1. CHAPTER 1:

INTRODUCTION: PROBLEM STATEMENT AND RATIONALE OF THE STUDY

1.1 INTRODUCTION

A central auditory processing disorder (CAPD) places the child at a great disadvantage, both socially and academically, as it is one of the most disabling childhood disorders (Rampp, 1980). A central auditory processing disorder may impede the learning of children from all walks of life and may affect both their schooling and adjustment in society. This can be attributed to the fact that auditory processing (AP) is fundamental to learning language, and deficits in auditory processing can cause disorders in areas of language, reading, spelling and learning (Rampp, 1980; Keith, 1988; Katz and Wilde, 1985; Bellis, 1996; Bench and Maule, 1997).

In the school environment children are expected to listen, process, store, and retrieve auditory information while simultaneously self-monitoring their comprehension (Richard and Hanner, 1990; Truesdale, 1990; Katz and Wilde, 1994). The academic problems of some children with central auditory processing disorders stem from their difficulty in listening, understanding and making full use of auditory information (Money, 1962; Duane, 1977; Bruner, Cole and Lloyd, 1978; Lasky and Cox, 1983; Richard and Hanner, 1990; Katz and Wilde, 1994).

There is a strong relationship between auditory processing and learning disability (LD) (Rampp, 1980; Cacace and McFarland, 1998; Keller, 1998). LD has a significant impact on the child's ability to listen, think, speak, read, write, spell or doing mathematical calculations (Cacace and McFarland, 1998).

The term LD excludes children whose problems are due to physical, mental, emotional, environmental, cultural or economic disadvantage. (Rampp, 1980; Nielsen, 1997). Therefore, this means that among a group of learning disabled, children with central auditory processing disorders can be identified (Rampp, 1980; Katz and Wilde, 1985;

Riley, 1992; Gillet, 1993; Nielsen 1997; Keller, 1998). It therefore follows logically that some of the characteristics of learning disabled children are also present in children with CAPD, for example reading difficulties, spelling and language problems (Tansley and Panckhurst, 1981; Riley, 1992; Gillet, 1993; Katz and Wilde, 1994; Nielsen, 1997; Cacace and McFarland, 1998).

CAPD is a very controversial area (Peck, Gressard, and Hellerman, 1991; Cacace and McFarland, 1998; Keller, 1998; Chermak, Hall and Musiek, 1999). The controversy surrounding CAPD documented (Peck *et al.*, 1991; ASLHA, 1996; Cacace and McFarland, 1998; Bellis and Ferre, 1999; Friel-Patti, 1999; Jerger, 1998; Keller, 1998; Keith, 1999) revolves around:

- The definition – lack of consensus surrounding the definition CAPD.
- Diagnosis and management – lack of sufficient testing instruments and insufficient rationale for effective intervention.
- Characteristics displayed by children with CAPD – similar to those experienced by children with attention deficit hyperactivity disorder (ADHD) and learning disorder (LD).

Lack of agreement on the area of CAPD has rendered some authors and researchers to regard research as "futile" (Rees 1973 cited in Keith, 1999). Kamhi and Beasley (1985) cited in Keith, (1999:324) stated: "although it is relatively easy to identify children with CAP deficits, what it means to have such a deficit is not clear".

Some similarities observed in the characteristics of children with CAPD, ADHD and LD give rise to question of the existence of CAPD as being a single separate clinical entity (Peck *et al.*, 1991; Cacace and McFarland, 1998; Keller, 1998; Chermak *et al.*, 1999). It is still unknown if there is a cause and effect among the relationship of these disorders (Cacace and McFarland, 1998). This is due to the intricate relationships between these disorders (DeConde Johnson, Benson, and Seaton, 1997; Keller, 1998; Chermak *et al.*, 1999). Children with CAPD have been found to have ADHD and those experiencing ADHD have been found to have CAPD (Keller, 1998). Academic

problems and significant underachievement are common in children with CAPD, ADHD and LD (Keller, 1998).

Although there appears to be a strong relationship among the above-mentioned disorders, it is still unknown how they interact. They overlap in a very complex manner, which cannot be easily understood (Keller, 1998; Chermak *et al.*, 1999). According to Riccio, Hynd, Cohen and Molt (1994, cited in Keller, (1998:37), "ADHD and CAPD are separate diagnostic entities". Chermak et al., (1999) also differentiate between ADHD and CAPD view ADHD as a behavioural regulation disorder rather than a primary attention disorder. While CAPD is seen as an input disorder due to inadequate processing of auditory information (Chermak et al., 1999). Given these differences between ADHD and CAPD, it is suggested that CAPD and ADHD are not a singular disorder but rather distinct entities (Keller, 1998; Chermak *et al.*, 1999). Regardless of the controversy surrounding CAPD and the uncertainty of it being a clinical entity, it is crucial for teachers to know and understand the nature of the problem (i.e. listening problem and not a hearing problem) (Jerger, 1998). Furthermore, teachers need to be empowered regarding differences among CAPD, ADHD and LD as these disorders can occur independently or co-exist (Keller, 1998; Chermak, *et al.*, 1999). This could be achieved by educating teachers about the characteristics of children experiencing these disorders.

Although there has been a lot of research regarding CAPD and academic achievement (Katz and Wilde, 1994; Nielsen, 1997), it appears that the findings have not been recognized universally and they have not been implemented in the educational setting in South Africa (SA), especially among the black community. This is apparent from the researcher's clinical experience which suggests that children with CAPD are referred to the speech-language pathologist and audiologists with reports stating that the "the child has hearing problems" or "the child is deaf" even when there is no medical or audiological confirmation of ear and hearing problems. This lack of understanding and knowledge about CAPD can most likely be attributed to fragmented educational policies, lack of human resource and financial problems where funds were not available for projects dealing with children who have special needs (NCESS, 1997) including

CAPD (SASLHA, 2001).

The Apartheid policies have produced teachers that have not necessarily been adequately educated or trained themselves especially dealing with children with disabilities and disorders. This resulted in most teachers not being aware of some of the professionals (for example, speech-language pathologists and audiologists) involved in assisting children experiencing difficulties in the educational sphere. The researcher's clinical experience suggests that the majority of teachers have not received training regarding CAPD in children. Children with CAPD are frequently referred to medical doctors as a hearing disorder is suspected.

It is therefore the aim of this chapter to delineate the problem of central auditory processing disorders (CAPD) in South Africa, and more specifically in black primary schools in Soweto, and to indicate the rationale for a research project in this field.

1.2 ORIENTATION TO AND RATIONALE FOR THE STUDY

The definition of central auditory processing disorders remains elusive and yet there is a similarity between definitions. Wepman (1969, cited in Rampp, 1980:8) defines auditory processing as "the capacity to collect, transmit, decode and integrate signals received along the auditory pathway". Another definition given by Berry (1969, cited in Rampp, 1980:8) outlines auditory processing as "the act of meaningfully interpreting or discriminating sounds and sound sequences employed in oral communication". Therefore, a central auditory processing disorder is a deficit in the areas of auditory processing. The term "central" refers to the brainstem and cortical areas of the auditory nervous system. It excludes the cochlea and the auditory nerve (peripheral auditory system) (Keith, 1999). Although the peripheral auditory mechanism of a child with a central auditory processing disorder is intact, the child is however, unable to interpret what he or she hears. CAPD can also be present in individuals with hearing loss (Keith, 1999) but this complex research area still requires substantial research and is beyond the scope of this study. Johnson and Myklebust (1967, cited in Rampp, 1980:

9) describe such children as lacking the ability "to structure their auditory world, sort out and associate sounds with particular objects and experiences". They store auditory information haphazardly, which results in inefficient and frustrating language retrieval (Richard and Hanner, 1990). On a more practical level, Richard and Hanner (1990) and Katz and Wilde (1994) state that children with CAPD are unable to make full use of the auditory signals they have received.

In the clinical situation it has been found that there are two different approaches in the conceptualisation and management of CAPD, namely, the *Audiological approach and the Speech-Language Pathology approach*. The Audiological approach, reflected in Wepman's definition (Rampp, 1980) suggests that a central auditory processing disorder manifests itself in the inability to understand distorted speech and the inability to listen to the primary signal (meaningful or intended signal) while ignoring a competing signal (noise, non-meaningful or unintended signal) (Campbell, 1994; Bench and Maule, 1997). The difficulty experienced in the understanding spoken language in the presence of noise, occurs in the absence of what is commonly considered a hearing loss (Lasky and Katz, 1983; Katz and Wilde, 1985; Willeford and Burleigh, 1985; Sloan, 1986; Keith, 1988;Campbell, 1994). The peripheral hearing thresholds of children with this type of disorder are normal when tested with puretone audiometry and speech discrimination word lists (in a sound-proof testing booth). However, when the Central Auditory Nervous System (CANS) is placed under stress by decreasing the redundancy of speech material, or by of increasing the informational content (complexity) or increasing the background noise, children with CAPD perceive the auditory information inaccurately and therefore respond inappropriately (Keith, 1981; Willeford and Burleigh, 1985; Bench and Maule, 1997).

According to the ASLHA CAPD Task Force (ASLHA Task Force on Central Auditory Consensus Development, 1996:41) the problem in the above type of central auditory processing disorder is: "the deficiency in one or more of the processes and mechanisms responsible for sound localization and lateralization, auditory discrimination, auditory pattern recognition, temporal masking, temporal integration, temporal ordering, temporal resolution, auditory performance decrements with

competing acoustic signals and auditory performance decrements with degraded acoustic signals" (ASLHA, 1996). The deficit, which result from one or more of the above processes and mechanisms, is referred to as ***Central Auditory Processing Disorder*** (CAPD).

The second approach to central auditory processing disorders, namely that of the Speech.

Language Pathology views CAPD as a deficiency in auditory-based linguistic skills and is reflected in Berry's definition of auditory processing (Rampp, 1980). The deficiency is manifested in one or more of the linguistic skills involving phonological awareness, auditory analysis (gross sound and speech sound discrimination), auditory synthesis (auditory closure and sound blending), auditory memory (short and long term memory and sequencing) (Willeford and Burleigh, 1985; Cline, 1988; Campbell, 1994). This type of central auditory processing disorder is usually referred to as a ***Linguistically dependent (or Language-Based) Central Auditory Processing Disorder*** (Campbell, 1994).

The two different approaches to CAPD are possibly due to the differences in the training offered to speech-language pathologists (SLP) and audiologists in this area. The differences have given rise to controversy in the literature regarding central auditory processing and the role of the audiologist and speech-language pathologist in the management of CAPD.

In recent years, the use of subprofiles (Bellis, 1996) or categories (Katz and Wilde, 1994), has been recommended as the integration of audiological and speech-language assessment results can be linked to a site of dysfunction, specific areas of dysfunctions and management guidelines. Katz and Wilde (1994) highlighted four different categories of children with central auditory processing disorders. Bellis (1996) described five different subprofiles of children with central auditory processing disorders which are divided into three primary profiles and two secondary profiles. The categories and subprofiles as suggested by these authors are presented in Table 1.1

and Table 1.2 respectively.

Table 1.1 A summary of central auditory processing disorders as proposed by Katz et al. (1991) and Katz (1992) cited by Katz and Wilde (1994).

Auditory Processing Category	Site of Lesion	Experienced Difficulties/Problems
Decoding Category	Primary Auditory Cortex.	Poor phonic ability, problem with reading and spelling, misarticulation at early school age (especially /r/ sound) and receptive language problems.
Tolerance-Fading Memory ((TFM)	Primary and associative cortical regions.	Difficulty blocking out background noise, poor short term memory for digits and sentences, distractible, hyper- and hypoactivity, difficulty with reading comprehension, problems with oral and written expression and poor handwriting.
Integration	Corpus callosum	
Type 1	Primary Auditory Cortex.	Extremely poor reading and spelling skills (Dyslexia), poor phonic ability.
Type 2	Primary and associative cortical regions.	Long delay responses, academic picture is like that of TFM.
Organization	Not certain - possibly the efferent nervous system.	Organizing and sequencing problems, messy, untidy, fatigue easily, easily frustrated, academic difficulties not clear, might have spelling problems (especially reversing the order of letters).

Table 1.2 A summary of Bellis (1996) central auditory processing disorders subprofiles

PRIMARY CENTRAL AUDITORY PROCESSING DISORDERS PROFILES		
Auditory Processing Subprofile.	**Site of Lesion**	**Experienced Difficulties/Problems.**
Auditory Decoding Deficit	Primary (left) Auditory Cortex	Poor sound blending, poor analytic skills, poor spelling (word attack), difficulty understanding speech in noisy environment, mimics hearing loss.
Prosodic Deficit	Non-primary (right) Auditory Cortex and associated areas	Difficulty with spelling (sight word), difficulty judging communicative intent, difficulty with perception and use of prosody, have monotonic speech, difficulty with visuospatial and mathematics calculations, socio-emotional concerns.
Integration Deficit	Corpus Callosum	Difficulty with multimodality functions, poor speech in noise skills, phonological deficits, difficulty with symbolic language and prosody, auditory language and memory deficits, difficulty with tasks requiring interhemispheric integration.
SECONDARY CENTRAL AUDITORY PROCESSING DISORDERS SUBPROFILES.		
Auditory Associative Deficit	Left (associative) cortex.	Receptive language deficits, problems with semantics and syntax, difficulty comprehending information of increasing linguistic complexity, poor reading comprehension, poor math application.
Output-Organization Deficit	Temporal-to-frontal and/or efferent system	Problems with sequencing, planning and organizational skills, poor recall and word retrieval abilities, difficulty with following directions, poor fine and gross motor skills, poor hearing in noise, difficulties with expressive language.

The sub-profiles/categories described in Tables 1.1 and 1.2 may occur in isolation or in any combination. In a study conducted by Katz and Burge (1992 cited in Katz and Wilde, 1994) on 120 (6 -12 years of age) children with learning disabilities, revealed that more than 50% of these children fall into two or more categories of CAPD (Katz and Wilde, 1994). This means that these categories/subprofiles are not mutually exclusive (Katz and Wilde, 1994).

Central auditory processing is a complex disorder with far-reaching implication (Katz and Wilde, 1985; Bellis and Ferre, 1999), necessitating a collaborative approach to the management of CAPD in children. Professionals like Teachers, Audiologists and Speech-Language Pathologists, Psychologists and Physicians are among some of the core members of the team associated with the identification, referral and remediation of CAPD (Willeford and Burleigh, 1985; Bellis, 1996). While all of these professionals play an important role in managing children with CAPD, it is perhaps the teacher whose role is the most significant. Teachers spend a large portion of the day with the child in the educational setting. They play an important role in providing information to the other team members regarding the child's listening and learning behaviour within the learning environment, academic strengths and weaknesses as well as the child's cognitive functioning (Giliomee, 1995; Bellis, 1996). Therefore, it is essential for them to have some knowledge of auditory processing disorders in order to identify, refer and assist children in the classroom.

Efficient processing of auditory information is crucial for the child's adjustment and learning as 70% of all information given by primary school teachers is oral (Rampp, 1980). This situation is complicated by the fact that competing messages are often an integral part of the learning situation (Rampp, 1980). The intended message is often subject to distortion or disruption by noise, music and/or the speech of the others (Rampp, 1980). It is logical to conclude that children with

CAPD are at a disadvantage in the learning situation, since they have difficulty or are unable to follow conversation in the presence of background noise – which is typical of the classroom situation. This problem can, in turn, lead to difficulty with the storing

and/or retrieving auditory information, which may result in a child being labelled as "learning disabled".

CAPD challenges in South Africa (S.A.) are quite different from overseas. South Africa is a multicultural and multilingual country with 11 official languages. The majority of the citizens of S.A. have low socio-economic standard (SASLHA, 2001). The policies of the past Apartheid system have contributed in producing teachers that have not always been adequately trained, as mentioned previously, and working in difficult circumstances (NCESS, 1997; SASLHA, 2001) whereas they are ideal persons to train in identifying and managing children with CAPD (Bellis, 1996). A limited number of speech-language pathologists and audiologists in relation to the number of children needing help is an area of concern. Furthermore, lack of South African standardized materials, resources such as place of referral following diagnosis and intervention procedures are amongst the challenges in area of CAPD service delivery (SASLHA, 2001).

It is estimated that 50% of children in South Africa are learning impaired, due largely to inadequate education caused by the Apartheid system (Kriegler, 1989). It is possible that difficulties associated with a large percentage of these children stem from CAPD related to the disadvantaged background and unfavourable listening environment in which they find themselves (for example, having to learn outside under the trees due to lack of classrooms, large classrooms with poor acoustic, low socio-economic factors). These children seldom receive early intervention due to a lack of exposure to speech-language pathology and audiology as these professions are relatively unknown among the black communities. According to the Gauteng Department of Education, there are currently 279 primary schools in Soweto attended by 154,121 children, and there are no speech-language pathologists and audiologists servicing those schools (Gauteng Department of Education, 1999). Furthermore most of these children are from a very poor socio-economic and political backgrounds, which is an additional complicating factor. The training of teachers in the field of CAPD could be time and cost effective, since individual intervention is largely impractical in terms of time and cost.

All children have the right to appropriate educational experiences (NCESS, 1997). This refers also to handicapped children, non-handicapped and children with different childhood disorders (Alper, Schloss, Etscheid, Macfarlane, 1995; IDEA, 1990 cited in Nielsen, 1997). Unfortunately most teachers - especially mainstream primary school teachers in South Africa - are not trained to work with children with disabilities and disorders, especially not with children with CAPD. The current move in the South African educational system towards the integration of children with disabilities into mainstream schools will result in larger numbers of children per class, increased noise levels and less individual attention (Giliomee, 1995; NCESS; 1997). This may potentially place a child with a CAPD at an even greater disadvantage. Thus, it is crucial for teachers to receive information about and suggestions for the integration of children with CAPD or other disabilities and disorders in their classrooms. Teachers are also regarded as key persons in providing information regarding children's physical, emotional, academic and social behaviours and they consequently play an important role in the identification and referral of children with disorders to different specialists (Giliomee, 1995; Bellis, 1996). In the case of CAPD, and specifically against the background of the new educational system in South Africa and lack of speech-language pathologists and audiologists in mainstream schools, teachers have a crucial role to play in managing the intervention process and carrying out remediation programmes.

As CAPD may lead to academic failure and limit the child's potential for learning, it is crucial for teachers to have knowledge of such disorders. Training of teachers about CAPD will enable them to manage children with these disorders with the required insight and knowledge so as to help them overcome the typical difficulties that they experience (Bellis, 1996; NCESS, 1997). Integrating children with CAPD in their classrooms and helping with their remediation will also help teachers not only to value these children for their unique strengths, but also to understand their disorders better. Finally, expanding teachers' knowledge of CAPD will result in early identification of and thus early intervention in these disorders (Giliomee, 1995; Bellis, 1996). According to Flynn (1983), early detection of disorders is prognostically advantageous. This should help to curb the high rate of high-school dropouts, limit the social maladjustment of children with learning disability resulting from CAPD and deal with the withdrawal

behaviours that stem from the continuous frustration and confusion experienced by children with CAPD.

Therefore, it is crucial that teachers should become aware of CAPD and be able to recognize them. They should also be exposed to the strategies employed in alleviating such disorders, since there will probably never be enough specialists to assist children with CAPD on an individual basis (Rampp, 1980). Educating teachers in areas of CAPD, providing them with methods of adapting the classroom situation to provide maximum benefit for a child with such a disorder and helping teachers to implement programmes that could possibly help children with CAPD will be a positive step, aimed at preventative rather than curative action (Egland, 1970; Norris, 1989).

From to the researcher's clinical experience it seems that teachers lack knowledge of CAPD. Their approach and attitude towards the behaviours displayed by children with such disorders is negative and there is often a stigma attached to the child. This is probably due to black communities' lack of exposure to speech-language pathology and audiology, and the role-played by these professions in the educational sphere. As mentioned previously, there are no speech-language pathologists and audiologists working in mainstream schools in Soweto. Against this background it becomes imperative that an answer to the following question should be found: What is the ***training*** and ***knowledge*** of primary school teachers in urban black schools pertaining to CAPD?"

1.3 DEFINITION OF TERMS

Although terms like *learning disability* and *language* do not occur in the title of this study, the researcher feels that they need to be defined due to the intimate relationship that exist among learning disability, language and CAPD. Furthermore, language is basic to all definitions of learning disability (Rampp, 1980). The co-occurance of language, central auditory processing and learning disabilities is well documented (Johnson and Myklebust, 1967; Rampp, 1980; Reid and Hresko, 1981; Kirk and Chalfant, 1984; Lerner, 1985; Parnell, Amerman, and Harting, 1986; Camatra, Hughes

and Ruhl, 1988; Norris, 1989; Riley, 1992; Gillet, 1993; Nielsen, 1997).

To clarify the terminology used in this study, the following terms will be defined.

1.3.1 Central auditory processing and central auditory processing disorders (CAPD)

It seems that there is a lack of agreement on the definition of auditory processing. According to Katz and Wilde, (1994) and DeConde Johnson, Benson and Seaton (1997) auditory processing is "what people do with what they hear" to make the information they have heard to be functionally useful/meaningful. Furthermore, auditory processing is the ability of receiving, transmitting, discriminating, sequencing and interpreting auditory information meaningfully to be functionally useful. Since hearing is normal, this means that the ear receives all auditory information (meaningful and non-meaningful), while the skills referred above (i.e. synthesis, analysis, discrimination and integration) facilitate the process of making the received auditory information functionally useful/meaningful (Berry, 1969 cited in Rampp, 1980; Wepman, 1972 cited in Rampp, 1980; Katz and Wilde, 1994; DeConde Johnson *et al.*, 1997).

As quoted earlier, central auditory processing (CAP) "involves processes and mechanisms that are responsible for auditory abilities such as sound localization, auditory discrimination, auditory pattern recognition, temporal aspects of audition including temporal resolution, temporal masking, temporal integration, temporal ordering, auditory performance decrements with competing acoustic signals and auditory performance decrements with degraded acoustic signals" (ASLHA Task Force on Central Auditory Consensus Development, 1996:41). Therefore, CAPD could be deficiencies in one or more of the auditory abilities mentioned above, the dysfunction of the processes and mechanisms dedicated to audition, general dysfunction (such as attention deficit or neural timing deficits) that affects performance across modalities, or any combination of the above (ASLHA, 1996). Although this definition is a collective effort of the ASHLA Task Force on Central Auditory Consensus Development, the definition of CAPD still remains a mystery. The definition of the ASLHA Task Force on Central Auditory Consensus Development (ASLHA, 1996) has received criticism from

authors such as DeConde Johnson *et al.*, (1997) for being too complex and difficult to be understood by non-experts and lay people. It is clear that uncertainty still surrounds the definition of CAPD.

It was suggested that the term auditory processing disorders be used in place of central auditory processing disorders at the Bruton Conference held in 2000 (Medwetsky, 2002) as the term auditory processing avoids the imputation of anatomical loci and emphasizes the interaction of disorders at both peripheral and central sites. This suggestion has however not been implemented by most researchers as reflected in recent publications (Medwetsky, 2002). For this reason the term CAPD will be used in this dissertation although the term "auditory processing" is used in the questionnaire as the term "central" is not a familiar term to the subjects, based on the researcher's clinical experience.

The definitions of CAPD as provided by Katz and Wilde's (1994) and DeConde *et al.* (1997) facilitate an understanding of the disorder in lay persons (the subjects of the study). Furthermore, Berry's (1969) and Wepman's (1972) respective definitions of auditory processing as cited by Rampp (1980:8), stating that auditory processing is "the act of meaningfully interpreting or discriminating sounds and sounds sequences employed in oral communication" and "the capacity to collect, transmit, decode and integrate signals received along the auditory pathways", appear to facilitate understanding of CAPD and avoid technical jargon. Hence, in this study the researcher would like to use a combination of these definitions to define the disorders. Combining these definitions is in line with the current efforts to bring the speech-language pathology and audiology approaches together when dealing with children with CAPD (Bellis, 1996). This will promote the idea of looking into a child's academic, communicative, behavioural, social and associated difficulties.

For the purpose of this study, Berry's (1969) and Wepman's (1972) definitions will therefore be combined with those of Katz and Wilde (1994) and DeConde Johnson *et al.*, (1997) resulting in the following definition:

Central auditory processing disorder (CAPD) is the inability to receive, transmit, discriminate, integrate, sequence and interpret auditory information meaningfully so as to be functionally useful (despite the individual having normal hearing).

1.3.2 Learning Disability (LD)

According to the United State Congress in 1977 (Section 5b, cited in Rampp, 1980:8) and the *Individual Disabilities Education Act* of (1990) (cited in Nielsen, 1997:65) learning disability is "a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. This term does not include children whose problems are primarily the result of visual, hearing, or motor handicaps, mental retardation, emotional disturbance, environmental, cultural, or economic disadvantage." This definition of learning disability will be used in this study.

1.3.3 Language

Bloom and Lahey (1978:4) define language as "knowledge of a code for representing ideas about the world through a conventional system of arbitrary signals for communication". Therefore, normal language processes that lead to normal processing of language for learning require intact end organs and intact central processors. Disturbances in one or both of the areas affect the child's language acquisition, which in turn affects his/her learning.

1.3.4 Training

Training is the process of developing attitudes, knowledge and skills required for adequate performance of a particular task or job (Creek, 1997). Training is conducted by a person who is knowledgeable about the subject and can occur in different forms at different venues.

1.3.5 Knowledge

Knowledge is an organized integrated body of information about a particular subject (Garbers, 1996). In terms of this study, the knowledge on CAPD will facilitate the management of children with such disorders

1.4 DIVISION OF CHAPTERS

In order to provide a clear answer to the research question "What is the ***training*** and ***knowledge*** of primary school teachers in urban black schools pertaining to CAPD?", the thesis is divided into six (6) chapters.

CHAPTER 1: PROBLEM STATEMENT AND RATIONALE OF THE STUDY

This serves as an introduction of the research question, which is "What is the ***training*** and ***knowledge*** of primary school teachers in urban black schools pertaining to CAPD?". The rationale and motivation for the study are presented in Chapter 1. The clinical experience of the researcher serves as the basis for the motivation of the study and revealed lack/poor relationship between speech-language pathologists and audiologists and teachers in black communities.

The review of literature briefly highlights the relationship between CAPD and academic achievements of children with such disorders. Definitions of terms and subprofiles/categories of children with CAPD are also discussed.

CHAPTER 2: CENTRAL AUDITORY PROCESSING DISORDERS (CAPD) IN THE SCHOOL-AGED CHILD

The consequences of CAPD in the school-going child manifest themselves mainly in the academic sphere. In this chapter problems experienced by children with CAPD and survey of literature regarding etiology of CAPD and behaviours displayed by children with CAPD are discussed. An explanation of classroom-specific behaviours and

behaviours that affect the child's social adjustment is also given.

CHAPTER 3: CENTRAL AUDITORY PROCESSING DISORDERS (CAPD): THE ROLE OF THE TEACHERS, SPEECH-LANGUAGE PATHOLOGIST AND AUDIOLOGIST IN THE EDUCATIONAL SETTING

The evaluation and remediation of CAPD require a multi-disciplinary approach. Chapter 3 discusses the role of the different team members involved in evaluation and remediation of children with CAPD. However, the focus is on the role of the teachers in terms of management and the role of speech-language pathologists and audiologists against this background. The relationship of team members and the need for the continuing education of teachers are also discussed in this chapter.

CHAPTER 4: METHODOLOGY

This chapter presents the research methodology of the study. It comprises of a description and discussion of aims, research design, subjects and subject selection criteria and procedures, apparatus and material, data collection procedures and finally the data analysis procedures used in the study.

CHAPTER 5: RESULTS AND DISCUSSION

This chapter presents the results of the study, treatment of data, and the interpretation and discussion of results contained in Chapter 4. The results are presented according to the developed sub-aims. The chapter commenced with discussing the role that teachers play for all children, including those with disabilities/disorders. The training and knowledge of teachers with regard to CAPD are subsequently analysed and interpreted.

CHAPTER 6: CONCLUSIONS AND IMPLICATIONS

This is the concluding chapter and it contains recommendations and a summary of the study. Attention is also given to recommendations for further research and a discussion

of the clinical implications of this study.

1.5 SUMMARY OF CHAPTER 1

Chapter 1 deals with the orientation and rationale of this study. The relationship between CAPD and learning abilities (which are addressed in Chapter 2) was discussed briefly. Another theme dealt with in this chapter is the different categories/subprofiles of children with CAPD, that link CAPD test results to site of dysfunction, areas in which academic difficulties are observed and management programs. The terminology used in the study is defined and outlines of the content of the chapters of the study are provided.

2. CHAPTER TWO:

CENTRAL AUDITORY PROCESSING DISORDERS IN THE SCHOOL-AGED CHILD

2.1. INTRODUCTION

A central auditory processing disorder (CAPD) is a very complex and obscure disorder (DeConde Johnson *et al.*, 1997). Although it is not rare, it can go unnoticed for several years until the child enters school (Stach and Loiselle, 1993). The United States Association for Children with Learning Disabilities reported that between eight and twelve million children in the United States are learning-disabled and majority of them have CAPD (DeConde Johnson *et al.,* 1997). CAPD not only disrupt the absorption of auditory materials, but also the cognitive processes that involve the auditory pathway such as attention, concentration and thinking (Bench and Maule, 1997). CAPD constitute one of the major disorders that handicap children face (Cacace and MacFarland, 1998; Keller, 1998; Chermak *et al.,* 1999) in the academic sphere. Their ability to process information for learning and communication is affected, with the result that some children with CAPD may experience learning difficulties (Young and Protti-Patterson, 1984; Riley, 1992; Gillet, 1993; Katz and Kusnierczyk, 1993; Bellis, 1996; Bench and Maule, 1997; Nielsen, 1997).

The co-occurance of CAPD and learning difficulties is well documented (Johnson and Myklebust, 1967; Rampp, 1980; Reid and Hresko, 1981; Kirk and Chalfant, 1984; Lerner, 1985; Parnell, Amerman and Harting, 1986; Norris, 1989; Riley, 1992; Gillet, 1993; Katz and Wilde, 1994; Nielsen 1997). The skills that are mostly affected in children with CAPD are precisely those that can also play an important role in academic achievement, for example reading and spelling (Katz and Wilde, 1985; Katz and Wilde, 1994; Bench Maule, 1997). The result of this is that some children with CAPD are often labelled as being learning disabled.

The aim of this chapter is to provide the necessary background information of children with central auditory processing disorders (CAPD) by considering aspects such as etiology and prevalence, behaviours and symptoms of school age children with CAPD, as well as the impact of CAPD on academic learning and progress.

This study will follow the current approach by looking at a child holistically and utilizing both approaches to CAPD (namely, that of the Speech-Language Pathologist and the Audiologist). The reason for this is that both types of approaches recognize the impact of such disorders on the academic, social and communicative abilities of children, although from different perspectives.

2.2. ETIOLOGY AND PREVALENCE

A CAPD is not a single entity (Katz and Wilde, 1994; Keller, 1998). Although the condition is definable, its exact *etiology* as observed in school-age children is unclear and often controversial (Barr, 1972; Katz and Wilde, 1985; DeConde Johnson *et al.*, 1997).

Some conditions have been identified as probable role players in the etiology of CAPD, namely, a genetic predisposition, abnormal brain maturation, lack of myelination of corpus callosum, lesions in diverse brain areas and general brain damage caused by conditions like anoxia and/or trauma (Barr, 1972; Musiek, Gollegly and Baran, 1984; Katz and Wilde, 1985; Pinheiro and Musiek, 1985; Bellis, 1996). However, it must be remembered that it is often very difficult, even in the case of specific conditions like brain lesions, to identify them as a definitive causative factor for CAPD. Brain maturation is highly individualized and only completed over a number of years (Pinheiro and Musiek, 1985; Musiek and Chermak, 1994; Bellis, 1996). In human beings the myelination of the corpus callosum is also reported to be completed only during adolescence (Musiek, Gollegly and Baran, 1984; Pinheiro and Musiek, 1985). On the other hand, most children referred for evaluation and treatment of CAPD are not

adolescents but young children in their early years of schooling, and their neural mechanism is still in the process of maturation.

It is furthermore important to note clinicians find it difficult to determine the exact site of lesion from results observed on central auditory evaluation. This is due to the fact that lesion in the brain may affect areas of the brain remote from its actual location because of interference with neural transmission of the biochemistry of the brainstem or cerebrum (Pinheiro and Musiek, 1985). This situation is fortunately improving, particularly with the advances in Electro-physiological measurements. These measures enable clinicians to observe the function of the Central Auditory Nervous System (CANS) and the procedures have demonstrated good sensitivity and specificity (Katz and Wilde, 1994; Bellis, 1996).

One condition that has been positively identified as an etiological factor of CAPD is recurrent otitis media (Duane, 1977; Rampp, 1980; Katz and Wilde, 1985; Keith, 1988; Katz and Wilde, 1994; Bellis, 1996; DeConde Johnson *et al.,* 1997). This condition is very common in young children and results in a fluctuating conductive hearing loss (Katz and Wilde, 1985; Ferman, Verschuure and van Zanten, 1993; Bellis, 1996). The fluid in the middle ear resulting from middle ear infection causes physiological changes that affect the conduction of sound to the inner ear. This causes the distortion of sounds and an inability to perceive sounds and short words with low acoustic energy. In addition, a child with fluctuating hearing loss experiences continuous changes in sound perception. This can be confusing to a child and often leads him/her to regard speech sounds as being unstable (Katz and Wilde, 1985; Campbell, 1994;Katz and Wilde, 1994; Bellis, 1996).

Katz and Wilde (1985) have also reported structural changes of the cochlea, the retrocochlear system and the brain due to deprivation of normal auditory activity as a result of fluctuating conductive hearing loss due to otitis media. Such fluctuating conductive hearing loss during the early developmental years of life results in a child being at risk for developing speech and language disorders as well as learning and auditory processing problems (Van Riper and Emerick, 1984; Katz and Wilde, 1985;

Katz and Wilde, 1994; Bellis, 1996) that often become observable at school going age only.

Other possible causes of CAPD that have been reported in the literature by Kelly, Davis and Hedge (1994) include the following:

- Organic disorders of deafness.*
- Neoplasms and tumours.
- Demyelinating diseases, including Multiple Sclerosis.
- Cerebrovascular diseases, including Stroke.
- Degenerative diseases, including Alzheimer's disease.
- Perinatal and paediatric neuropathy, including various genetic disorders and asphyxia at birth.
- Infectious and inflammatory diseases, including human immuno deficiency virus (HIV/AIDS).
- Miscellaneous neuropathy, including meningitis.

Apart from the above-mentioned disorders, studies indicate that the majority of school-going children with CAPD present without identifiable organic causes (Kelly, Davis, and Hedge, 1984; Campbell, 1994). The medical, birth and familial histories of these children do not necessarily display any information that can be associated with their CAPD. They may have normal or high intelligence but still experience difficulty with auditory processing (Campbell, 1994; Bellis, 1996). With regard to family history, Katz and Wilde (1994) as well as Bellis (1996) have reported that it is common in children with CAPD that one parent had a similar disorder in his/her youth, and it can therefore be concluded that in some cases this condition may be hereditary (Katz and Wilde, 1994; Bellis, 1996).

Furthermore, the improper neural migration during foetal development and variables in the brain structure may be associated to the heredity of CAPD (Rampp, 1980; Katz and Wilde, 1994). It was also observed that in the families of children with CAPD there is a history of left-handedness (Rampp, 1980; Katz and Wilde, 1994). This can perhaps

relate to the fact that reading and other cognitive disabilities are reported to be more common in left-handers than right-handers (Katz and Wilde, 1994). However left-handedness alone does not necessarily imply the presence of a CAPD.

The etiology of CAPD in school going children is thus controversial. The fact that there is no evidence that the brain has processed auditory signal incorrectly (Jerger, 1998) makes it difficulties to get the exact etiology of CAPD. According to Jerger (1998) even the electrophysiological measures do not provide a "gold standard" for the diagnosis of CAPD. It appear that clinicians and researchers still have a long way to go to try and uncover the mystery of the etiology of CAPD in school going children and whether it originate from a single or multiple factors.

The *prevalence* of CAPD is reported to be higher in boys than in girls (Katz and Wilde, 1994; DeConde Johnson, *et al.,* 1997; Chermak, Hall and Musiek, 1999). Musiek, Gollegly , Lamb and Lamb, (1990 cited in Chermak, Hall and Musiek, 1999) reported the prevalence of CAPD to be 3% to 7% among boys and girls respectively, whereas Chermak and Musiek (1997) mentioned that it occurs in 2% to 3% of children, with a ratio of 2:1 for boys and girls (Chermak et al., 1999). One of the factors that attribute to this difference between the sexes is the structure of the corpus callosum where reading and spelling abilities are based. Girls are reported to have a large and bulbous splenium (the area responsible for transmitting auditory and visual information between the two hemispheres) (Katz and Wilde, 1985), with the result that they are able to integrate auditory and visual information from the two hemispheres more effectively than boys (Katz and Wilde, 1994).

It is difficult to study the prevalence of CAPD due to the following:

- Lack of standard definition and terminologies used,
- The fact that mild CAPD are easily compensated for when educational demands are minimum,
- The variability of auditory performance in children up to 12 - 13 years of age and
- The different approaches for assessing and managing children with CAPD (Keith, 1988 in Roesner and Downs, 1988).

Nevertheless, as mentioned previously, it is estimated that between eight and twelve million of children in the USA with learning disabilities have CAPD (Keith, 1988; DeConde Johnson, *et al.*, 1997). In South Africa the number of children with learning disabilities resulting from CAPD is probably even higher, due to the poor listening environment in which they find themselves most of the time, combined with a lack of stimulation, poor socio-economic factors and a lack of adequate early identification and intervention.

2.3. BEHAVIOURS AND SYMPTOMS OF CHILDREN WITH CENTRAL AUDITORY PROCESSING DISORDERS

Children with CAPD are a complex heterogeneous group (Young and Protti-Patterson, 1984; Katz and Wilde, 1985; Sloan, 1986; Katz and Wilde, 1994; Bellis, 1996; DeConde Johnson *et al.*, 1997) and cannot be described by means of a single profile (Katz and Kusnierczyk, 1993, Bellis, 1996). Not all of these children manifest with *all* the symptoms and behaviours listed in literature. They differ in the degree and nature of their problems (Butler, 1980), the severity of a specific symptom, as well as the overall handicapping effects (Katz and Kusnierczyk, 1993). The most common symptoms and behaviours of children with CAPD can be listed as follows (based on the work of Rampp (1980), Keith (1988) and ASHA (1996), DeConde Johnson *et al.*, (1997)):

- Difficulty with figure-ground discrimination.
- Poor auditory attention or inconsistent response to auditory stimuli
- Short attention span and easily fatigued.
- Easily distracted by both auditory and visual stimuli.
- Limitation in memory and retrieval of auditory information.
- Poor integrative skills.
- Difficulty with localization of the source of auditory stimuli.
- Difficulty with phonics.
- Reduced ability to sequence auditory information.
- Difficulty following instructions in class or at home.

- Problem with time-altered speech.
- Poor word and sound attack skills in reading.
- Difficulty separating words into syllables or sounds.
- Poor sound blending skills.

There is also a high incidence of speech and language problems amongst children with CAPD (Katz and Wilde, 1994; Bellis, 1996; DeConde Johnson *et al.,* 1997). These language and speech related symptoms of CAPD have important implications. Egland (1970) remarks that when a child enters school, the most important skills for adjustment and learning are expressive and receptive language. This implies that the scholastic achievement of children with CAPD (especially those with language problems) is compromised due to the inability to understand what is required of them and the inability to express themselves in both verbally and by using written symbols. This highlights the need of the speech-language pathologist's intervention with some children with CAPD.

Auditory processing skills are important for academic achievement and intact auditory processing skills are essential for a child to perform well at school (especially in academic subjects related to reading and spelling abilities). Deficits in one or more of the skills will consequently manifest in poor performance in the academic sphere. Furthermore, children with CAPD appear to lack the ability to think systematically and pay attention selectively, and cannot distinguish easily between relevant and distracting information (Rampp, 1980; Bellis, 1996). They respond to all sounds as if these sounds have equal importance. Hence they become distracted and are unable to pay sustained attention (Smoski, Brunt, Tannahill, 1992). In the classroom context these children will often be seen as disruptive.

Other behaviours noted in children with CAPD include the improper integration between visual and auditory systems. Thus they find it difficult to understand the teacher when she talks and writes on the board at the same time, and struggle to listen and write simultaneously (Stach and Loiselle, 1993). Children with CAPD also appear to need extra effort in order to be able to listen carefully and concentrate properly (Crandell and

Smaldino, 1996; Kramer, Kapteyn, Festen and Kuik, 1997) especially in the presence of background noise that is typical of most classrooms.

2.3.1. Additional behaviours associated with central auditory processing disorders

Apart from the symptoms mentioned above, children with CAPD often display abnormal behaviour patterns that can co-occur with the already discussed symptoms. It must be remembered that due to the heterogeneity mentioned previously, not all children with CAPD will necessarily display one or more of the behaviours discussed below. Some of these symptoms form part of the basic condition while, others are behavioural responses that have developed because of the CAPD. The following list of related behaviour patterns are based on the work of Rampp, (1980), Katz and Wilde, (1985), Willeford and Burleigh, (1985), Katz and Kusnierczyk (1993), Stach and Loiselle, (1993) and DeConde Johnson *et al.,* (1997).

- Hypoactivity
- Hyperactivity
- Nervousness
- Disinhibition and daydreaming
- A-social behaviours
- Boredom
- Motor co-ordination and dominance problem
- Serial events and rote sequencing problems
- Low self-esteem

Children with ADHD and CAPD may present with similar behaviours. Some researchers have even suggested that they are in fact the same development disorder (Chermak *et al.,* 1999). The differences in the similar behaviours (e.g. attention deficits) displayed by children with ADHD and those with CAPD is that the deficits experienced by children with ADHD are pervasive and supramodal impacting more than one sensory modality whereas those of children with CAPD are restricted to auditory modality (Chermak *et al.,* 1999).

2.3.2 Classroom related behaviours and symptoms of children with central auditory processing disorders

Some of the observable behaviours and symptoms displayed by children with CAPD in the classroom have been reported by authors such as Rampp, (1980), Keith, (1988), Katz and Wilde, (1985) Katz and Wilde, (1994), Bellis, (1996), and DeConde Johnson *et al.*, (1997). Knowledge of these behaviours and symptoms can help the teacher to identify children with CAPD. These observable behaviours and symptoms in the educational setting are graphically presented in figure 2.1.

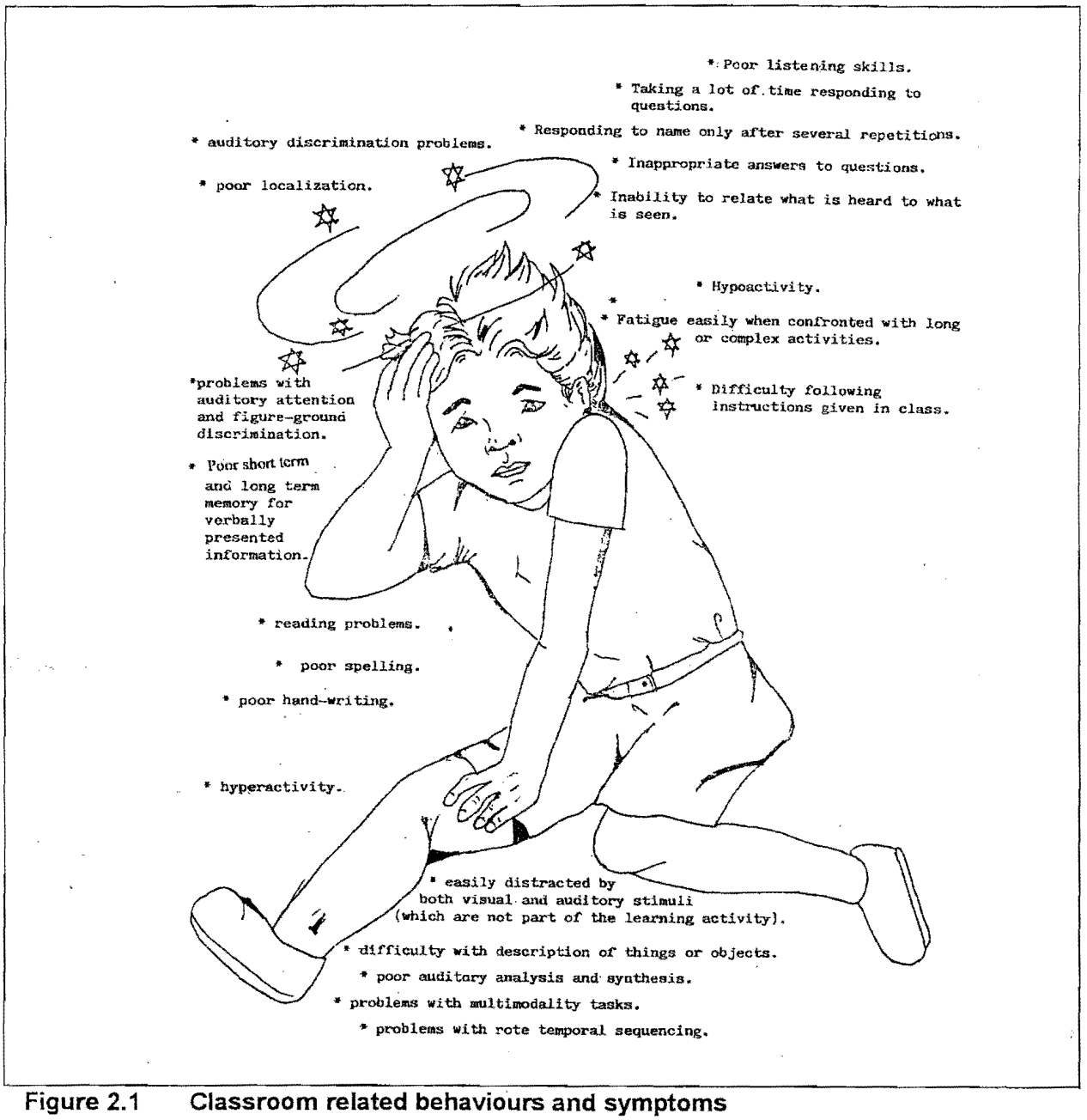

Figure 2.1 Classroom related behaviours and symptoms

Source: Compiled from Rampp, (1980); Katz and Wilde, (1985); Keith, (1988); Katz and Wilde, (1994); Bellis, (1996) and DeConde Johnson *et al.*, (1977)

2.3.3. The impact of central auditory processing disorders on schoolwork

CAPD have a negative impact on the child=s work and performance in the classroom. The performance of children with CAPD is reported to be very poor, specifically on academic subjects that involve the use of verbal language skills (Katz and Kusniesczyk, 1993; Bellis, 1996). This is a problem that generates a vicious circle - the poor self-concept that results from a multiple failure may lead the child with CAPD not to participate in classroom activities. This in turn, will have a negative effect on their ability to learn (Keith, 1988; Bellis, 1996; DeConde Johnson *et al.*, 1997). In class these children may respond inappropriately to questions, which reveals a lack of understanding of the content of the conversation or topic being discussed (Keith, 1988; Bellis, 1996; DeConde Johnson *et al.,* 1997).

Children with CAPD experience difficulty with verbal instructions that involve a multi-step directions (Rampp, 1980; Keith, 1988; Katz and Kusnierczyk, 1993; Bellis, 1996, DeConde Johnson *et al.,* 1997). This difficulty in following directions and verbal instructions often leads to the children not doing their schoolwork (Keith, 1988; Bellis, 1996). The scholastic achievement is further compromised due to reading problems, spelling difficulties and language disorders (in some of the children) (Rampp, 1980; Katz and Kusnierczyk, 1993). Hence these children tend to be labelled as a learning disabled (Rampp, 1980; Katz and Wilde, 1994; Bellis, 1996).

The ability to read and write is a basic necessity in the lives of civilized people of the world of today. It has social and communicative value and provides access to a fuller cultural life through reception of ideas, thoughts, feelings and emotions. Children with CAPD are deprived of these basic needs as a result of the communication, reading and writing deficiencies that these disorders impose on them (Katz and Wilde, 1985).

2.4. SUMMARY OF CHAPTER TWO

The etiology, behaviours and symptoms of children with CAPD have been discussed in detail in this chapter. An attempt was made to look at the child as a whole, by firstly discussing both the speech-language pathology approach and the audiology approach towards CAPD and secondly merging the two approaches in view of the fact that they both have an adverse impact on the communicative, learning and social aspects of the child.

Finally this chapter contains a brief discussion of the future implications of CAPD on children as far as workplace and social interaction are concerned. Since CAPD cannot be outgrown (Stach and Loiselle, 1993), it follows logically that they have to be managed on a long-term basis. This leads us to Chapter 3, which deals with evaluation and management of children with CAPD.

3. CHAPTER THREE:

CENTRAL AUDITORY PROCESSING DISORDERS: THE ROLE OF THE TEACHER, SPEECH-LANGUAGE PATHOLOGIST AND AUDIOLOGIST IN THE EDUCATIONAL SETTING

3.1 INTRODUCTION

Central auditory processing disorders (CAPD) constitute a multidimensional problem (Katz and Wilde, 1985; Bellis and Ferre, 1999). The complexity, nature and uniqueness of the problems displayed by children with these disorders pose a great challenge to professionals called upon to evaluate and manage this category of the population. The heterogeneity referred to in the previous chapters adds to the difficulties in terms of treatment, as each child requires a unique treatment programme tailored for his/her problems and needs. Hence, the need for a multidisciplinary approach (Bellis, 1996; Nielsen, 1997; Bellis and Ferre, 1999).

Because of the complexity of the problem and the heterogeneous nature of the affected population, a team approach could be considered appropriate in terms of intervention (Bellis, 1996; Nielsen, 1997; Sloan, 1998). Such a team - with the task to evaluate and manage children with CAPD - may include, parents, classroom teachers, speech-language pathologists and audiologists, general practitioners, remedial teachers, occupational therapists, physiotherapists, nutritionists, psychologists, paediatricians, ear, nose and throat specialists (ENTs) and neurologists (Barr, 1972; Katz and Wilde, 1985; Katz and Kuisnierczyk, 1993; Campbell, 1994; Musiek and Chermak, 1994, Bellis, 1996; Nielsen, 1997). Each of these professionals plays an important role in dealing with children with CAPD. The involvement of the team members depends on the nature and the degree of the disorder/s (Bellis, 1996; Sloan, 1998). However, in the educational setting (which is the focus of this study), the most important team member will be the teacher as it is the teacher who enforces recommendations made by other team members. Furthermore, teachers are in daily contact with these children in the classroom and can assist in helping the child overcome the difficulties associated with CAPD. Therefore the following discussion will concentrate on the role of the teachers and refer to the role of the speech-language pathologist and audiologist

against this background. As mentioned in the previous chapter, teachers are in daily contact with children. They are a source of referral in most cases and they play an important role in the intervention process aimed at children with CAPD.

The aim of this chapter is to investigate the role of the teacher as the most important member of the educational team dealing with children with central auditory processing disorders (CAPD). This will be discussed against the framework of the traditional approach towards intervention in the case of children with CAPD, namely intervention by the audiologist and the speech-language pathologist.

3.2 THE ROLE OF THE AUDIOLOGIST IN EVALUATING CHILDREN WITH CENTRAL AUDITORY PROCESSING DISORDERS

Children with CAPD generally give the impression that they are not listening, or that they do not hear or fail to understand what is said to them (Willeford, and Burleigh, 1985). Hearing (or specifically the inability to hear) is therefore often the first suspected impairment and the main reason for seeking professional assistance. This subsequently explains why an audiologist is often the first professional to see a child with a CAPD. It also explains why the audiologist is predominantly involved in the assessment of children with CAPD. According to ASHA (cited in Sloan, 1998), the best professionals to assess children affected by these disorders are the speech- language pathologists and audiologists (Sloan, 1998).

The processing of auditory information requires the integrated function of both the peripheral and central nervous system (Willeford and Burleigh, 1985; Katz and Kusnierczyk, 1993). The functional status of both these areas therefore has to be assessed when dealing with children with CAPD.

As a first step, the standard audiological battery which consists of Pure Tone Audiometry, Immitance and Speech Audiometry should be administered in a sound

proof audiological suite in which the listening environment and signal are optimal (Yantis, 1985). Testing under these conditions usually reveals that the child has normal peripheral hearing. Peripheral hearing loss and CAPD can however occur together (Jerger, 1981, in keith, 1981; Willeford and Burleigh, 1985; Katz and Kusnierczyk, 1993, Campbell, 1994). The condition under which the testing of the peripheral auditory system take place is not the ideal representation of situations where the child experiences difficulties (for example, the playground, classroom situation, home) because the tests are administered in a sound proof room. Hodgson (1982:221) stated that "testing speech in a sound-isolated environment is a totally unrepresentative of any situation anyone will ever encounter in the real world". Although this procedure does not provide much information about children with CAPD, it gives some indication that the disability is not in the peripheral auditory system. The basic test battery also provides valuable information regarding the audiometric setting for CAPD tests. Normal results obtained from the basic test battery allow the audiologist to perform a holistic and complete assessment of the entire auditory system, including the peripheral to central auditory pathways.

The so-called special tests used for assessing children with CAPD were initially used to assess adults to confirm the presence or absence of Site Of Lesion (SOL) in their Central Auditory Nervous System (CANS) for medical purposes (Kaplan, Gladstone and Katz, 1984; Willeford and Burleigh, 1985; Katz and Kusnierczyk, 1993). The auditory mechanism at various levels of the CANS is placed under a unique stress, the objective being to identify deficiencies in the CANS (Keith, 1981; Willeford and Burleigh, 1985).

There are many different ways of categorising tests of central auditory processing. They can be classified according to presentation method (ASHA, 1990), the type of stimuli utilized (Katz, 1994) and the redundancy (low or high) of the auditory signal (Bellis, 1996). Baran and Musiek (1991 cited by Bellis, 1996) divided central tests into two broad categories, namely, behavioural and electro-physiological procedures. For the sake of clarity and simplicity, Baran and Musiek (1991, cited in Bellis, 1996) classification will be followed to present a summary of tests of each category and the skills evaluated in the test. This is presented in Tables 3.1 and 3.2.

3.2.1 Behavioural Tests In Audiological Assessment

Tests in this category require the child's active participation, as the child is required to respond in a particular way to the stimuli. The results of the tests are based on the behaviours displayed by the child. They include dichotic speech tests, temporal ordering tasks, monaural low-redundancy speech tests and binaural interaction tests (Katz and Wilde, 1985; Katz and Wilde, 1994; Bellis, 1996; DeConde Johnson *et al.,* 1997). The examples of these behavioural measures are summarized in Table 3.1. The recommended test battery is one test from each category with the exception of Dichotic tests where it is recommended that one linguistically-loaded and one linguistically non-loaded test be included (Bellis, 1996). The South African Taskforce on CAPD is using these guidelines in the development of CAPD tests for South Africa (SASLHA, 2001).

Table 3.1 Summary of Behavioural measures based on the work of Bellis (1996)

Categories of test	Examples of test	Processes assessed
Monaural Low Redundancy Speech tests	Low-Pass Filtered Speech, Time Compressed Speech, Time Compressed plus reverberation, Synthetic Sentence Identification Test with Ipsilateral Competing Message and Speech-in-Noise.	Auditory Closure
Dichotic tests	Dichotic Digits, Dichotic Consonants-Vowels, Staggered Spondaic Word Test, Synthetic Sentence Identification Test With Contralateral Competing Message, Dichotic Sentence Identification Test and Dichotic Rhyme.	Binaural integration and binaural separation.
Temporal Tests	Frequency Patterns, Duration Patterns and Psychoacoustic Pattern Discrimination Tests.	Frequency discrimination, temporal ordering, linguistic labelling, duration discrimination and temporal discrimination.
Binaural Interaction Tests	Rapidly Alternating Speech Perception, Binaural Fusion (Band-Pass Filtered and Consonant-Vowel-Consonants) and Interaural Just Noticeable Differences.	Binaural interaction.

On an academic level, the results obtained from the different test categories were combined and interpreted. The deficits manifested gave rise to sub-profiles of CAPD (e.g. Auditory Decoding Deficit, Integration Deficit, Associative Deficit, Output-Organization Deficit, Prosodic deficit) (Bellis, 1996). The sub-profiles in turn, assisted

in planning a management programme that was deficit specific. The results are linked to place of lesion, academic difficulties and guidelines for management.

3.2.2 Electrophysiological Tests

These groups of tests are reported to be objective and believed to be free from contamination influences, such as fatigue, subject co-operation, that may affect the behavioural measures (Jerger and Jerger, 1976; Keith, 1981; Willeford and Burleigh, 1985; ASHA, 1990; Katz and Kusnierczyk, 1993). The test battery includes Auditory Reflex and Auditory Evoked Potentials. The audiologist has to bear in mind that neural responses to puretones can be poor predictors of the response to complex stimuli (Brugge, 1975 in Willeford and Burleigh, 1985). The selected electro-physiolocal tests are summarized in Table 3.2.

Table 3.2 Summary of Selected Electrophysiological Tests

Tests	Skill(s) Assessed	Sensitive to
ABR (Auditory Brainstem Response)	Binaural separation	Retrocochlear disorders, low brainstem lesions.
MMN (Mismatched Negativity)	Auditory discrimination,	Primary auditory cortex lesion, supra-temporal plane and temporal cortex lesions.
MLR (Middle Latency Response)	Word recognition, auditory discrimination and figure-ground perception, auditory-visual perception, auditory attention, auditory-visual integration and auditory sequencing.	Temporal lobe lesions, thalamocortical projections lesions, midbrain lesions.
LEP (Late Evoked Potentials)	Auditory integration and attention.	Limbic system, auditory cortex.
P300	Auditory attention and discrimination, memory, semantics, sequencing.	Multiple subcortical sites, limbic system (Hyppocampus), auditory cortex, frontal cortex, centro-parietal cortex.
Otoacoustic emissions (OAE)	Auditory attention skills and analysis of complex signals.	Outer hair cells in the cochlear.

The tests discussed in Tables 3.1 and 3.2 are among others considered very useful to evaluate children with CAPD. It is however extremely important to remember that these tests are not to be used in isolation but as part of a test battery. There is no single test that is comprehensive enough to diagnose or distinguish CAPD (Young and Protti-Patterson, 1984; Bellis, 1996; Sloan, 1998). Furthermore, some children with CAPD

have been reported to perform well or fail in some of the tests whereas have failed or passed all the other tests (Rintelman, 1985; Willeford and Burleigh, 1985; Bellis, 1996; Nielsen, 1997).

Hence the use of a number of tests combined in a specific battery. Due to difficulty in distinguishing a primary message from competing messages, difficulty in the storage and retrieval of auditory information, the inability to attend to meaningful messages in the presence of noise and difficulty with the synthesis of auditory information, children with CAPD can be expected to perform poorly in the above-mentioned tests.

In the case of children with CAPD in the classroom, these special tests referred to above are usually applied only after the child has failed the screening tests done by the teachers (using the checklists or list of behaviours). The test selection focuses on the main complaints of the referring agent and the nature of CAPD while bearing in mind the age of the child (DeConde Johnson, Benson, and Seaton, 1997). This fact emphazises the important role of the teacher as part of the rehabilitation team in providing the audiologist with information about the child's problems. Such information helps to establish guidelines to be followed for a detail assessment, diagnosis and appropriate management.

3.2.3 The role of the audiologist in the management of children with central auditory processing disorders

The main concern of an audiologist in the management of children with CAPD is to enhance the auditory signal which results in improved listening environment as well as the teaching of compensatory strategies that facilitate overcoming residual dysfunction and maximise the use of auditory information (ASHA, 1996; Bellis, 1996; Sloan, 1998; Stach, 1998). The audiologist achieve this by utilizing Assistive Listening Devices (ALD) and employing strategies and techniques that enhance the acoustic signal and increase the scope and control of language resources (Katz and Kusnierczyk, 1993; Lewis, 1994; AJA, 1996; Noe, Davidson and Mishler, 1997). These Assistive Listening Devices should be thoroughly evaluated by an audiologist, first to determine which children are candidates for these devices since not all children need them, and

secondly to ensure optimal fitting and minimize possible detrimental effects (ASHA, 1996).

To enhance the acoustic signal, the acoustic environment (for example classrooms) should have appropriate combination of reflective, absorptive and diffusive materials (Berg, Blair and Benson, 1996; Sloan, 1998). The technique of using different types of materials is referred to as Signal Control Without Amplification. The use of Individual Amplification and Sound Field Amplification system and Noise Control are very important for maximum benefit of students under poor acoustical conditions (Katz and Wilde, 1985; 1994; Berg *et al.,* 1996; Palmer, 1997).

Some of the rehabilitation strategies that have traditionally been used for the hearing impaired population can also be used for children with CAPD (Sloan, 1998) especially those children with Auditory Decoding Deficits (Bellis, 1996). Remedial reading and the augmentation of auditory stimuli with visual stimuli are also helpful to some children with CAPD. Remediation strategies recommended should be deficit-specific, as some children (those with Integration Deficits) will benefit from a discontinuation or limitation of the use of multimodality cues (Bellis, 1996; Katz and Wilde, 1994). Desensitization to noise has been found to be a useful strategy in improving the ability to tolerate background noise and improving understanding of speech in noisy environments (Katz and Wilde, 1994). In this speech-in-noise training, the introduction of noise is always preceded by relaxation (Katz and Wilde, 1994).

Reinforcement and counselling constitute an integral part of the remediation process of children with CAPD. It is important to educate and make the child aware of his/her auditory processing problems (Bellis, 1996; Sloan, 1998), as this will help the child to recognize unfavourable listening conditions and to know which strategies to apply in order to overcome/cope in such adverse situations (Katz and Wilde, 1994; Bellis, 1996; Sloan, 1998).

3.3 THE ROLE OF THE SPEECH-LANGUAGE PATHOLOGIST IN EVALUATING CHILDREN WITH CENTRAL AUDITORY PROCESSING DISORDERS

The speech-language pathology approach views CAPD as a deficiency in basic linguistic skills (Keith, 1981; Katz and Wilde, 1985; Willeford and Burleigh, 1985; Sloan, 1986; Stach, 1993). It is based on the assumption that if discrete elements of language behaviour can be identified, measured and found defective they can be treated. Finding the basic weakness rather than the root cause of the deficits in the processing ability is the major concern of this approach (Rees, 1981 in Keith, 1981; Sloan, 1998).

Sub-elements of central auditory events that are important for language processing to occur, are isolated and evaluated by the use of different speech-language tests. Auditory descriptors are used to describe specific events that are believed to take place in the process of understanding verbal stimuli so that language processes are set in motion. These events are based on the theoretical principles of language development and language use and they are therefore impossible to isolate independently and define in clinical assessment (Rees, 1981). According to Witkin (1971 in Willeford and Burleigh, 1985), many of these concepts overlap and occur in complicated simultaneous relationships. It becomes difficult to determine which event is being evaluated (Willeford and Burleigh, 1985).

The speech-language pathologist's approach is based on an analysis of the complex processing skill into simple or basic components. According to Rees (1981), Willeford and Burleigh (1985), Cline (1988), Riley, (1992), Gillet, (1993) and Sloan, (1998) the components that are thus identified and should be assessed for the purpose of remediation include following:

- Auditory discrimination
- Auditory memory
- Auditory attention
- Auditory analysis

- Auditory synthesis
- Auditory closure
- Auditory localization
- Auditory sequencing
- Auditory-visual integration.

The tests that are commonly used to evaluate these components are summarized in Table 3.3.

Table 3.3 Tests commonly used by Speech-Language Pathologists in assessing CAPD

TESTS	SKILLS/ABILITIES ASSESSED
Illinois Test of Psycholinguistic Abilities (ITPA)	Expressive speech, sequential memory, association, recognition, closure and sound blending.
Lindamood Auditory Conceptualization Test (LAC)	Speech-sound discrimination, and speech sequencing.
Goldman-Fristoe-Woodcock Auditory Skills Battery (GFWB)	Selective attention, discrimination, recognition memory, memory (for content and sequence), sound mimicry, recognition, analysis, blending, sound symbol association, reading of symbols and spelling of sounds.
Flowers-Costello Test of Central Auditory Abilities.	Selective or attentional listening.
Composite Auditory Perceptual Test (CAPT)	Attention, selective attention, memory, discrimination and sequencing.
Detroit Test of Learning Aptitude	Auditory and visual perception, auditory sequential memory, association, recognition, closure and sound blending.
Auditory Discrimination Test (ADT)	Phoneme discrimination.
Differentiation of Auditory Perceptual Skills Test	Auditory discrimination of phonemes and words.
Test of Auditory Perceptual Skills	Digit span, memory (for words and sentences), word discrimination and dictation.
Carrow Auditory Visual Abilities Test	General auditory memory (for related and unrelated stimuli), auditory sequencing, short-term auditory memory, digit span repetition (forward-reversed), auditory discrimination, word and sentence repetition, auditory blending and auditory-visual integration abilities.
Token Test for Children	Receptive language and understanding of verbal instructions (long and complex instructions).
Auditory Sequential Memory Test (ASMT)	Auditory memory and auditory sequencing.
Woodcock-Johnson Psychoeducational Battery - Revised.	Auditory perceptual abilities and academic achievement.
Tests of Written Language Ability (Clinical Evaluation of Language Fundamentals - Revised).	Phonemic representation, word attack, reading comprehension.

The tests used by the speech-language pathologist to assess children with CAPD need not be administered in a sound proof booth, but in a quiet controlled environment (DeConde Johnson *et al.*, 1997). Like the special audiometric tests, they are usually administered after the child has displayed difficulties in specific areas of auditory processing (often revealed by the screening tests or list of behaviours used by the teachers). Again, the nature of the CAPD, the child's age, concentration/attention span, motivation and the use of both verbal and non-verbal test stimuli should be taken into consideration (DeConde Johnson *et al.*, 1997).

3.3.1. The role of the speech-language pathologist in the management of children with central auditory processing disorders

In the management of children with CAPD the speech-language pathologist focuses on improving language ability and language-based auditory processing skills (Rees, 1986; Rampp, 1980; DeConde *et al,* 1997). Compensatory strategies and techniques are therefore used to enhance the child's language resources (Rampp, 1980; Bellis, 1996; DeConde *et al*, 1997). The clinician makes the child aware of the problem and increases the child's attention to acoustic properties of speech (ASLHA, 1996; DeConde *et al.,* 1997; Sloan; 1998). Activities such as skill building and repeated practise of the skill are beneficial to the child with a CAPD. Children with CAPD need structured environment, consistancy and routine. The strategies used for remediation should therefore be consistant to avoid confusion. It is also important to concretize information as children with CAPD have problems with abstract information (Rampp, 1980).

If a child has multiple defective skills, the clinician should target one skill at a time and target another only after the child has mastered the first targeted skill. The clinician has to facilitate the use of remediated skills, extended grammar and forms of speech that the child learned. This should be done in such a way that the child uses his/her knowledge of language and speech reliably and automatically (ASLHA, 1996). Furthermore visual stimuli should accompany oral stimuli. Clearly articulated slow speech, accompanied by gestures should be used when remediating children with CAPD (Rampp, 1980; Bellis, 1996; Sloan, 1998).

It is of vital importance that the child, as well as the parents, teachers and people surrounding the child be made aware and educated about his/her language problems and how they impact on his/her communication, learning and academic progress (Bellis, 1996; Sloan, 1998). Insight into the problem facilitates the remediation process, as the child and people around him/her contribute in respect of the planning of the remediation programme (Bellis, 1996; Sloan, 1998).

The speech-language pathologist focuses on improving receptive and expressive language abilities, depending on the specific type of CAPD. Training on suprasegmental aspects of speech and pragmatics, as well as metalinguistics/metacognitive strategies is very important for enchancing auditory comprehension and memory. Sufficient exposure to and experience of the rules of language will enable the child to recognize and retrieve the targeted language structures or skills and be able to use them automatically in all communicative contexts. The systematic use of multisensory rule-based approach to language and learning is reported to be of benefit to children with CAPD, especially those with Auditory Associative Deficits.

All children with CAPD need to be trained on monitoring their comprehension. The child is not allowed to guess but is encouraged to ask for repetition if s/he is unable to recall the stimulus in order to be sure of what has been said. This places the responsibility of learning and understanding on the child him-/herself (Sloan, 1998).

Strategies such as chunking or grouping and clustering, using meaning or association, are also appropriate in enhancing memory (Sloan, 1998). To facilitate retention and recalling, older children with CAPD could be trained on using crib sheets or notation devices, outlining and summarizing information (Sloan, 1998).

As mentioned previously, counselling still plays an important role in speech-language intervention of children with CAPD, as they also display social and emotional problem (Bellis, 1996; Sloan, 1998). Children who present with deep emotional and social problems should be referred to the psychologist.

3.4 THE ROLE OF THE SPEECH-LANGUAGE PATHOLOGIST AND AUDIOLOGIST AS PART OF THE EDUCATIONAL TEAM

As discussed previously, the different roles of the audiologist and the speech-language pathologist can best be seen in their different approaches to the evaluation of children with CAPD. However, their roles are also evident in the total intervention process. This is illustrated in figure 3.1.

THE AUDIOLOGIST	THE SPEECH-LANGUAGE PATHOLOGIST
HEARING ASSESSMENT: Entire auditory system. Peripheral and central auditory nervous system to rule out the presence of hearing loss and identify the defective auditory mechanisms and processes.	**SPEECH AND LANGUAGE ASSESSMENT:** Speech abilities, receptive and expressive language abilities to identify and measure the defective basic linguistic skills as well as linguistically dependent skills.
DIAGNOSIS: Defining the nature of auditory processing disorders and gives it a category/sub-profile. Report writing.	**DIAGNOSIS:** Defining the nature of auditory processing disorders and gives it a category/sub-profile. Report writing.
MANAGEMENT: Modification of classroom environment, use of assistive listening devices e.g. FM system and sound control devices. Awareness and education regarding the disorder. Counselling and refer to other team members when necessary.	**MANAGEMENT:** Speech and language therapy teaching the rules of language. Training on compensatory strategies. Awareness and education regarding disorder. Counselling and refer to other team members when necessary. Encourage and support other team members.
COLLABORATION WITH OTHER TEAM MEMBERS: To provide a holistic and integrated approach in the management of CAPD in children. **TRAINING OF TEACHERS:** This should include: - sharing of knowledge of CAPD and implications of CAPD - training in early identification using checklists - training in making of appropriate referrals - training in modifications in the classroom including assestive listening devices - monitoring of child's progress - training in importance of ongoing collaboration with speech-language pathologists and audiologists and other team members	

Figure 3.1: The different roles of the audiologist and speech-language pathologist in intervention with children with central auditory processing disorders

In South Africa the audiologists and speech-language pathologists (because they have traditionally been trained in this field) have a great responsibility of educating parents,

teachers and education authorities (especially among black communities) to meeting the unique needs of children with CAPD. The government, in consultation with Professional Boards, has to be sensitive to the needs of this group (Medwetsky, 1994; NCESS, 1997; Boland, Cann, McCuaig and Onslow, 1998; Fletcher, 1998) and employ professionals who will ensure that the communicative, social and learning aspects of children with CAPD are maximized in order to meet their educational and real life capabilities (Medwetsky, 1994; NCESS, 1997).

Parents of children with CAPD get frustrated as they do not know what to do with these children. The audiologists and speech-language pathologists have a responsibility of discussing the child's problems with them and making suggestions on how to overcome or cope with the problem. For emotional support, the audiologist and speech-language pathologist can form a support group consisting of parents, siblings or any family members of children with CAPD (Bellis, 1996; Nielsen, 1997). It is the responsibility of the audiologist and speech-language pathologist to listen carefully to the concerns and needs of the group. The audiologist and speech-language pathologist should continue to support the group by giving them new information about the disorder and acts as a facilitator. The speech-language pathologist and audiologist - as the leader of the project when dealing with CAPD - should be more educated in the matters relating to the disorder in order to pass on appropriate and relevant information to teachers to ensure the desired results (Bellis, 1996; Nielsen, 1997).

It is the responsibility of the speech-language pathologist and audiologist to provide guidance to teachers relating to strategies used in assisting a child with a CAPD (Katz and Wilde, 1994; Bellis, 1996; Nielsen, 1997).

The speech-language pathologist and audiologist also have to train teachers about CAPD and the implications that these have for the child's learning. Teachers need to know when and where to refer a child with a CAPD. As the speech-language pathologist and audiologist is most involved in the implementation of management of children with CAPD (Bellis, 1996; Sloan, 1998), it is his/her responsibility to give guidelines for classroom modification and the use of compensatory strategies. In order

for teachers to get involved in the management process of children with CAPD, the speech-language pathologist and audiologist needs to highlight the importance and benefits of these strategies. Furthermore, the speech-language pathologist and audiologist need to offer lots of support and encouragement to the teachers during the process of managing children with CAPD (Bellis, 1996).

3.5 THE ROLE OF THE TEACHER AS A TEAM MEMBER IN PROVIDING A SERVICE TO CHILDREN WITH CENTRAL AUDITORY PROCESSING DISORDERS

According to NCESS (1997:iv) a teacher is "a person who educate others at all levels of education in any type of education or training context, including formal and informal". Teachers instruct children and work together with other professionals in identifying and referring children with possible disabilities requiring further assessment and management (Bellis, 1996). The teacher also has an important role in managing children with disabilities in the classroom. In S.A. the emphases is on mainstreaming (NCESS, 1997).

Below-average school performance of children with CAPD is the main reason for seeking professional assistance (Smoski, Brunt and Tannahill, 1992). The clinical impression is that children do not outgrow the disorder, however, they appear to develop compensatory skills as they get older (Stach and Loiselle, 1993). Parents and teachers are usually the first people to notice the child's problems. Useful information regarding the child and the child's problems can be gathered from them even before assessing the child (Giliomee, 1995; Bellis, 1996).

Although there is an overlap in some of the roles played by the audiologist, parents and teachers, the latter play an important role in identifying and remediating children with CAPD, as they are the ones who enforce the roles played by other team members. As mentioned previously, teachers are in daily contact with children and CAPD has a greater impact in the academic sphere. A teacher who has acquired a specialized knowledge on CAPD (Moodley, 1999), will be motivated to put the theory of management of CAPD into practise. According to Moodley (1999) specialized

knowledge is the knowledge above the basic knowledge provided by specific disciplines and it produces better understanding of the theoretical and practical part of the subject. Therefore, imparting knowledge regarding CAPD to teachers will result in them becoming aware of the nature of CAPD and the unique needs of children with CAPD (Bellis, 1996; Jerger, 1998). The team members that may be involved in the management of a child with CAPD is presented in figure 3.2. The cardinal central role of the teacher is highlighted in this figure.

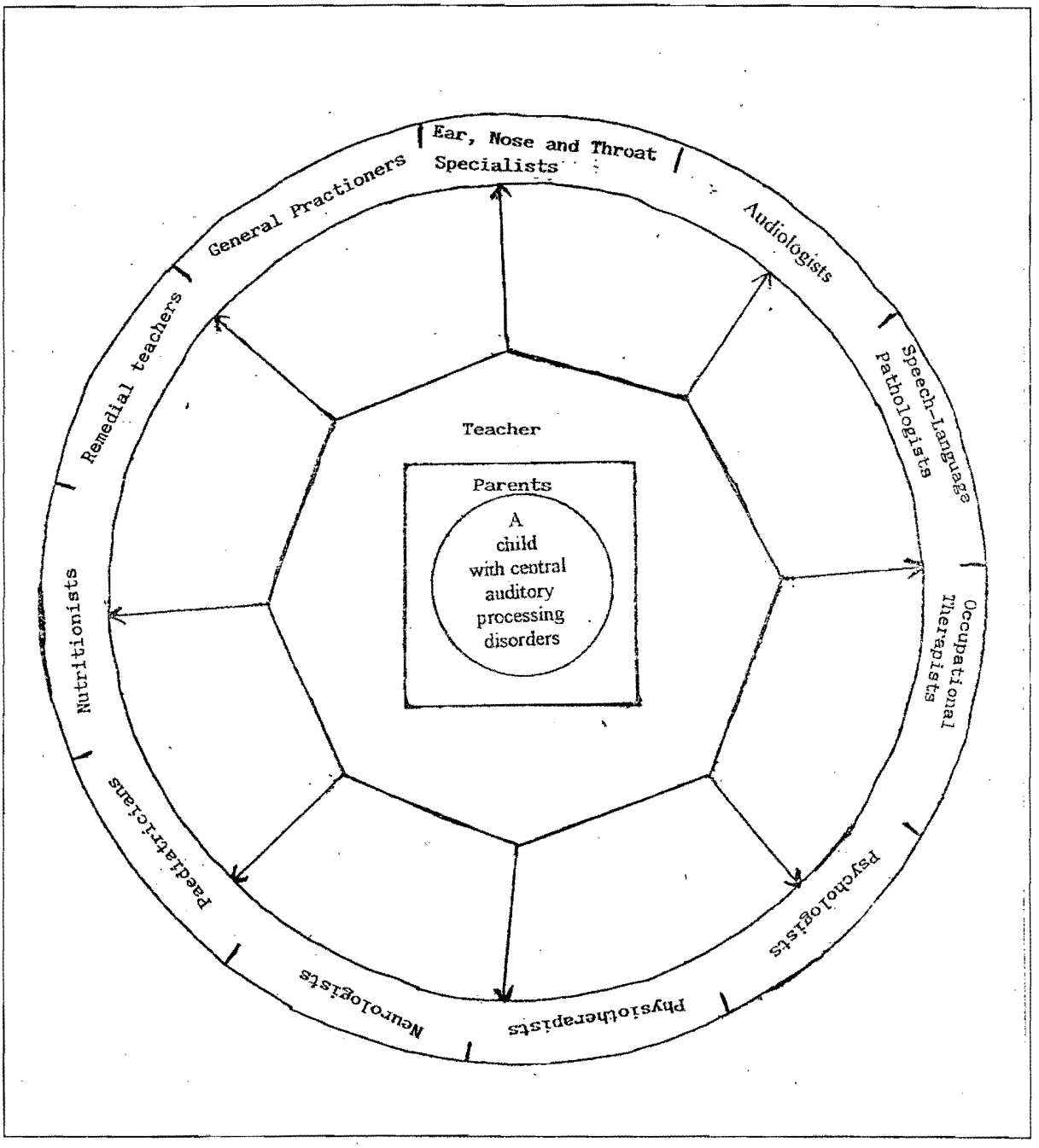

Figure 3.2: Professionals involved in management of children with central auditory processing disorders and the role of the teacher in terms of referring (presented by arrows) children in need of the specialists' assistance.

Sourse: (Developed based on information from Barr, (1972); Rampp, (1980); Katz and Wilde, (1985); Katz and Kusnierczyk, (1993); Campbell, (1944); Musiek and Chermak, (1994) and Bellis, (1996)).

The relationship between the child, parents and teachers is a very close one. Parents and teachers have daily contact with the child and they are usually the first people to notice the child's problems. The arrows surrounding the teacher leading to different directions highlight the role that teachers play as sources of referral to different professionals. In other words, teachers have access to different professionals after having identified a problem in a child. They can subsequently refer a child for a detailed assessment, appropriate diagnosis and management. The other team members work closely with the teacher in terms of identification and management of children with disorders. In the case of children with CAPD, the speech-language pathologist and audiologist will need to work closely with the teacher and then with other team members (Fletcher, 1998; Boland *et al.*, 1998).

Teachers are in contact with children on a daily basis and they are therefore key persons for identifying and referring children who need the assistance of specialists (Giliomee, 1995; Bellis, 1996) (illustrated in Figure 3.2.). Thus it is clear that teachers need to be trained in identifying and assisting children with CAPD in order to know when and where to refer a child with these disorders. Referring a child to the appropriate professional, will save time and money and result in early intervention. It will also relieve parents from the anxiety of not knowing what is wrong with their child as the speech-language pathologist and audiologist will counsel them (Jerger, 1998) and educate them about the child's problem.

The process of integrating children with disorders and disabilities into mainstream schools mentioned previously, poses a formidable challenge to teachers as the number of children per classroom will increase and therefore also the number of children with CAPD, will increase steadily (Giliomee, 1995; NCESS, 1997). Teachers must therefore be empowered NCESS, 1997) to handle these children. The specific role of the teacher is clearly indicated in figure 3.3.

Although the literature provides some information on the role of the teachers regarding CAPD (Bellis, 1996; DeConde Johnson, *et al.,* 1997), these discussions tend to be superficial and only refer briefly to identifying and referring, with general guidelines that

can be given to the teacher for managing the child in the class. It is important to recognise the very important role, which the teacher has to play in the management of CAPD.

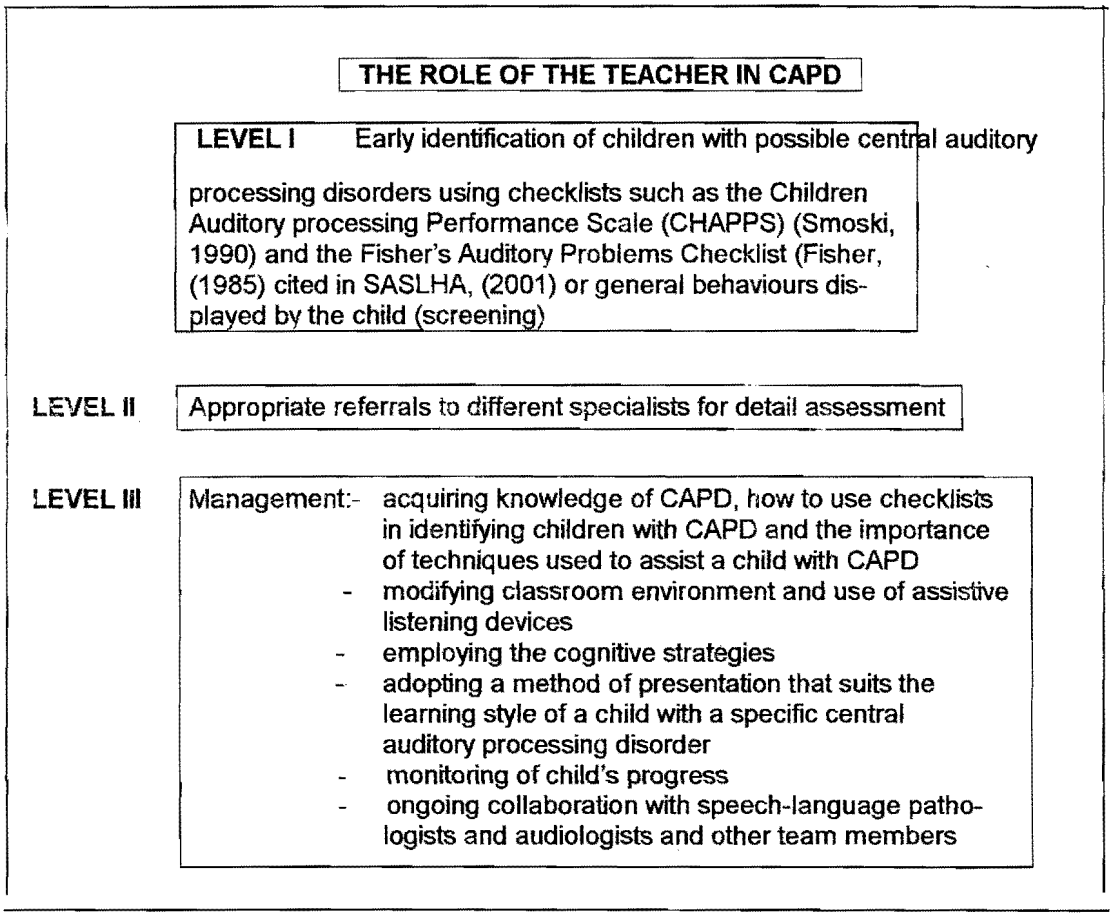

Figure 3.3. The role of the teacher in the management of children with central auditory processing disorders

As seen in **figure 3.3**. the role of the teacher outlined above can be divided into three different levels:-.

- Level I involves the identification and screening of children with CAPD
- Level II is concerned with the referral and detail assessment of children with CAPD (proper diagnosis).
- Level III has to do with planning of management procedures. This includes the ongoing assessments and other issues/concerns that may arise during the management process.

3.5.1 LEVEL I: TEACHER'S ROLE IN SCREENING CHILDREN WITH CENTRAL AUDITORY PROCESSING DISORDERS

Teachers should screen children with CAPD by using a list of general behaviours displayed by this population group or by using checklists (Richard and Hanner, 1990) such as those mentioned in **Figure 3.3** for identification purposes. This procedure is time and cost effective, as the speech-language pathologists and audiologists only have to focus on detail assessment, appropriate referrals and monitoring remediation suggestions (Medwetsky, 1994).

3.5.2 LEVEL II: TEACHER'S ROLE IN REFERRAL OF CHILDREN WITH CENTRAL AUDITORY PROCESSING DISORDERS - IMPLICATIONS FOR TEACHERS TRAINING

As discussed previously, teachers have access to different professionals. Any child who displays some difficulties or strange/abnormal behaviours should be referred for detail assessment and management. Children with CAPD should be referred to the speech-language pathologist and audiologist as they may present as having a hearing loss or learning disabilities. The teacher's role in this process is first to act as a referral agent. Additionally, the teacher must also provide the diagnostician with information about the child's functioning in the classroom, which will enhance the diagnostic process.

3.5.3. LEVEL III: THE TEACHER'S ROLE IN MANAGEMENT OF CHILDREN WITH CENTRAL AUDITORY PROCESSING DISORDERS - IMPLICATIONS FOR TEACHER'S TRAINING

As a first step in management, teachers as referring agents, can also help in counselling parents of children with CAPD as they have easier access to them compared to other professionals.

Teacher can furthermore impart knowledge received from other team members regarding CAPD and the management thereof. This will facilitate the formation of support groups and it will empower parents with knowledge that will eventually smooth progress of the total management process (Fletcher, 1998; Boland *et al.*, 1998).

Although teachers are not directly involved in the diagnostic process, they play an important role in monitoring the classroom-based strategies and techniques suggested to help in remediation of CAPD (Bellis, 1996). They must therefore have knowledge and an understanding of general characteristics of children with these disorders and their educational impact. It is also important for teachers to understand the rationale behind the implementation of each classroom-based method and compensatory strategies used in the management of CAPD (Bellis, 1996). Having insight into the method used in remediation will motivate them to provide an environment that is conducive to learning for these children and to carry out suggestions made by other team members.

The following guidelines and techniques are among others that can be employed by teachers in an attempt to help children with CAPD.

- **Classroom placement and preferential seating**

  The child should preferably sit in the front row in order to get maximum visual cues or even lip read if possible (Willeford and Burleigh, 1985; Stach and Loiselle, 1993; Campbell, 1994; Bellis, 1996; NCESS, 1997; Sloan, 1998).

- **Structured environment**

  Children with CAPD prefer self-contained structured environment (Katz and Wilde, 1985; Bellis, 1996; NCESS, 1997). Thus teachers are advised to avoid an open unstructured environment when dealing with these children.

- **Acoustical control and visual aids**

  It is important to supplement the auditory message with visual input to help the child to retain new learning. Reduction of noise by getting rid of noise generating objects greatly benefits children with CAPD (Young and Protti-Patterson, 1984; Katz and Wilde, 1985; Crandell and Smaldino, 1996; Bellis, 1996; Bench and Maule, 1997; Sloan, 1998).

- **Modification of listening environment**

  Increasing clarity of the primary spoken message by improving signal-to-noise (S/N) ratio can be obtained by using heavy materials, soft porous materials, bookshelves, acoustic tiles, carpets, bulletin boards and wall hangings to furnish the room. These objects and materials are reported to exclude sound and will reduce and absorb reverberation (Katz and Wilde, 1985; Campbell, 1994; Berg et al., 1996; Bellis, 1996; Sloan, 1998).

- **Quiet study area**

  This area should be away from visual and auditory distraction (Katz and Wilde, 1985; Stach, Loiselle, 1993; Bellis, 1996).

- **Frequency Modulated (FM) system/Loop FM System/Infrared System**

  This system is reported to be helpful in the reducing background noise, enhancing the primary signal, reducing emotional outburst in the classroom, and in improving assignments as well as the quality of overall classroom performance (Stach, 1993; Stach and Loiselle, 1993, Campbell, 1994; Lewis, 1994; Crandell and Smaldino, 1996; Bellis, 1996; Palmer, 1997). The problem is that not all children can afford to have such a system as it is expensive and is only suitable for children who do not have language problems.

- **Sound control devices**

  Earmuffs or earplugs are reported to have produced satisfactory results when applied to children with CAPD that result from the dysfunction of the auditory mechanism and processes. Both ears or only the weak ear can be occluded in order to reduce the ambient noise that interferes with important academic tasks. Unfortunately bilateral occlusion is recommended during desk-activities only, when concentration is important (Willeford and Burleigh, 1985).

- **Improvement of communication. Suggestions for strategies that will achieve better communication in the classroom**

  Gain the child's attention before giving instructions. This can be done by calling the child's name or by touching him gently (Lasky and Cox, 1983; Katz and Wilde, 1985; Cline, 1988).

  Monitoring comprehension by asking the child questions related to the subject being discussed (Cline, 1988; Richard and Hanner, 1990; Bellis, 1996; Sloan, 1998).

  Rephrasing/Repetition of the misunderstood information by reducing linguistic complexity of the statements as well as the vocabulary level (Katz and Wilde, 1985; Cline, 1988; Bellis, 1996).

  Use brief instructions to help with memory and decoding (Bellis, 1996).

  Pretutoring. This involves familiarizing the child beforehand with new vocabulary and concepts to be covered in class (Katz and Wilde, 1985; Bellis, 1996).

  Listing key vocabulary words of new materials on the chalkboard before discussion. Writing down instructions also benefits children with CAPD (Cline, 1988; Bellis, 1996).

  One-to-one tutoring helps with filling in the gaps in the child's understanding (Katz and Wilde, 1985; Bellis, 1996).

  Providing breaks helps to reduce frustration as children with CAPD fatigue easily (Katz and Wilde, 1985).

  "Mindmapping" and mnemonic devices are reported to be useful (Campbell, 1994) and may be motivating to the child.

  Frequent check of comprehension by asking the child to paraphrase or act what has been said (Richard and Hanner, 1990; Bellis, 1996).

  Provide a note taker or allowing the child to tape record the lesson in order to avoid divided attention and concentration in children with CAPD (Bellis, 1996; Sloan 1998).

Truesdale (1990) emphasizes the importance of teaching the child that listening is an active behaviour. *The whole body should take part in the listening process.* The child has to be taught to listen with the whole body by sitting still, being quiet, concentrating

on the speaker, thinking of and paying attention to what is being said. Teachers should train children on "Whole-body" listening skills (Truesdale, 1990). Since the "whole body" is participating actively in listening, the child should think about listening and pay attention to the sounds that are presented orally, as this will promote spelling and reading abilities (Truesdale, 1990). Teachers should concretize listening by using body parts, by asking children to complete the missing sound in a word presented orally or by identifying a tape recorded sound or by sequencing directions that were presented verbally (Truesdale, 1990).

The strategies and techniques discussed above have been devised to improve the child's academic performance and communication. This should be combined with modification of the child's environment.

To ensure that children with CAPD are given opportunity to reach their full academic potential, teachers need to be empowered to identify and manage such children. As mentioned previously, children with CAPD are mistakenly regarded by teachers as having hearing loss. Teachers in mainstream schools consider themselves not capable of teaching children with hearing losses, with the results that they recommend them to be placed in schools for the deaf. This reveals their lack of knowledge of CAPD. Collaboration between the Department of Health and the Department of Education is of vital importance in order to enhance the teacher's knowledge of issues regarding CAPD. Speech-language pathologists and audiologists and teachers need to work together in order to benefit children with CAPD. A sound relationship between all the stakeholders will facilitate the integration process. Teachers will be aware of disorders that impede on children's academic performance and that can be eradicated with special assistance, while children can be taught to cope by utilizing certain strategies and techniques.

3.6 SUMMARY OF CHAPTER THREE

Chapter 3 discusses the role of the speech-language pathologist and audiologist in terms of the evaluation and management of children with CAPD. Different speech-

language and audiological tests that are used to assess such children were briefly summarized. The role and the importance of the teacher in the intervention process have been highlighted in this chapter, while techniques and strategies that can improve academic performance, communicative and social abilities of this population group also received attention.