the literature. The aim of STEM is to examine the language problems of children thoroughly before applying therapy.

#### Level 1: Screening based on the descriptive orientation

Screening is a short assessment procedure designed to identify children who may need more comprehensive evaluation (American Academy of Pediatrics 2001). Milestones appear to be good measures for detecting language delays (Stromswold 2000; Kelly and Sally 1999; Stott et al. 2002). Delays in language development become noticeable when developmental milestones are not reached by certain ages. Screening instruments that are based on milestones in language development include the following: CLAMS (Clinical Linguistic and Auditory Milestone Scale), GMS (Groninger Minimum Spreeknormen), ELM (Early Language Milestone Scale), LDS (Language Development Survey), and Denver II (Denver,
Table 3.1: STEM Model: Screening, Testing, Examination, and Mapping, the different levels in the diagnosis of language problems.

<table>
<thead>
<tr>
<th>Level 1: Screening</th>
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<tbody>
<tr>
<td>Differentiation between normal (+) and deviant or delayed (–) language development</td>
</tr>
<tr>
<td>Disciplines: teachers or Child Health Physicians</td>
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<tr>
<th>Level 2: Testing</th>
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<tbody>
<tr>
<td>Diagnosis of language comprehension (+ or –) and language production (+ or –) according to standardized language tests.</td>
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<tr>
<td>Disciplines: speech therapists, clinical linguists, or speech and language pathologists</td>
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<th>Level 3: Examination</th>
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<tr>
<td>Differentiation between specific and non-specific language problems</td>
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<tr>
<td>Disciplines: audiologists, child psychologists, otolaryngologists, neurologists, psychiatrists, remedial educationalists</td>
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</tbody>
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<th>Level 4: Mapping</th>
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<tr>
<td>Diagnosis of the different language modalities (+ or –)</td>
</tr>
<tr>
<td>Disciplines: Speech therapists, clinical linguists, or speech and language pathologists</td>
</tr>
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</table>

Developmental Screening Test) (Wachtel et al. 1994; Goorhuis-Brouwer and Van der Lucht 1995; Coplan et al. 1982; Rescorla and Alley 2001; Frankenburg et al. 1992).

Language problems can be defined according to broad distinctions, such as delayed or deviant language development in comparison with peers. Level 1 encompasses the screening of the language of children on a pass-fail basis. Language that meets the milestones appropriate to chronological age is considered indicative of normal language development. Language that does not meet the criteria based on milestones may indicate delays or deviations in language development; children with such results should be referred for further assessment. Information can also be gathered from parents and teachers, as well as from observations of children during intake.

Teachers and Child Health Physicians are equipped to screen children for language problems. Screenings are useful in surveys of large numbers of children for distinguishing children with normal language development from those who are at risk of language problems. Elaborate tests should be used, however, to determine whether children actually have language problems.

Level 2: Testing based on language production and language comprehension

Testing is intended for more comprehensive evaluation and may lead to a definite diagnosis of a language problem. Level 2 establishes the presence of language problems according to the results of standardized tests for language production and comprehension. To diagnose language problems correctly, such tests should have good psychometric properties and meet generally accepted standards. Speech therapists, clinical linguists, and speech and language
3.4 Discussion

Pathologists are experts in testing the language production and comprehension of children. Although language tests are used to diagnose language problems, they say nothing about the etiology of such language problems or about the underlying failures in language and information processing.

Level 3: Examination based on the categorical and specific abilities orientations

Level 3 examines the medical status and the cognitive and social-emotional development of a child. Multidisciplinary teams can use this type of examination to distinguish between specific and non-specific language problems (see Table 3.2).

<table>
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<tr>
<th>Factors influencing language development</th>
<th>Discipline</th>
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</thead>
<tbody>
<tr>
<td>Background information (e.g., SES, family composition, gender, birth weight, day-care/home-care)</td>
<td>Not specified</td>
</tr>
<tr>
<td>Hearing</td>
<td>Audiologist, otorhinolaryngologist</td>
</tr>
<tr>
<td>Learning capacity</td>
<td>Child psychologist, remedial educationalist</td>
</tr>
<tr>
<td>Speech motor capacity and anatomy</td>
<td>Otorhinolaryngologist</td>
</tr>
<tr>
<td>Neurological anamnesis (e.g., tonus, spontaneous movements, consciousness)</td>
<td>Neurologist</td>
</tr>
<tr>
<td>Psychiatric anamneses (e.g., behavior, attention)</td>
<td>Psychiatrist, child psychologist</td>
</tr>
</tbody>
</table>

Treatment should be based on the outcome of this examination. Diagnosis at this level involves determining whether the language problems are caused by medical and psychological conditions. Although the treatment of children with non-specific language problems is particularly concentrated on the diagnosed causes of the language problems, the language problems themselves should also be considered.

Level 4: Mapping based on the linguistic orientation

Level 4 explores and assesses the various language modalities of children with language problems. Speech therapists, clinical linguists, and speech and language pathologists examine the phonology, semantics, morphology, syntax, pragmatics, and meta-linguistics of children. These findings can be used to determine the most appropriate therapy.

3.4 Discussion

Language problems can be classified according to various taxonomies that focus on the descriptive, categorical and specific-abilities, and linguistic orientations. These orientations
can be classified within a clinical diagnostic model for language problems (STEM): screening, testing, examining, and mapping (see Table 3.1). STEM describes the diagnosis of language problems systematically. In the STEM model, screening is based on several descriptive stages that are derived from explanatory stages. Testing is based on the distinction between language production and language comprehension. Examination includes both the categorical and specific-abilities orientations. The final diagnostic level (mapping) is based on the linguistic orientation.

The different levels on which language problems can be classified can explain the multiple definitions of language problems, and they may influence the variation in prevalence estimations as well. In a review of many studies about language problems, Law et al. (1998) found estimates of the prevalence of language problems among pre-school children ranging from 0.6% to 33.2%. This rate is in accordance with estimates provided by Dutch primary health care professionals, which ranged from 1 to 40% (Luinge et al. 2002). The differences in prevalence estimations may be due to ambiguities in definition, cut-off scores, and the nature of language problems. Furthermore, language problems are probably more prevalent at the screening level of STEM than they are at the mapping level.

Screening is intended to detect possible problems during primary health care intake. Although the time available for such intake is limited, sufficient information should be gathered in order to detect language problems (Kievit et al. 1992). Screening instruments based on observations of children are very detailed, and they are therefore time-consuming to administer. The use of parental report in screenings for young children is very practical, as the language of young children primarily refers to concepts that can be found in the environment at home (e.g., “daddy book”); their language abilities are therefore difficult to observe in artificial testing situations. Moreover, the use of parental report eliminates the need to involve children in the screening, thus facilitating the screening process by removing the necessity of scheduling and transporting children.

It is difficult to determine whether the language development of a given child is deviant, as language acquisition varies from child to child. Although some children acquire language more slowly than do others, delays in language do not necessarily indicate language problems. As Enderby and Emerson (1995), p. 34 observed, “The normal acquisition of speech and language shows considerable variation and it is not always easy to distinguish between a child at the lower range of normality and one who is deviating from the usual pattern of speech and language development.”

After screening, the testing of children’s language profiles is recommended in order to evaluate the presence of actual language problems. If children have not reached the language milestones appropriate for their ages, standardized language tests should be performed to assess language production and comprehension. The distinction between expressive and comprehensive language abilities, related to the dichotomy between Broca’s aphasia and Wernicke’s aphasia, however, is somewhat superseded. Blumstein (1995) concluded that the classical view, in which speech production is subserved solely by anterior brain structures and reception is subserved solely by posterior brain structures, is not supported by the results of her study. The phonological representation of the sound structure of words informs both
3.4 Discussion

the production and the perception of speech, and the underlying anatomical structures of this system are broadly distributed in the perisylvian areas of the left hemisphere (Blumstein 1995).

The diagnosis of language problems should be interpreted according to standard scores and not by age equivalents. Because age equivalents are based on mean performances at particular ages, they make it easy to assume pass-fail procedures, thus leading to a tendency to overlook normal variations in language development (Bishop 1997). Standard scores allow the comparison of different children at a particular age or the comparison of different age groups. In this way, standard scores can help to assess the severity of language problems.

After testing, it is important to examine all of the underlying problems that could occur simultaneously with the language problem. The classification of language problems according to etiology seems promising, particularly for determining the most appropriate therapy. One limitation of this approach, however, is that categories provide little information about the language functioning of children. Cause and effect are usually not linear. Influences on language problems are multi-causal (Kievit et al. 1992). The classification of language problems should be used not only to discover the basis of language problems, but to explore the range of variation in cognitive deficits as well, and how they are related to language profiles. Furthermore, because children may move across various language profiles over developmental time (Conti-Ramsden and Botting 1999), the linguistic approach is important for describing language problems according to one or more different language modalities repeatedly. When children are categorized as having as SLI or non-SLI, the manifestations of their language impairments should also be described in linguistic terms.

The keys to successful outcomes for children with language problems are early identification, accurate diagnosis, and implementation of appropriate management interventions (Kelly and Sally 1999). STEM shows that the diagnosis of language problems in children involves four levels. Accurate diagnosis and appropriate therapy require all levels of STEM. Although therapy may include language therapy, the efficacy of language therapy has yet to be demonstrated overwhelmingly, even among children with SLI. The evidence concerning the effectiveness of intervention in expressive language problems (syntax difficulties) diverges, and there is little evidence for the effectiveness of therapy for receptive language difficulties (Law et al. 2004). Furthermore, in the context of screening, the characteristics that can best predict response to treatment are not clear (Stott et al. 2002). Language therapy alone is not always sufficient. The possible causes of language problems, the language problems themselves, and their possible consequences should be examined and treated if possible. Further research is necessary to demonstrate which therapies are effective.