# Knowledge of Primary School Teachers about Central Auditory Processing Disorders in Private, Urban Primary Schools in Lahore, Pakistan

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## ABSTRACT

Central Auditory Processing Disorder (CAPD) may impact a child's ability to listen, learn and participate in the classroom even when hearing tests are normal. Teachers are often the first to notice these difficulties, so what they know matters. This study looked at four areas of CAPD knowledge among primary school teachers in private, urban schools in Lahore, Pakistan. This included knowledge of symptoms, knowledge of how CAPD differs from other related disorders, knowledge of specialists involved in the identification and treatment of CAPD, knowledge of classroom interventions. A survey of 350 teachers was analysed using partial least squares structural equation modelling (PLS-SEM). The four measures were reliable and clearly distinct from one another. Additionally, all seven hypotheses were confirmed by the results. Teachers who knew more about symptoms, and who could better tell CAPD apart from related conditions, were also disposed to know more about the specialists and about interventions employed in the classroom. Knowledge of specialists partly explained the link between basic CAPD knowledge and knowledge of classroom interventions. Training for teachers may therefore work best when it covers recognising difficulties, knowing who to refer to and how to provide classroom support. The study however measured knowledge at one point tin tome, hence it does not conclusively show that one type of knowledge leads to another, or if training would lead to a change in teacher practises.

**Keywords:** *Teacher knowledge; Central Auditory Processing Disorder; classroom intervention; primary-school teachers; specialist knowledge; Knowledge-to-Action Framework.*

## INTRODUCTION

### Background to the Study

It is generally assumed that hearing involves only the ear, yet the ear is only the entry point into a far more complex system.

Once sound reaches the cochlea, it is converted into an electrical signal that must travel along the auditory nerve, through the brainstem and up to the auditory cortex, where it is perceived, refined, organised and ultimately understood (American Speech-Language-Hearing Association [ASHA], 2005).

ASHA (2005) defines Central Auditory Processing (CAP) as the perceptual processing of auditory information in the central auditory nervous system (CANS), as well as the neurobiological activity that underlies that processing and gives rise to electrophysiologic auditory potentials.

Thus, whilst the peripheral auditory system comprises the outer, middle and inner ear and is responsible for receiving and converting sounds into neural signals, the central system is responsible for converting these signals into auditory sensations that are processed in the auditory cortex (Ryan & Logue-Kennedy, 2013).

Central auditory processing can therefore be understood as the process through which a listener interprets and makes sense of auditory information (Katz et al., 1992).

When this process is disrupted through disease, disorganisation or delayed maturation of the central auditory nervous system, the resultant disorder is referred to as central auditory processing disorder (CAPD), also referred to in literature as auditory processing disorder (APD) (Chermak & Musiek, 1997).

Individuals with CAPD typically have normal outer, middle and inner ear function and anatomy, with normal peripheral hearing sensitivity, yet they struggle to interpret what they hear, particularly in the presence of background noise, competing speech, or degraded or rapid acoustic signals (Aristidou & Hohman, 2023).

The disorder manifests as difficulties with auditory perception, auditory pattern recognition, sound localisation and lateralisation, and the temporal aspects of speech, including temporal resolution, integration and ordering (British Society of Audiology [BSA], 2011; Choudhury & Sanju, 2017).

CAPD is therefore frequently described as a hidden disability, as peripheral hearing is typically intact and the difficulties experienced by children are often mistaken for inattention, learning difficulties or poor motivation (Bellis, 2003).

CAPD also affects a child's ability to comprehend the subtle nuances of prosody required to understand sarcasm and humour. Children with CAPD have poorer communication, cognition, language and reading skills compared to their typically developing peers. They may also struggle to understand commands and simple requests (Ryan & Logue-Kennedy, 2013).

Additionally, they experience more sleep disturbances and psychosocial difficulties, as well as higher levels of stress in response to everyday stressors, compared to their

typically developing peers (Bernard et al., 2025).

Furthermore, auditory perceptual abilities and language development are interrelated, as are auditory processing and pre-literacy skills. Processing speech involves auditory, cognitive and language skills simultaneously; hence, difficulties with auditory processing can have an impact on pre-literacy and academic skills (ASHA, n.d.).

Symptoms of CAPD overlap with those of other disorders, such as autism spectrum disorder, attention-deficit hyperactivity disorder, specific language impairment and learning-related problems.

Children with CAPD reportedly demonstrate reduced attention, are easily distracted, and experience difficulties understanding speech in noisy or suboptimal listening conditions.

CAPD may also impact a child's executive functioning. This is in addition to general difficulties with communication, reading, spelling, phonological awareness and language comprehension. Together, these factors can contribute to poor performance in school (Almusawi & Hamadah, 2022).

Despite inconsistencies and variations in the methodologies and populations studied, it is estimated that approximately 10% of children present with CAPD (Bamiou & Luxon, 2008; BSA, 2011; Choudhury & Sanju, 2017).

CAPD symptoms often become noticeable when children start school, as learning is highly dependent on listening. Inadequate performance in activities important for learning can negatively affect a child both academically and socially. Due to the range of symptoms with which children may present, the impact of CAPD will vary between individuals (Ryan & Logue-Kennedy, 2013).

Moreover, due to the overlap of symptoms with those of other disorders, misdiagnosis of CAPD is fairly common. Diagnosis therefore requires a multidisciplinary approach involving audiologists, speech and language pathologists, teachers, psychologists and physicians, although there is no current consensus on the protocol for the diagnosis of CAPD (Almusawi & Hamadah, 2022).

Early observation that a problem exists and may be related to CAPD, frequently falls within the role of the teacher (Logue-Kennedy et al., 2011). Teachers who are able to identify children who struggle to follow multistep instructions, become distracted in noisy environments, or fall behind in reading and spelling may make appropriate referrals rather than assuming that these difficulties are due to inattention or a general learning difficulty (Sharma et al., 2026).

Additionally, there is a lack of clarity regarding intervention strategies for CAPD. Intervention strategies used for related disorders are often utilised based on the child's presenting symptoms. It therefore follows that teachers' awareness of CAPD symptoms and possible intervention strategies may be vital to the identification and treatment of children with CAPD (Almusawi & Hamadah, 2022).

Despite teachers' pivotal role, there are only a handful of studies examining what teachers actually know about CAPD. The studies that do exist point to a scenario of very low

awareness amongst teachers (Hlabangwane, 2002; Ryan & Logue-Kennedy, 2013).

## REVIEW OF LITERATURE

This section reviews the literature relevant to CAPD and, in particular, the awareness and knowledge of CAPD among professionals responsible for identifying and managing it. The section defines the disorder, how it presents in children and what is understood about its prevalence. It also reviews the small body of literature examining professionals' knowledge of CAPD, particularly that of primary school teachers.

### Defining Central Auditory Processing Disorder

CAPD refers to a difficulty in processing auditory information within the central nervous system that occurs despite normal peripheral hearing sensitivity (Choudhury & Sanju, 2017). The British Society of Audiology similarly describes the disorder as a non-speech, auditory-specific condition that is distinguished from broader linguistic or multimodal cognitive deficits (Choudhury & Sanju, 2017).

Clinically, CAPD is characterised by a deficit in one or more processes involving auditory evoked potentials, sound localisation and lateralisation, auditory discrimination, pattern recognition and temporal processing, including temporal resolution, masking, integration and ordering, as well as reduced performance when speech is presented with competing or degraded acoustic signals (Choudhury & Sanju, 2017).

Functionally, children with CAPD are often described as needing frequent repetition, appearing inattentive or easily distracted, showing poor memory for spoken information, struggling to follow verbal directions, and underperforming academically, especially in reading tasks (Choudhury & Sanju, 2017). Since these symptoms are behavioural rather than physical, and audiometric test results are typically normal, CAPD is often overlooked and symptoms are attributed to other causes (Baldry & Hind, 2008).

CAPD may either be acquired or developmental. Acquired cases may be due to head injury, prolonged or recurrent ear infections, or any other damage to the central auditory nervous system (CANS).

Developmental cases are typically idiopathic, with the cause attributed to delayed maturation or disease of the CANS. Genetic factors, exposure to heavy metals, prematurity and low birth weight may be causative factors (Almusawi & Hamadah, 2022). Exposure to smoke or bilirubin toxicity has also been speculated as a causative factor in CAPD (Choudhury & Sanju, 2017).

Audiologists are regarded as central to a formal diagnosis, especially to exclude peripheral hearing impairment prior to the interpretation of any auditory processing battery (ASHA, 2005; Baldry & Hind, 2008).

However, before a child can be seen by an audiologist, someone earlier in the pathway has to suspect CAPD and initiate a referral. Logue-Kennedy et al. (2011) noted that this early recognition commonly falls to speech and language pathologists, but also importantly to doctors and teachers, who are

often the first professionals to register concern about a child's listening and learning. If awareness at this early stage is weak or missing, the entire pathway to recognition and diagnosis of CAPD is usually jeopardized (Baldry & Hind, 2008).

### Awareness and Knowledge among Health and Allied Health Professionals

Some of the earliest systematic evidence on professional awareness of CAPD comes from studies of disciplines most directly responsible for its diagnosis.

In the USA, Chermak et al. (1998) surveyed audiologists and discovered that whilst the majority had received some academic training in CAPD, a considerable proportion rated their training as unsatisfactory. Fewer than half reported that they actually provided assessment of the central auditory system. A follow-up study nearly a decade later found some improvement in academic training but little corresponding change in clinical practice (Chermak et al., 2007).

A similar situation was found in the United Kingdom. Hind (2006) surveyed audiologists and speech and language pathologists, and found that no clear diagnostic and management protocol had been agreed upon; only a small minority offered screening or diagnosis, and more than half of the respondents rated themselves as not well informed about CAPD.

In Ireland, Logue-Kennedy et al. (2011) surveyed speech and language pathologists, audiologic scientists and educational psychologists nationally, achieving a 53% response rate. The majority of respondents across all three professions rated themselves as poorly or very poorly informed about CAPD. Audiologic scientists and speech and language pathologists reported particularly low confidence, whilst educational psychologists reported modestly higher awareness. Additionally, very few respondents reported that they screened, diagnosed or provided management services. When management services were offered, they largely consisted of informal advice rather than evidence-based practices.

As a second phase of the same research, over one hundred professionals were brought together to design an interdisciplinary pathway of care for Ireland by identifying needs relating to resourcing, training and interdisciplinary collaboration (Logue-Kennedy et al., 2011).

Other studies examining awareness of CAPD have been conducted amongst general practitioners (GPs) and ear, nose and throat (ENT) doctors. These professionals are often among the first to be consulted when a child shows signs of difficulty. Baldry and Hind (2008) surveyed members of both professional groups. The majority of GPs rated themselves as poorly informed, but a small minority said they would refer for a CAPD assessment if symptoms were present despite normal peripheral hearing.

There was also a positive correlation between awareness and attitudes towards referrals. This suggests that targeted training may not only increase knowledge but also help establish an appropriate referral system (Baldry & Hind, 2008).

Furthermore, a study involving 118 paediatricians in India indicated that the majority reported having heard of CAPD, yet only one third had ever actually suspected the condition, and their recognition of the

symptoms was inconsistent. However, once the symptoms were recognised, most paediatricians made appropriate referrals (Sharma et al., 2026).

### Awareness and Knowledge among Teachers

Primary school teachers' knowledge of CAPD was investigated by Hlabangwane (2002) in South Africa. Teachers from 55 mainstream primary schools in the Soweto area participated in a descriptive survey. Of the 300 respondents, a substantial majority, around 88%, were found to lack both basic knowledge and formal training in CAPD. A number of teachers confused the condition with hearing impairment. Despite the substantial gap in knowledge, the teachers in the study reported a positive attitude towards receiving CAPD-specific training. This suggests that the lack of knowledge may be due to a lack of opportunity rather than a lack of willingness (Hlabangwane, 2002).

Another enquiry into the knowledge of primary school teachers was conducted by Ryan and Logue-Kennedy (2013) in the Republic of Ireland and Northern Ireland. A total of 137 questionnaires were returned. Of the teachers surveyed, 80% reported poor to very poor knowledge of CAPD, while only 1.4% rated their knowledge as good or very good.

Furthermore, 86.1% had received no formal training in the condition, with only a minority reporting even informal exposure. The study found no significant difference in knowledge based on the number of years in the profession or the specific post held. Interestingly, teachers in rural settings showed marginally better knowledge than those in urban settings. The conclusion drawn from this is that the gap in knowledge may only be filled through deliberate, structured training (Ryan & Logue-Kennedy, 2013).

A more recent study was conducted in Kuwait by Almusawi and Hamadah (2022). A 70-item, seven-domain questionnaire was administered to 1,003 primary school teachers nationwide. Unlike the studies in South Africa and Ireland, this research reported a moderate rather than poor overall level of awareness.

The authors attributed this difference partly to sample composition and prior exposure to affected children. Only 28.6% of teachers reported being aware of CAPD prior to the survey, and over a third had previously taught a child with the condition. However, average performance across the seven domains, which covered classroom symptoms, causes, distinguishing features and intervention strategies, was around 60%. The most reliably recognised symptoms were that children with CAPD are slow to respond to questions and instructions and require frequent repetition, but teachers were less confident in distinguishing CAPD from other disorders. Fewer teachers identified the link between CAPD and autism compared to the link between CAPD and learning difficulties. A small number of teachers also identified factors such as left-handedness, low socioeconomic status and low birth weight as possible causes (Almusawi & Hamadah, 2022).

Prior exposure to a child with CAPD was associated with better understanding across these domains, including symptom recognition, causal understanding and intervention strategies (Almusawi & Hamadah, 2022). These findings amongst

teachers mirrored those found amongst paediatricians in India (Sharma et al., 2026).

Overall, the picture that emerges is that awareness of CAPD is generally low amongst teachers and other professionals who may encounter the disorder (Baldry & Hind, 2008; Logue-Kennedy et al., 2011; Ryan & Logue-Kennedy, 2013; Sharma et al., 2026).

Amongst teachers, knowledge has ranged from generally poor (Hlabangwane, 2002; Ryan & Logue-Kennedy, 2013) to moderate at best in Kuwait (Almusawi & Hamadah, 2022). These differences may arise as a result of factors such as teacher training and prior exposure to the disorder. Research suggests that knowledge of CAPD may improve with direct exposure to a child with the condition, years of professional experience and level of qualification (Almusawi & Hamadah, 2022; Sharma et al., 2026).

CAPD also continues to be confused with other disorders such as hearing loss, ADHD, autism spectrum disorder and general learning disability (Almusawi & Hamadah, 2022; Baldry & Hind, 2008; Hlabangwane, 2002). The direct impact of this may be confusion in the referral process and delays in identifying a child with CAPD.

Moreover, the amount of literature remains sparse and offers only a partial picture of what primary school teachers may know. The present study is designed to address this gap and increase insight into the extent of their knowledge based on geographical location.

## Need of the Study

A child with unidentified CAPD is likely to be misunderstood and may experience delays in receiving support for academic and social difficulties, which can further compound the problem. Hence, the extent of teachers' knowledge about the symptoms, causes and appropriate responses to CAPD is of practical importance to the outcomes of children with CAPD.

It is critical to establish the extent of teachers' knowledge and whether this is influenced by the level of training they have received. This information is essential, as the results may guide teacher training in CAPD, either through teacher training programmes or professional development courses.

The study aims to investigate the level of knowledge that primary school teachers have regarding CAPD, including their awareness of its characteristics, symptoms, causes and overlap with other developmental conditions, as well as their confidence in recognising and responding to children who may present with the disorder.

Its findings are intended to be of practical use by identifying specific areas of strength and weakness in teacher knowledge based on their level of education, with the aim of informing the design of continuous professional development and pre-service training.

More informed teachers are better positioned to identify the signs of CAPD in a timely manner, reduce the length of time a child may struggle, and help prevent them from falling behind in the classroom.

## METHOD

This section outlines the aims of this study, the conceptual framework, the dependent and independent variables, the hypothesis, the inclusion and exclusion criteria, the procedure as well as the methods of analysis of the data collected.

### Aim of the study

The study aims to assess the theoretical and practical knowledge of CAPD amongst primary school teachers in the private, urban primary schools in Lahore, Pakistan. The study aimed to:

- Assess teachers' knowledge of CAPD symptoms and characteristics.
- Assess whether teachers can distinguish CAPD from related developmental, behavioural and learning disorders.
- Examine whether knowledge of CAPD symptoms is associated with knowledge of the specialists involved in its management.
- Examine whether knowledge of related disorders is associated with knowledge of CAPD specialists.
- Examine whether these areas of knowledge are associated with knowledge of classroom interventions for CAPD.
- Examine whether knowledge of specialists partly explains the link between symptom knowledge and classroom intervention knowledge.
- Examine whether knowledge of specialists partly explains the link between knowledge of related disorders and classroom intervention knowledge.

### Conceptual Framework

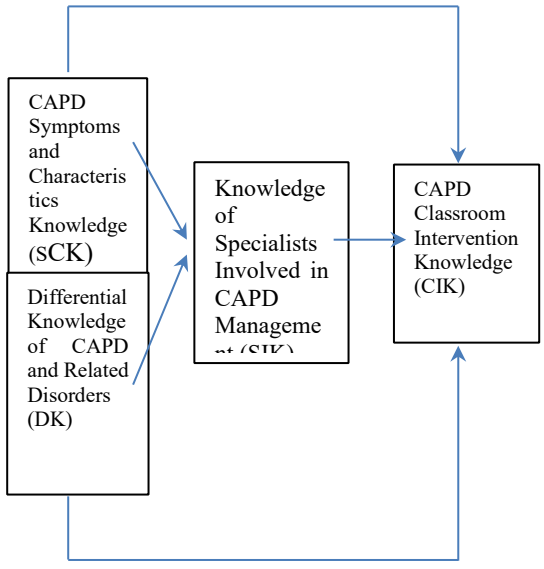
The study examined four related areas of knowledge: CAPD symptoms and characteristics (SCK), how CAPD differs from related disorders (DK), the specialists involved in CAPD management (SIK), and classroom interventions (CIK). It proposed that knowledge of symptoms and related disorders would be linked to knowledge of specialists and interventions. The following teacher characteristics were also considered in the framework:

- The teacher's years of experience.
- The teacher's academic qualifications.
- The teacher's prior exposure to CAPD

These can be outlined in Figure 1.

**Figure 1.**

*Scheme of the variables tested*



The arrows show the proposed links between what teachers know about CAPD symptoms and related disorders, which specialists can help, and what support may be used in the classroom. The diagram shows the study's questions, not proof that one type of knowledge causes another.

Key: Symptoms and Characteristics (SCK); Differential Knowledge of CAPD and Related Disorders (DK) Knowledge of Specialists Involved (SIK); Classroom Intervention Knowledge (CIK)

## Research Hypotheses

The study examined the following proposed relationships:

H1: Teachers who know more about CAPD symptoms and characteristics will know more about the specialists involved in its management.

H2: Teachers who can distinguish CAPD from related disorders will know more about the specialists involved in its management.

H3: Teachers who know more about CAPD symptoms and characteristics will know more about classroom interventions.

H4: Teachers who can distinguish CAPD from related disorders will know more about classroom interventions.

H5: Teachers who know more about CAPD specialists will know more about classroom interventions.

H6: Knowledge of specialists may partly describe the relationship between symptom knowledge and classroom intervention knowledge.

H7: Knowledge of specialists may partly describe the relationship between knowledge of related disorders and classroom intervention knowledge.

## Theoretical Basis

The framework draws on earlier findings about CAPD, classroom learning and teacher knowledge.

### CAPD as a hidden disability

Children with CAPD usually have normal peripheral hearing but may struggle to interpret sounds, especially in noisy classrooms (American Speech-Language-Hearing Association [ASHA], 2005; Bellis, 2003). Because these difficulties are shown through classroom behaviour rather than an obvious physical problem, teachers may be among the first people to notice them (Logue-Kennedy et al., 2011; Ryan & Logue-Kennedy, 2013).

### Overlap with other conditions

CAPD can resemble or occur alongside ADHD, autism spectrum disorder and specific learning difficulties (Almusawi & Hamadah, 2023; Chermak et al., 1999). The questionnaire therefore included decoy questions relating to other conditions. These questions were used to assess whether teachers could distinguish CAPD from broader behavioural, cognitive or sensory difficulties.

### Professional exposure and training

Studies in other countries have found that experience in the classroom does not always lead to strong knowledge of CAPD (Hlabangwane, 2002; Ryan & Logue-Kennedy, 2013). The study therefore considered teachers' qualifications, teaching experience and previous exposure to CAPD. It also considered whether specific training

might be needed (Almusawi & Hamadah, 2023; Sharma et al., 2026).

### Inclusion criteria

Schools were eligible if they were privately owned or managed by a trust, located in an urban area of Lahore, Pakistan, and used English as the medium of instruction.

A criterion-based, purposeful sampling strategy is used to select schools.

Teachers from private schools must be full time employees of the school and teaching mainstream classrooms. Teachers from the primary classes are defined as teachers teaching kindergarten (children age five), class 1 (children age six), class 2 (children age seven), class three (children age eight), class four (children age nine), and class five (children age ten).

### Exclusion criteria

Prospective participants which will not be included are

- Teachers who are temporary, part-time or in substitute teaching roles and hence have limited daily observation of students.
- School staff who are in non-instructional roles such as office administration.
- Employed by public or government-funded primary institutions within the defined setting of Lahore, Pakistan.

### Procedure

Teachers completed the questionnaire once. Their responses were used to describe their knowledge and examine how the four areas of knowledge were related.

In particular, the analysis looked at whether knowledge of symptoms and related disorders was linked to knowledge of specialists and classroom support.

The dependent variable was:

- The CAPD Classroom Intervention Knowledge (CIK)

The independent variables were:

- CAPD Symptoms and Characteristics Knowledge (SCK)
- Differential Knowledge of CAPD and Related Disorders (DK)

The mediating variable was:

- Knowledge of Specialists Involved in CAPD Management (SIK)

The questionnaire brought together questions about CAPD from published research, screening checklists and clinical sources. The four main knowledge areas were based in part on the work of Almusawi and Hamadah (2023).

The questionnaire included demographic questions and items adapted from the following sources:

• Almusawi & Hamada, 2022

• Fisher's Auditory Problems Checklist

• Johnson and Spangler, 2015

• Children's Auditory Performance Scale (CHAPS), (Smoski et al., 1998)

• The DSM V ASD checklist adapted by the Oregon Centre for Children and Youth with Special Health Needs

• Self-observation of practices followed in schools for children with special needs.

The complete survey is divided into six distinct operational sections:

Section A: Teacher Demographics

It included qualification levels, teaching duration, and the grade level which the teacher teaches.

Section B: General Familiarity and Training:

Enquires about prior professional training for and exposure to children with CAPD

Section C: Clinical Causes

Measures theoretical knowledge regarding valid medical causes versus historical misconceptions.

Section D: Behavioral Symptoms and Classroom Manifestations

Includes statements to ascertain the symptoms and effects of CAPD.

Section E: Multidisciplinary Referral Routes

Investigates teacher's knowledge of which professionals need to be involved and which are most suited to identifying and managing CAPD.

Section F: Classroom Interventions:

Investigates the knowledge of classroom intervention strategies for CAPD.

The survey intentionally included built-in decoy or trap questions throughout the sections. These trap questions state symptoms and treatments that apply to co-occurring or unrelated conditions like ADHD, specific learning difficulties, or visual deficits. This design feature evaluates whether educators can isolate true central auditory processing weakness from general cognitive, behavioral, or sensory impairments.

The inclusion of decoy items regarding causes and to whom to refer was based on cultural relevance and practices, which have been observed. These items were reversed scored hence agreeing with a decoy item lowered the participants overall differential knowledge score.

The four areas of knowledge that were selected, are summarised Table 2. The relationships were examined using a statistical model called partial least squares structural equation modelling (PLS-SEM).

The primary objective of this study was to examine the relationships between the four main blocks of teacher knowledge of teacher knowledge- outlined in Table 2. However, the theoretical framework acknowledges that background characteristics such as years of teacher experience, highest academic qualification, and prior CAPD training- can influence and educator's baseline awareness.

To ensure accuracy teacher's experience, degrees, and past training were factored in into the PLS-SEM path model a control variables.

**Table 2.**

*Subsections of the questionnaire.*

| Construct | Original items |
|---|---|
| CAPD Symptoms and Characteristics Knowledge (SCK) | 23 |

| | |
|---|---|
| Differential Knowledge of CAPD and Related Disorders (DK) | 5 |
| Knowledge of Specialists Involved in CAPD Management (SIK) | 8 |
| CAPD Classroom Intervention Knowledge (CIK) | 11 |
| Total | **47** |

The 47 questions related to CAPD knowledge were grouped into four areas: recognising CAPD, distinguishing it from other conditions, knowing which specialists can help, and knowing possible classroom responses. The numbers show how many questions covered each area; they are not teachers' scores.

## Data Collection and Sampling Technique

Teachers could complete the questionnaire online through Google Forms or on paper in schools that allowed its distribution. Schools were chosen because they met the study criteria. Teachers in those schools were recruited according to availability. More than 500 questionnaires were distributed, and 350 complete responses were used in the analysis.

### Informed Consent Considerations

Permission to conduct the survey, as well as gauging the cultural and ethical appropriateness of the prompt questions was obtained from the heads of school, which meet the inclusion criteria.

A pilot study to determine the appropriateness of the questionnaire was determined by requesting a group of ten teachers who meet the inclusion criteria to complete the questionnaire.

## Results and Analysis

First, the data and the model are checked to see whether they were suitable.

After incomplete questionnaires, that is those with missing answers were excluded, 350 responses remained for analysis.

Average answers to the knowledge questions were close to the middle of the five-point scale (around 3.00), with standard deviations between 1.05 and 1.11. Answers were spread fairly evenly and were not heavily skewed.

Because average answers sat near the midpoint, these results say more about how the four areas of knowledge are related than about how much teachers know. The study did not set a pass mark, so it cannot say what proportion of teachers have adequate knowledge.

The study examined four areas of knowledge: CAPD symptoms (SCK), how CAPD differs from related disorders (DK), specialists involved in management (SIK), and classroom interventions (CIK).

Before testing the relationships, The reliability and the distinctiveness of the four measures was assessed. All four measures were very consistent. The values were above the usual minimum of 0.70, and the average variance extracted (AVE) is above .50 for every measure, which means each measure captures most of what its items have in common. This data is displayed in Table 3.

**Table 3.**

*Reliability and convergent validity of the four measures. Cronbach's alpha and composite reliability (rho_a, rho_c) should be above .70. AVE should be above .50.*

| Measure | Cronbach's alpha | Reliability (rho_a) | Reliability (rho_c) | AVE |
|---|---|---|---|---|
| **CIK** | .973 | .974 | .976 | .730 |
| **DK** | .921 | .922 | .941 | .761 |
| **SCK** | .976 | .977 | .978 | .726 |
| **SIK** | .974 | .974 | .976 | .747 |

*Very high values (above about .95) can mean that some items are repeating each other.*

**Key:** Symptoms and Characteristics (SCK); Differential Knowledge of CAPD and Related Disorders (DK) Knowledge of Specialists Involved (SIK); Classroom Intervention Knowledge (CIK)

Table 4 presents the results of the heterotrait-monotrait ratio (HTMT). This compares how strongly different measures are related to each other and how strongly items within a measure are related. Values less than 0.85 indicate that measures are distinct. The highest value obtained was 0.660, between knowledge of specialists and knowledge of classroom interventions. Recognising whom to involve and knowing what to do in class were therefore related but separate kinds of knowledge.

**Table 4.**

*Discriminant validity (HTMT). Values below .85 show that the measures are distinct.*

| | CIK | DK | SCK | SIK |
|---|---|---|---|---|
| **CIK** | | | | |
| **DK** | .551 | | | |
| **SCK** | .503 | .215 | | |
| **SIK** | .660 | .553 | .592 | |

**Key:** Symptoms and Characteristics (SCK); Differential Knowledge of CAPD and Related Disorders (DK) Knowledge of Specialists Involved (SIK); Classroom Intervention Knowledge (CIK)

## Results from the Analysis of the Seven Hypotheses

Together, symptom knowledge and knowledge of related disorders accounted for 50.8% of the differences in specialist knowledge between teachers. These two areas, together with specialist knowledge, accounted for 49.4% of the differences in classroom intervention knowledge. The remaining differences may be related to factors outside this model.

Table 5 lists what the survey found. All seven proposed hypothesis were supported among the 350 teachers. Teachers who knew more about the specialists involved in CAPD also tended to know more about classroom support; this was the strongest direct link to classroom knowledge. A larger positive coefficient means a stronger association. H6 and H7 describe indirect links through knowledge of specialists. These are associations between teachers' answers, not

evidence that one area of knowledge caused another.

**Table 5.**

*β is the standardised path coefficient; a larger positive value means a stronger association*

| Hypothesis | What the relationship means | Strength (β) |
|---|---|---|
| H1 | Those who recognised more CAPD signs knew more about relevant specialists. | .493 |
| H2 | Those who better distinguished CAPD from related conditions knew more about specialists. | .424 |
| H3 | Those who recognised more CAPD signs knew more classroom strategies. | .222 |
| H4 | Those who better distinguished CAPD from related conditions knew more classroom strategies. | .283 |
| H5 | Those who knew more about specialists knew more classroom strategies. This was the strongest direct link to classroom knowledge. | .367 |
| H6 | Symptom knowledge was also linked to classroom strategies through knowledge of specialists. | .181 |
| H7 | Knowledge of related conditions was also linked to classroom strategies through knowledge of specialists. | .156 |

All five direct relationships were supported. Teachers who knew more about CAPD symptoms, or could better distinguish CAPD from related disorders, also tended to know more about specialists. Each of these areas was linked to greater knowledge of classroom interventions. Of the three areas directly linked to classroom intervention knowledge, knowledge of specialists had the strongest relationship.

The strongest direct link to classroom intervention knowledge was with knowledge of specialists (H5). The two indirect links (H6 and H7) suggest that knowing about specialists helps explain part of the connection between basic CAPD knowledge and classroom knowledge. Every relationship shown was statistically significant ($p < .001$). The survey cannot show whether one type of knowledge led to another.

Knowledge of specialists partly explained the link between symptom knowledge and classroom intervention knowledge (H6). Symptom knowledge was also linked to intervention knowledge directly. Both routes therefore contributed to the pattern found in the survey.

The same pattern was found for knowledge of related disorders (H7). Specialist knowledge explained part of its link with classroom intervention knowledge, while a direct link also remained. This is consistent with the idea that knowing whom to consult may be one part of understanding how to support a child in class. The survey measured what teachers knew, rather than what they actually did.

As detailed in Table 5, the statistical inclusion of teacher demographics adjusted for the inflated values of the structural paths.

When these background variables were help constant all five direct paths that is (H1) to (H5) and both indirect paths (H6 and H7) experienced a minor, expected deflation their standardised path coefficients.

Despite this downward adjustment, all seven hypotheses remained statistically significant. Hence the structural relationships are robust and hold true despite the teacher's background.

## DISCUSSION

The present study examined the interrelationships among various aspects of teachers' foundation knowledge of Central Auditory Processing Disorder (CAPD) and the possibility that the foundation knowledge may help to inform knowledge that guides classroom responses. The results of the study are consistent and support the proposed conceptual model. The knowledge of symptoms and characteristics of CAPD (CAPD-SYK) and differential knowledge of CAPD and related disorders (CAPD-DK) were significant predictors of teachers' knowledge of specialists involved in CAPD management (SIK).

The strongest relationship in the model was between symptom knowledge and knowledge of specialists (H1). Teachers who recognised more possible signs of CAPD also tended to know more about who could assess and support a child. Ryan and Logue-Kennedy (2013) also stressed that teachers have a role in noticing difficulties and making referrals. Their survey found low awareness among primary school teachers and pointed to a need for training. The present study adds that, among these teachers, knowing the signs and knowing whom to involve went together. Almusawi and Hamadah (2023) likewise described theoretical and practical knowledge as related but separate, and the present findings are consistent with this.

Knowledge of how CAPD differs from other conditions was also related to knowledge of specialists (H2). This is a reasonable assumption since difficulty in following instructions, listening in noise, reading or paying attention may have several explanations. Teachers who are familiar with this overlap of symptoms may be more likely to refer for a specialists' assessment. Earlier work in this domain has also stressed the need to distinguish listening difficulties from language, attention and learning problems (Cacace & McFarland, 1998; Konopka et al., 2024).

### Classroom Interventions

According to (H3) symptom knowledge was linked to classroom intervention knowledge. A teacher who recognises the symptoms of CAPD may better see why changes in the classroom could help. Ferre (2002) discussed teaching and environmental strategies for children with APD. Konopka et al. (2024) describe supports that include changes to the listening environment, auditory training, speech and language therapy and assistive listening devices. Thus, teachers who recognise the symptoms of CAPD will also recognise the importance of implementing therapeutic strategies.

Knowledge of related disorders was also linked to classroom intervention knowledge (H4). Being able to differentially identify children with similar disorders may help teachers think about which response suits the child.

Interestingly, knowledge of specialists had the largest coefficient with classroom

intervention knowledge (H5). Assessment and support may involve audiologists, speech and language professionals, psychologists and educators, depending on the child (Konopka et al., 2024). Knowing what each of these professionals does may help a teacher see which classroom supports belong within a wider plan of care.

This is further supported by (H6) and (H7). Specialist knowledge partly accounted for the link between symptom knowledge and classroom intervention knowledge (H6), and between knowledge of related disorders and classroom intervention knowledge (H7). In both cases the direct link remained.

However, a crucial insight that was observed from controlling for background variables was that prior CAPD training exerted a positive effect on both specialist and classroom intervention knowledge. On the other hand, years of teaching experience alone did not yield a statistically significant path.

Within the Pakistani primary education sector, it proves that merely spending years in the mainstream classroom does not automatically grant the teacher ability to recognise or manage a condition such as CAPD. Instead targeted, explicit professional development is required to build teacher capacities.

However, these statistical relationships were established from data collected at one time. The study cannot show a causative relationship that learning about specialists leads teachers to know about interventions. The relationship could exist the other way, or could have come from something else such as attending the same training seminar.

## The Pakistani Context

The participants taught in private, urban primary schools in Lahore, where persistent difficulties with listening, following instructions, reading or attention may first be noticed by the class teacher. Research on professional development in Pakistan has described gaps in training and practical support for special education teachers (Khan, 2026). Studies of inclusive education in Pakistan have also identified limited teacher preparation and resources. These studies do not test the relationships measured here, but they give context for why practical training may be useful. The sample cannot represent every school in Pakistan.

## Implications for Training

Training on CAPD could cover four connected topics: possible signs and symptoms, overlap with other conditions, the roles of specialists and how to refer, and practical classroom support. Training should also say what a teacher can do after noticing a possible listening difficulty. Teachers should not label or diagnose a child as having CAPD. They can record what they see, try reasonable adjustments in class, speak with families and school staff, and refer concerns to qualified professionals. This matters because CAPD overlaps with other conditions and diagnosis is complex and, in some respects, still debated.

## Limitations

There were certain limitations to the study which are listed below.

- Design. Data were collected at one time, so the results show association only.
- Sampling. Schools were chosen purposively and teachers by

availability. The response rate is not known exactly, and teachers who chose to answer a survey about CAPD may know more or care more about it than those who did not. This could make the relationships appear stronger than they are among teachers generally.

- Generalisability. All teachers were from private, English-medium urban schools in Lahore. The results may differ in public or rural schools, other regions, secondary schools or special education settings.
- Very high reliability. Cronbach's alpha values of .92 to .98 are excellent but, above about .95, they can mean that items overlap. The questionnaire could be shortened in future.
- Answers near the midpoint. Average answers were close to 3.00, which may reflect uncertainty or a tendency to choose the neutral option. The measures therefore show how knowledge areas relate more clearly than they show how much teachers know.
- Short differential-knowledge measure. DK used only five items, and scoring depended on how teachers answered decoy items. A longer measure would be more stable.
- Knowledge, not practice. The study measured what teachers know. It did not measure referrals or classroom practice.
- Teacher characteristics. Years of experience, qualifications and previous exposure to CAPD were collected but are not reported in this analysis. They should be examined in future work.

## Conclusion

The study examined the knowledge of CAPD amongst primary school teachers in private, urban schools in Lahore, Pakistan. It asked what teachers knew about symptoms, related disorders, specialists and classroom interventions, and how these areas of knowledge were linked. All seven proposed relationships were supported in the sample.

Symptom knowledge and knowledge of related disorders together accounted for 50.8% of the differences in specialist knowledge. These two, with specialist knowledge, accounted for 49.4% of the differences in classroom intervention knowledge. Specialist knowledge partly accounted for the link between symptom knowledge and classroom intervention knowledge (indirect $\beta = .181$), and for the link between knowledge of related disorders and classroom intervention knowledge (indirect $\beta = .156$). The findings support earlier work that sees teachers as important in noticing difficulties and seeking support (Ryan & Logue-Kennedy, 2013; Almusawi & Hamadah, 2023).

Teachers may be among the first to notice that a child has lasting difficulties with listening or following instructions. Their role is to observe, support the child in class, speak with families, and refer concerns when needed. However, classroom exposure alone does not ensure that teachers acquire relevant skills to ensure this. Training may be most useful if it covers symptoms, overlap with other disorders, referral routes and classroom

strategies together. However, they should not be expected to diagnose CAPD.

Future studies could compare teachers across school types and follow teachers before and after CAPD training. They could also look at actual referrals, classroom practice, access to specialists, and children's educational outcomes. This would show whether more knowledge leads to more useful classroom support (Graham et al., 2006).

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